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REASONER BASED ONTOLOGY QUERY MACHINE

Ausgeführt am Institut für Informatik an der Uni Wien

unter der Anleitung von

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Statement of Authentication

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in whole or in part, for a degree at this or any other institution.

Stefan Wurm | Hamburg, December 2007

Acknowledgments and Preface

The first steps – before I left for the south of France – were towards Axis and SOAP with attachments to get in touch with the technology, to understand the principles, and to be able to keep on far away from my home university. The bigger part of the implementation was then written in Montpellier – within a foreign thesis program. It was quite hard to resist the French sun and the bunch of students from all over the world to keep on learning and implementing.

The written part and the finalization of the web application happened back in Austria. As I preferred the programming, the try and error, the javadoc/w3c definition digging over the creation of the written part it took me quite a while. Thanks to some proposals of Helmut Wanek the final corrections took place in Maastricht and Hamburg as I already started to work as a project based consultant. These last lines are written in my hometown again.

Many tanks go to
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1 Introduction

1.1 Motivation

With whatever projects ‘SolProv’ [L1.1a] will work together in the future, it was planned and implemented as a standalone OWL-based [1.1a] registry for web services (WS) [L1.1c] providing mathematical solutions by artificial neuronal networks [L1.1d]. Although it is meant as a proof-of-concept it is fully implemented.

Written in Java and based on the open-source framework Jena [L1.1e] and the reasoner Pellet [1.1b] it is constructed to leverage the ability to reason knowledge stored in an ontology. Though the solution uses some cutting edge web technology and standards the users do not need to have any knowledge of them. Incorporating functions for users with no or advanced knowledge of querying ontologies the (optional) browser based front end provides the possibility to query or update the registry.
With this package of functions a global community will be able to publish implementations of web service based neuronal nets to consumers with a lot of raw data to process – which is also important for the growing use of data mining and business intelligence.

1.2 What is it

‘SolProv’ is a set of web service based functions to query or update an ontology containing the descriptive properties of several web services providing artificial neuronal networks. These nets can be used e.g. to process scanned handwritten input (forms, pattern recognition) or to estimate the future development of time series providing historical data. They can be completely different in structure, input needed, output provided, charge, paradigm used, trained, trainable by the user, etc. The programming languages, operating systems, databases, technologies or other resources used are generally not known and not of interest.

The package consists of four modules. The browser based front end (the client) provides simple and advanced queries and insert/update functionality of the individuals [L1.2a] stored in the ontology. Then the web service itself (technically seen), the solprovManager which implements the business logic (the query processing and ontology update) and last but not least the irreplaceable auxiliary class ‘solprovUtilities’ which handles the properties and (error) logging. The properties file (stored in a simple .properties text file) is used to control the way ‘SolProv’ processes the queries (e.g. whether filter expressions shall be handled in a case sensitive manner) or to configure the product. This assures a highly flexible application – whether the server or the path to the ontology is changed or the variable names of returned property values shall be changed. For debugging and testing there is the possibility to log each step of the process – including the value of critical variables. As this will flood the log file this extended logging feature can be turned off.

With these four modules ‘SolProv’ provides all features for a (human) agent as shown in Figure 1-1: ‘SolProv’ Use Case Diagram (UML) below. For ideas about possible features to enhance the overall usability of ‘SolProv’ see chapter ‘1.4’.

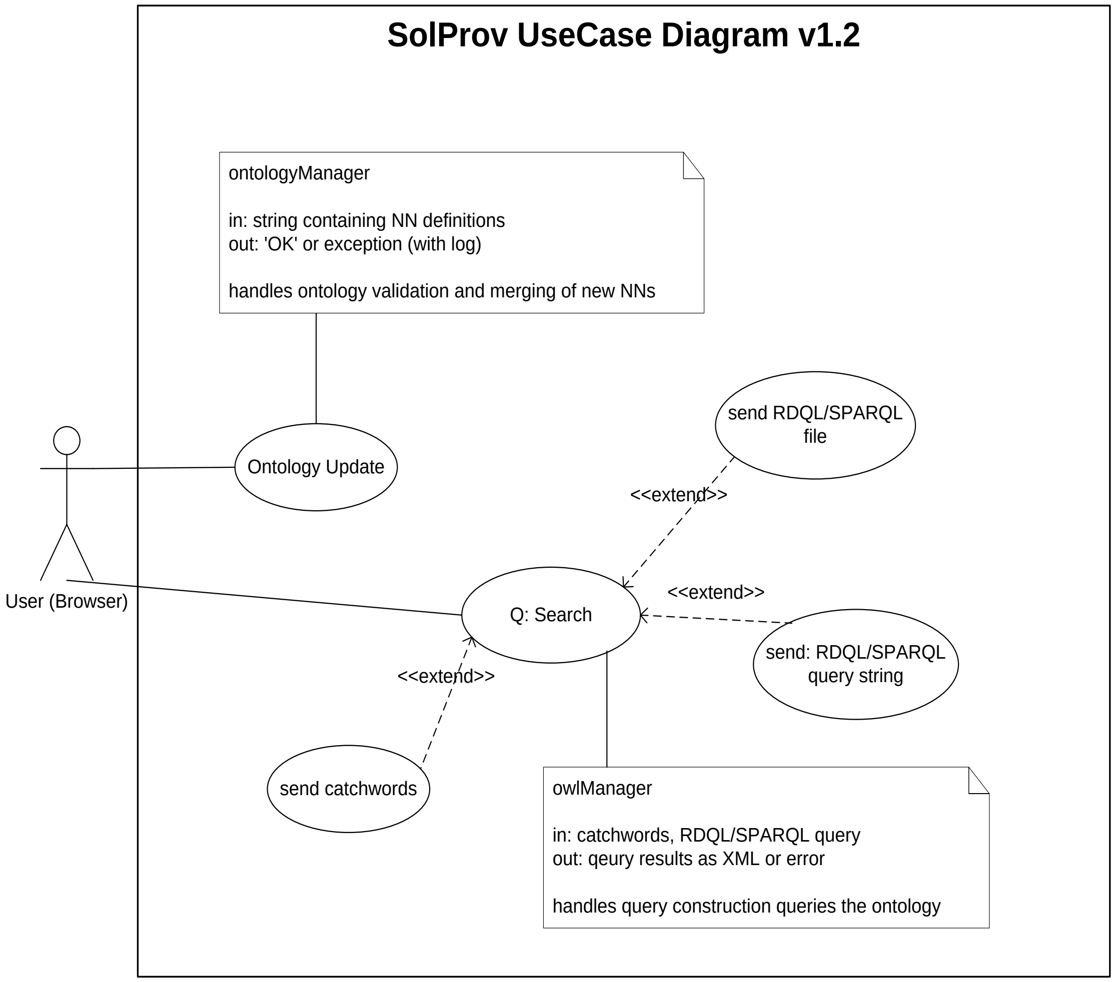

Figure 1-1: ‘SolProv’ Use Case Diagram (UML)

Figure 1–1 shows the use case diagram for ‘SolProv’. The user has principally two possibilities: to query or to update the ontology. Depending on the action performed and the input provided ‘SolProv’ processes the request differently.

1.2.1 The client

1.2.1.1 First tab – Simple query

The front-end is a tab based single page. On the first tab – simple query – the ontology can be queried by keywords – to restrict properties or filter by literals. The catchwords are sent to the web service as string and composed to a SPARQL [1.2.1.1] query by the queryManager. The constructed query is used to instantiate an 'ARQ' (Jena) [L1.2.1.1a] query object. If the string is parsed successfully the query object is used to query the ontology with a pellet packed inference model. The result is formatted as XML-string, returned to the client by the called web service function and displayed as it is. Although the XML-notation is not the best way to present data to human users, its sufficient for a proof-of-concept and can be improved by adding XML-formatting ability to the client. Once the whole process of discovery and invoking of neuronal net based web services is automated, a returned XML-string is easy to process by a client.
If no other variables are requested to output, the query is constructed to return the unique name (URI or IRI) [L1.2.1.1b] of the net, the description and the location of the web service. Other properties can be added by defining which properties shall be selected by which variable name. This variable name will then be the embracing XML-element of the returned property value.
The returned XML-string contains a 'head' and a 'results' tag within a 'sparql' tag. The 'head' tag holds the variable names of all selected variables listed with their values within the 'results' tag. If no matches were returned, the 'results' tag is empty – the 'head' tag always holds the selected variables.
This tab also allows to just display the query constructed by the queryManager using the indicated keywords. No reasoning or internal ontology/inference model construction is performed in this case. For example outputs see Part III.
Although the user does not need any ontology query knowledge to use this function she/he needs to know the properties and possible property values to leverage this function (e.g. property: nn:hasInput, e.g. value: nn:Binary).

1.2.1.2 Second tab – Advanced query

The advanced query functionality – second tab – accepts just complete RDQL [1.2.1.2] or SPARQL queries – although the latest release of the W3C specification of the SPARQL query language is still a draft. Should this specification be changed in regard to e.g. how to separate the variables to select (currently an open issue) the quicksearch function (simple search) probably will not work with an updated reasoner or an updated Jena SPARQL query engine respectively. (The variable separator won't be a problem – it can be changed in the solprov.properties file – see Part III.)
If a given query is valid, it is passed to the same routine as the constructed one to query the ontology.
On the same tab one can upload a text file containing a *single* RDQL or SPARQL query. The further processing of the uploaded query is exactly the same as if it was directly entered.

The output of these functions is the same as for a simple query, which was described in the previous sections. The (possibly empty) result is displayed as XML-string – same as at '1.2.1.1 First tab – Simple query'.

1.2.1.3 Third tab – Ontology update

The third tab holds the ontology update functionality. It needs an OWL (text) file containing new or updated individuals (neuronal networks). To enable Jena to handle the uploaded individuals the uploaded file needs to contain a 'reduced ontology' a sound OWL-file containing XML-header and namespace definitions as attributes of the root RDF element. The neuronal net definitions are located within the RDF element. Which nets are going to be inserted, which updated, which will not be altered and why is displayed on the page – as are errors occurring during the process and validity problems aborting the operation.

1.2.1.4 Fourth tab – Links

This tab provides no functionality – it holds just links to various important in- and external documents. The external link section points to the homepage of several used or considered to use products/technologies/standards. The internal documents point to PDFs like UML-diagram or the Part III of this document, the 'SolProv' tutorial. Besides the links to the Javadoc of the four modules building 'SolProv' (client, web service, manager, and utilities) a direct link to the ontology is available. Users who intend to insert their definitions of neuronal net based web services into the ontology can easily write an update file by using the already existing definitions of the individuals ('NeuronalNet' elements).

1.2.2 The web Service

The web service itself, the interface to which a client sends its requests, does not implement any processing. It just passes the received strings to the solprovManager and returns the result back to the caller. After all it reads the properties file.

1.2.3 The solprov manager

This is the sole place, where queries are constructed and, the ontology is queried and updated.

1.2.3.1 Query manager

The primary tasks of the query manager are the construction of a SPARQL query from the keywords, to query the ontology and to format and return the result.

In order to describe the implementation of the quicksearch function (simple search) I'd like to introduce SPARQL – the language constructed to query the ontology.
Compared with the predecessor RDQL SPARQL has some more features as:

- ability to add optional information to query results
- disjunction of graph patterns

- more expression testing (date-time support, etc.)
- named graphs
- sorting

The basic structure of a SPARQL query is as follows:
Prefix section: defines prefixes to qualify attributes
Select clause: lists the variables to be selected and returned
Where clause: <subject> <predicate> <object> filtering the searched data
I.e. just resources (subjects) with a given predicate (property) and given object (value of the property) are returned.
The example below shows a simple SPARQL query returning all subjects that have a 'title' property with the value 'SPARQL Tutorial':

```
SELECT ?book
WHERE { ?book <http://purl.org/dc/elements/1.1/title> 'SPARQL Tutorial' . }
```

To get a list of all resources and their titles the query would be:

```
SELECT ?book ?title
WHERE { ?book <http://purl.org/dc/elements/1.1/title> ?title . }
```

Depending on the given catchwords the select-clause is enlarged by variable names to be returned and the where-clause by restricting triples (first above example) or query triples (second above example).

To construct a query accordant to the keywords the general query structure is split in two groups (select- and where-clause) and defaulted with the standard select variables. This is done to be able to add select variables and/or restrictions. The initial definitions of the select clause (stmtHeader) and the where clause (stmtWhere) can be seen below. All the variables (in the code) are properties defined in the properties file. Just parts not likely to change are hard coded as 'PREFIX and 'SELECT DISTINCT'. That means of course that there is no way to execute a query without 'DISTINCT' (without the result set grouped) – if this is needed the use of the advanced query function is highly recommended.

One difference to SQL is that output variables need also to be handled in the where clause. Another would be that the 'from clause' is defined by the 'PREFIX' – which ontology should be queried. As the ontology is seen by the reasoner as a batch of (nested) triples in the form <subject> <predicate> <object> the select-variables also need to be defined in the where clause to tell which property value of which subject they represent – also shown below.
The bold lines below the code are the results of the initialization (without any enlargement by catchwords) with the current configuration (properties).

```
String stmtHeader = "PREFIX " + nnabbrev + " <" + serverURL + ontPath + "#>\r\n" +
    "SELECT DISTINCT " + nnvarname + selvarsep + descrvarname + selvarsep + urlvarname;
```

PREFIX nn: <http://big.pri.univie.ac.at:8888/nnont/NNFull#>
SELECT DISTINCT ?net ?descr ?wsurl

```
String stmtWhere = "WHERE { \r\n" +
    " " + nnvarname + " " + nnabbrev + "hasDescription " + descrvarname + ". \r\n" +
    " " + nnvarname + " " + nnabbrev + "hasEndpointURI " + urlvarname + ". \r\n";
[the curly bracket is not closed to allow addition of further, user-defind restrictions]
```

```
WHERE {
 ?net nn:hasDescription ?descr.
 ?net nn:hasEndpointURI ?wsurl.
[the curly bracket is not closed to allow addition of further, user-defind restrictions]
```

The variables used are prefixed with a '?' sign. As this is hardcoded and not part of the variable definition in the properties file the code needs to be changed if this specification changes – although this is quite improbable.
To explain the construction of the query given several different catchwords we need to have a look on the possible token. There are four cases – one or two words per token separated by colon (defined as property):

1. String
2. Property/value
3. Property/variable name
4. Property/string

The first and fourth are similar. Is one word indicated (1) just the description will be filtered with the string – two words (4) mean that the literal property given will be filtered with the string. This won't be possible if just Pellet is used without Jena because Pellet does not allow 'FILTER' expressions in the queries. Using the Jena query engine it is possible to add following string to the where clause:

```
FILTER ( regex(?descr, 'c2', 'i'))
```

This filter matches each description property with the indicated string (here 'c2'). The 'i' indicates that case insensitive matching is performed (defined as property). As the 'regex' function within the filter indicates a regular expression can also be indicated though it has never been tested. Additionally to the filter the where clause needs to be expanded by a triple declaring affiliation of the variable used in the filter expression (unless '?descr' which is there by default):

```
?net nn:isTrained ?isTrained.
FILTER ( regex(?isTrained, 'true', 'i'))
```

Above filter expression tells the reasoner to match the property nn:isTrained of the individual ?net (any individual who has this property) with the literal 'true' by using the variable name ?isTrained.

Are more than one filter expressions indicated (several (1) or (4) cases or mixed) the same number of regex functions are held by the filter (concatenated with the logical and expression: '&&'). Is the description filtered and a literal property, just nets matching both criteria are returned.

```
FILTER ( regex(?descr, 'c2', 'i') && regex(?isTrained, 'true', 'i'))
```

The second case (2) indicates a property restricted to a certain value. This means in the triple notation that a predicate is set to an object:

nn:hasInput nn:Real

Is this pair given just nets with a real input are queried. Here just the where clause is expanded by the triple

?net nn:hasInput nn:Real.

The third possibility (3) enables the user to add variables to the output (without restricting the properties). The property and the variable name (with a leading '?' which is not part of the variable name) needs to be indicated.

nn:isSupervised ?super

The variable name (with the leading '?') will be added to the select clause and a defining triple to the where clause:

?net nn:isSupervised ?super.

This is why it is important to handle the different clauses independently – to expand them as the catchwords require and concatenate them at the end. For the exact grammar please see SPARQL Query Language for RDF [1.2.1.1].

The complete constructed query with any description matching 'xyz' looks like:

```
PREFIX nn: <http://big.pri.univie.ac.at:8888/nnont/NNFull#>
SELECT DISTINCT ?net ?descr ?wsurl
WHERE {
 ?net nn:hasDescription ?descr.
 ?net nn:hasEndpointURI ?wsurl.
 FILTER ( regex(?descr, 'xyz', 'i')
) }
```

Reasoning

The query manager is also the place where the magic happens: the reasoning.

As Ian Horrocks (University of Manchester, UK) and Ulrike Sattler (RWTH Aachen, Germany) put it, there would be no reason to have web ontologies without the possibility to reason them:

Ontologies are set to play a key role in the "Semantic Web" by providing a source of shared and precisely defined terms that can be used in descriptions of web resources. Reasoning over such descriptions will be essential if web resources are to be more accessible to automated processes. [1.2.3.1a]

Sean Bechhofer introduces reasoning as follows:

The OWL Web Ontology Language describes a language for ontologies. This language is equipped with a formal semantics described in the OWL Web Ontology Semantics and Abstract Syntax. Using these semantics, inferences about ontologies and individuals can be made. [1.2.3.1b]

In fact, talking about reasoning ontologies means inference. Inference is the act or process of deriving a (logical) conclusion based solely on what one already knows. To pick one example of 'OWL Reasoning Examples' [L1.2.3.1a]:

The relevant definitions:
(The complete ontology can be found at http://owl.man.ac.uk/2003/why/latest/ontology.rdf – shown below are the statements in abstract syntax)

```
Class(a:bus_driver complete intersectionOf(a:person
  restriction(a:drives someValuesFrom (a:bus))))

Class(a:driver complete intersectionOf(a:person
  restriction(a:drives someValuesFrom (a:vehicle))))

Class(a:bus partial a:vehicle)
```

The conclusion:

- A bus driver is a person that drives a bus.
- A bus is a vehicle.
- A bus driver drives a vehicle, so must be a driver.

Depending on the ontology (which OWL-restrictions are used, etc.) different search results can be achieved. Using the example from above, a user looking for drivers finds also bus drivers who are not explicitly declared as drivers.

Why pellet

The paper 'Pellet: A Practical OWL-DL Reasoner' introduces the tool as follows:
Pellet is the first sound and complete OWL-DL reasoner with extensive support for reasoning with individuals (including nominal support and conjunctive query), user-defined data types, and debugging support for ontologies. It implements several extensions to OWLDL including a combination formalism for OWL-DL ontologies, a non-monotonic operator, and preliminary support for OWL/Rule hybrid reasoning. It has proven to be a reliable tool for working with OWL-DL ontologies and experimenting with OWL extensions. [**Pellet: A Practical OWL-DL Reasoner]**

As this introduction to pellet shows, it is not just the Description Logic reasoner core or the efficiency of it (see OWL Test Results [L1.2.3.1b]) that makes this open source, Java based reasoner a perfect match for the requirements of this project. Based on Jena, 'Query Manager' uses ARQ – the query engine of/for Jena. This comes natively shipped with the pellet libraries so no additional product needs to be administered. The ontology validation (consistency checking) used by 'Ontology Manager' is provided by the Jena libraries shipped with Pellet. In fact, pellet is just providing the inference model. Everything else – query, result, reading/writing/updating OWL-files, query execution itself – is provided by Jena. This has the advantage of being capable of using a FILTER expression within SPARQL queries – which is not supported by the pellet query engine.
Also of value is the fact, that Pellet is a project still growing. The latest release candidate (1.4 RC2) is from February 5th 2007. This will allow benefiting from features of OWL itself (OWL 1.1) or e.g. e-connections [L1.2.3.1c].
Features not used in 'SolProv' are e.g. 'Ontology Analysis and Repair' – detects *syntactic*
and *semantic* defects in ontologies – which is providing species coercion (OWL-DL or OWL-Full [L1.2.3.1d]) or debugging support. (The defect detection is used by 'ontologyManager'.)

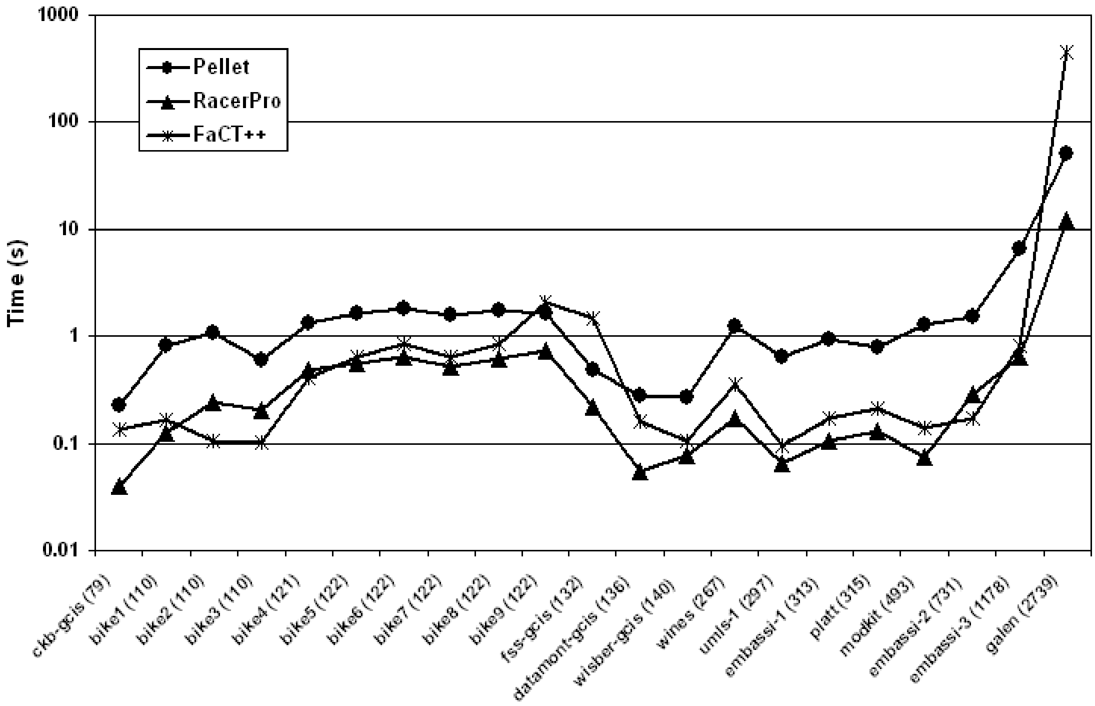

Figure 1-2: Pellet vs. RacerPro and Fact++
Results for the test cases in DL benchmark suite (logarithmic scale)
(Suite: I. Horrocks, P. F. Patel-Schneider, DL systems comparison, in: Proc. of the Int. Description Logics Workshop (DL'98), 1998, pp. 55–57.)

Figure 1-2: Pellet vs. RacerPro and Fact++ suggests that Pellet is not the most efficient but efficient enough for most applications. For more details to this diagram (versions, testsystem, etc.), other diagrams and useful information refer to [1.1b].

1.2.3.2 Ontology manager

Until now, the 'Ontology Manager' has just one function: to update the ontology. This chapter explains how this process is performed.

As mentioned in chapter '1.2.1.3 Third tab – Ontology update' the user must provide a sound set of individuals of web service descriptions. Sound means that the descriptions need to be valid against the 'SolProv' ontology. With this initial release of 'SolProv' the ontology consists of one file holding classes, properties and individuals. This means, the ontology holds the data and the schema. Until now, just individuals can be inserted or updated by an open community. New classes, properties or restrictions must be added manually by the 'SolProv' provider. As this would be harder to implement for a wide community and – as it is no trivial task to enlarge the schema of an ontology – better stays with the provider.
Like the 'Query manager' the 'Ontology Manager' uses Jena more than Pellet. Pellet is used to create an inference model which is validated, Jena to read and modify the ontology itself.

First of all, the passed individuals are written as an OWL-file on the server. This is done because it is easier to read an ontology model from a file than from a string. The model is constructed using Pellet specifications – the model itself is part of Jena. The update file is validated using an inference model with a pellet reasoner object. If a model is not valid, a validity report is logged and returned to the caller – e.g.:

- Error (KB is inconsistent!): Individual http://localhost:8080/nnont/NNFull#HopfieldBadTest has more than one value for the functional property http://localhost:8080/nnont/NNFull#hasInput

The error above occurs when a web service implementing a Hopfield net has a wrong property – in this case ‘hasInput’. The Hopfield net class is defined as having the property ‘hasInput’ binary but the net to update or insert has a real input. The new net would have two values for ‘hasInput’ which is restricted to exactly one.

When the update model is valid, all definitions are extracted and looked for in the ontology. If an individual of the same root class with the same name exists, the ‘hasVersion’ property of the existing definition is checked with the ‘hasPrevVersion’ property of the new one. If these two literal properties do not match, the net will not be updated and an error is logged. However, the process is not aborted. If they match, the old one is deleted from the ontology.
Not yet existing nets are not treated in any special way.
This mechanism is a lock free implementation to prevent that any changes of user A are (accidently) overwritten by user B. In case that user A copies a WS definition from the ontology and begins to update it while user B updates the same WS definition before user A uploads his modifications the version mismatch is logged and user A can consider the changes performed meanwhile (or discard them) and upload a new, version-matching definition. Modified, older versions of WS definitions are NOT stored in any way or place. The registry should reflect the current implementation of WSs.
However, this is not really the case. Deletions for WSs no more existing (or deprecated) are not possible. Just the workaround to empty the attributes of such definitions or to add a status attribute to the ontology (definition of the individual) would be possible.

After each net of the update file is checked this way the two models – the old ontology (without the nets to update) and the update model are merged. The new ontology afterwards contains both parts. Before the new ontology is written it will be validated in much the same way as the update above. The old, not modified ontology is saved as ‘<ontology name>previous.owl’. This provides a onetime step back functionality in case of a severe crash causing an inconsistent ontology. It would be easy to store a full history of changes of the ontology (each update leaves a backup) but for our purposes right now this feature is sufficient.

In any case the user gets a log of each relevant step – which nets are inserted, which updated, which are not and why, whether the operation was overall successful (new ontology file has been written) or not. The new ontology file, however, is the internal representation of the model used to perform the update. That means, it is no longer as easy to read as the original, manually created one. See appendix B.

1.2.3.3 Solprov utilites

This class is an auxiliary class used by each part of ‘SolProv’ (Client, WS, and Manager). It implements basic logging and properties handling functionality. As each step of the program is also logged (if logging is enabled) the string (where, when and what) is built and printed here.

The more important function, however, is the properties handling. The class reads the properties file and checks existence of obligatory properties. If at least one of those is empty or not defined, an error is logged and ‘SolProv’ is not able to proceed. Until the error is corrected by the provider, the class tries to read and validate the properties file. Once the needed ones all exist and are not empty, the properties will not be read again. To change properties afterwards a server restart is needed.
Optional parameters will be checked the same way. If they are not defined or empty they are defaulted with appropriate values. ‘regexcasesensitive’ e.g. is defaulted to ‘false’ – that means that string matching queries (FILTER expressions) are not case sensitive.

1.3 What it is not

This short section shall confine ‘SolProv's’ functionality and capability.

First of all, as there is one ontology file to be reasoned and one web service addressed by the current implementation of the client, there is no way to leverage the computing power of a grid. To enable this in any way (several equal web services addressed by the client or a central WS, distributed querying over distributed ontologies, etc.) the program needs to be substantially modified.

The previous chapters should have clearly shown following point – but to mention it explicitly: there is no processing of any data the user would like to be performed by a neuronal net web service. ‘SolProv’ is just a registry to find services.

‘SolProv’ provides no deletion of WS definitions. This may be achieved in further releases by uploading a WS definition containing just empty attributes or with a certain ‘toBeRemoved’ attribute. However, it is currently not implemented. Workarounds like updating a no more existing WS definition with empty attributes may help.

Until now, there seems to be no reason to implement web service security or reliable messaging. No personal data is used at any place – all information is public.

The system does not support natural language queries. Even for the ‘1.2.1.1 First tab – Simple query’ function, that does not need the user to know SPARQL query syntax, it is obligatory to know the properties and possible values of the individuals to leverage this function.

1.4 Visions

As the possibilities of such systems as ‘SolProv’ are quite large – considering the lasting growth of the internet (as semantic web) and the information and services provided – this section describes just a few interesting and possible future developments and is far from complete. No special order is intended for the following paragraphs.

Enlarge the content of the ontology from neuronal nets providing WSs to general WSs. Though this makes sense the ontology and the system reasoning the ontology need to be substantially changed. Depending how this would be realized – one big ontology, several specialized ontologies (grouped by technology providing, problems addressing, etc.) at least the ‘quicksearch’- and ‘update’-function is needed to be updated.
Like UDDI this extended registry would provide simple and advanced search functionality and possibly fully automated processing to find and use WSs.
Additionally to UDDI – which uses a XML-based registry – OWL ontologies allow to reason the registry and may return better results.

As already mentioned in chapter 1.3 ‘What it is not’, the current implementation of ‘SolProv’ is not able to benefit from distributed processing entities (GRID). This may change in further releases by instantiating the ontology model partially on distributed systems, query (reason) them there, unify the results and return them. Whether this will be several web services or a ‘crawler like’ reasoner depends on technical possibilities/properties. An advantage of this split up architecture – besides the faster search over vast data – would be that – depending on the indicated query – just subontologies (parts of the overall data) could be queried – of course in parallel.

In order to better address human users the output could – or even should – be formatted. Currently displayed as XML this structure should be displayed more user friendly. It would be no big effort to use XSL and format the output a lot better. For now, it should satisfy as proof-of-concept.

The paragraph about ‘SolProv’ and GRID already mentioned the possibility to automatically find and use services. To enable this feature the ontology would need to be expanded with the interface description of the services – to be able to search for services fitting not just the way the data needs to be processed but fitting the structure the data is available in and/or to (automatically) generate the data (out of DBs) the right way.
To achieve this goal OWL-S [L1.4a] would be needed within the ontology (to be able to also query interface information) or as supporting description at the web service.

As the focus for this proof-of-concept has not been on the ontology it is currently just a basic and OWL-Full one. To benefit better from the power of OWL a more complex and strict OWL-DL ontology is needed. As this is no trivial task a more basic one was used to implement and test 'SolProv'.

Future releases of OWL specification (OWL 1.1) and Pellet 1.4 already exist in draft resp. beta status. Some improvements are mentioned on the site presenting planned changes for discussion:
"[…] which provides increased expressive power with respect to properties and cardinality restrictions; user-defined data types and restrictions involving data type predicates; a weak form of meta-modeling known as punning; and a semantics-free comment mechanism."
(Peter F. Patel-Schneider)

Currently the ontology must reside on the same server as the 'SolProv' web service because 'SolProv' must be able to write the new ontology. This could be resolved by an ontology file just importing other ontologies (one or more). So the ontology can be available on another server and it could be split. The search functions will work as usual. Though, the ontology update will work, it will create a new ontology on the same server (inside a relative path). The old ontology (just importing others) will be no longer addressed.

2 State-of-the-art

2.1 Introduction

As the technologies utilized by SolProv are widely used in semantic web projects most of the current and recent usage occurs in this sector. In contrast to semantic web this system is not built to implement or realize semantic web. Semantic web is about to saturate the existing web with descriptive Meta data which is readable by machines to automatically search and process data. The SolProv query machine is about to reason knowledge explicitly stored in an ontology to find web services providing neuronal net based solutions for mathematical tasks.
In this chapter I will introduce briefly similar projects.

2.2 A Broker for OWL-S Web services

This project is about to define and realize a broker capable of accepting user (service requester) queries, finding the most appropriate service provider, translate the requester query for the provider and pass the answer (maybe translated or formatted) back to the requester.
The differences between 'SolProv' and this system are that it directly queries and returns the data looked for, and that it translates in- and output (the requesters query into a query understandable by the provider).
This means, the web services queried by the broker need to have a semantic description which limits this system in the real world 'SolProv' does not need semantic web services – it just needs a semantic description of the web service within the ontology. Further the requester directly sees the process model (i.e. the requirements of the provider web service) and can decide whether it fits his/her requirements but must format the data to be sent to the service him-/herself. [2.2]

2.3 IRS-II: A Framework and Infrastructure for Semantic Web Services

The Internet Reasoning Service project is based on three ontologies – one holding the domain definitions, one for the task models, and one for problem solving methods – each bridged with any other - according to the UPML framework.
The advantages of IRS-II are: it transforms standard stand-alone code into web services (Java and LISP), and delivers directly the requested data from heterogeneous web services as a sequence of requests to obtain a certain goal.
As the tasks have to be precisely specified it has some disadvantages compared with the more general possible requests like clustering or pattern recognition through 'SolProv'. [2.3]

2.4 A Framework for Design and Composition of Semantic Web Services

This paper describes how to implement semantic web services using PSM (problem solving methods) which results in a similar system as 'SolProv'. [2.4]

2.5 A New Paradigm of Distributed Problem Solving

This paper focuses on PSML (Problem Solver Markup Language) and PSML-based distributed Web inference engines. It demonstrates a possible implementation of certain distributed reasoning capabilities. The implementation – called β-PSML – is based on the combination of OWL and Horn clauses. It is also discussed how β-PSML can be enlarged for solving problems in a large scale distributed Web environment. [2.5]

2.6 A Proof Markup Language for Semantic Web

"In this paper, we address the issue of understanding and trusting results generated by web services. We introduce a proof markup language (PML) that provides an interlingua for capturing the information agents need to understand results and to justify why they should believe the results. We also introduce our Inference Web infrastructure that uses PML as the foundation for providing explanations of web services to end users. We additionally show how PML is critical for and provides the foundation for hybrid reasoning. Our contributions in this paper focus on technological foundations for capturing formal representations of term meaning and justification descriptions thereby facilitating trust and reuse of answers from web agents." [2.6]

2.7 Adding OWL-S to UDDI, implementation and throughput

As proposed under 1.4 Visions this paper tries to merge the common UDDI functionality with enhanced discovery capability using OWL-S.
Abstract: "The increasing availability of web services demands for a discovery mechanism to find services that satisfy our requirement. UDDI provides a web wide registry of web services, but its lack of an explicit capability representation and its syntax based search provided produces results that are coarse in nature. We propose to base the discovery mechanism on OWL-S. OWL-S allows us to semantically describe web services in terms of capabilities offered and to perform logic inference to match the capabilities requested with the capabilities offered. We propose OWL-S/UDDI matchmaker that combines the better of two technologies. We also implemented and analyzed its performance." [2.7]

2.8 Enriching ebXML Registries with OWL Ontologies for Efficient Service Discovery

Abstract (excerpt)
"In this paper, we address how ebXML registries can be enriched through OWL ontologies to describe Web service semantics. We describe how the various constructs of OWL can be mapped to ebXML classification hierarchies and show how the stored semantics can be queried through standardized queries by using the ebXML query facility. We also provide our observations on how ebXML registries can be extended to provide more efficient semantic support." [2.8]

2.9 Ontology management in enterprises

A more business focused paper – targeting the needs of enterprises to manage heterogeneous information. Different approaches and architectures are explained (mediator based, DOME, etc). It “explores the role of ontologies in enterprises, and proposes a methodology for managing enterprise ontology resources and a suite of support tools”. [2.9]

2.10 Decentralized Case-Based Reasoning for the semanticWeb

Abstract. “Decentralized case-based reasoning (DzCBR) is a reasoning framework that addresses the problem of adaptive reasoning in a multi-ontology environment. It is a case-based reasoning (CBR) approach which relies on contextualized ontologies in the C-OWL formalism for the representation of domain knowledge and adaptation knowledge. A context in C-OWL is used to represent a particular viewpoint, containing the knowledge needed to solve a particular local problem. Semantic relations between contexts and the associated reasoning mechanisms allow the CBR process in a particular viewpoint to reuse and share information about the problem and the already found solutions in the other viewpoints.” [2.10]

Introduction (excerpt)

“This paper presents a research work on the application of case-based reasoning within the semantic Web technologies and principles. CBR is a type of analogical reasoning in which problem-solving is based on the adaptation of the solutions of similar problems, already solved and stored in a case base. In particular, knowledge-intensive CBR relies on a knowledge base including domain knowledge and, as well, knowledge units exploited for the retrieval and adaptation operations of CBR.” [2.10]

2.11 DRAGO: Distributed Reasoning Architecture for the Semantic Web

Abstract. The paper addresses the problem of reasoning with multiple ontologies interrelated with semantic mappings. This problem is becoming more and more relevant due to the necessity of building a scalable ontological reasoning tools for the Semantic Web. In contrast to the so called global approach, in which reasoning with multiple semantically related ontologies is performed in a global knowledge base that encodes both ontologies and semantic mappings, we propose a distributed reasoning approach in which reasoning is the result of combination via semantic mappings of local reasonings chunks performed in single ontologies. The paper presents a tableau-based distributed reasoning procedure which is sound and complete w.r.t. Distributed Description Logics, the forma framework used to represent multiple semantically connected ontologies. The paper also describes the design and implementation principles of a distributed reasoning system, called DRAGO (Distributed Reasoning Architecture for a Galaxy of Ontology), that implements such distributed decision procedure. [2.11]

Introduction (excerpt)

The number of ontologies appearing on the web is growing steadily. Each ontology describes a domain of interest from a subjective perspective and level of granularity.

This inevitably leads to heterogeneity between ontologies describing even the very same domain. As a consequence, making multiple heterogeneous ontologies interoperate, is becoming a significant problem on the Semantic Web. [2.11]

2.12 Fuzzy OWL: Uncertainty and the Semantic Web

Abstract. “In the SemanticWeb context information would be retrieved, processed, shared, reused and aligned in the maximum automatic way possible. Our experience with such applications in the Semantic Web has shown that these are rarely a matter of true or false but rather procedures that require degrees of relatedness, similarity, or ranking. Apart from the wealth of applications that are inherently imprecise, information itself is many times imprecise or vague. For example, the concepts of a “hot” place, an “expensive” item, a “fast” car, a “near” city, are examples of such concepts. Dealing with such type of information would yield more realistic, intelligent and effective applications. In the current paper we extend the OWL web ontology language, with fuzzy set theory, in order to be able to capture, represent and reason with such type of information.” [2.12]

2.13 Grounded Contextual Reasoning enabling Innovative Mobile Services

This paper provides an approach for a highly dynamic mobile service scenario. Similar to the “travelling salesmen” it focuses on travellers in context with schedules, traffic jams, transportation means, priority, location, etc. Its primary about knowledge and reasoning, not the semantic web, ontologies, etc. [2.13]

2.14 On Knowledge Grid and Grid Intelligence: A Survey

This paper describes how the wisdom web is going to alter search and how to gain practical wisdom for problem solving. The autors present the capabilities of the wisdom web “as well as the conceptual architecture of an intelligent Grid”. [2.14]

3 Technical details

3.1 Developer notes

SolProv has been developed and tested with Tomcat 5.5 on Linux (#4 SMP Thu Jul 21 18:56:14 CEST 2005) and Windows XP by using ‘Java Studio Creator 2 Update 1’ to create the front end (browser based) and ‘Netbeans 5.5’ for the web service and business logic (J2SE 5 and 6). The SolProv web application needs the libraries of ‘pellet 1.3’ - an open-source Java based OWL DL reasoner.

3.1.1 Set up a Tomcat server

To be able to run the front end created by Java Studio Creator on a Tomcat server the ‘Jakarta Standard Tag-library 1.1’ [L3.1.1a] (‘jstl.jar’ and ‘standard.jar’) must be copied into the <CATALINA_HOME>/common/lib directory.

To install SolProv the war-files (solprovFE.war – the front end and solprovWA.war – the web application) need to be copied into the <CATALINA_HOME>/webapps directory. On Linux with the server running these files are extracted automatically, no deletion or reboot is required. Different on Windows XP where the server needs to be shut down, the extracted folders (e.g. <CATALINA_HOME>/webapps/solprovFE) deleted and the server restarted. It is also possible to reload the war-file with the tomcat manager or to redeploy it with Netbeans – no need to restart the server then.

The relative paths of the ontology and temporary update files as defined in ‘3.2.2’ have also to be created in the <CATALINA_HOME>/webapps directory
(e.g. <CATALINA_HOME>/webapps/nnont/NNFull.owl). The Ontology has to be present at the proper place with the proper name and the file extension ‘.owl’ whereas just the directory for the temporary update files needs to exist.

3.1.2 Set up the Netbeans project

To be able to compile and deploy the web service/back end within Netbeans some pellet libraries need to be imported. The jar-files can be found in pellet-1.3\lib directory and sub directories.

3.1.2.1 Custom libraries for solprovManager

- custom library: pellet (pellet-1.3\lib)
    - aterm-java-1.6.jar
    - pellet.jar
    - rdfapi.jar

- custom library: pelletJena (pellet-1.3\lib\jena)
    - arq.jar
    - commons-logging.jar
    - concurrent.jar
    - jena.jar

- xml-apis.jar
- xercesImpl.jar
- jakarta-oro-2.0.8.jar
- icu4j_3_4.jar

3.1.2.2 Custom libraries for solprovWS

The web service class needs the same custom libraries as solprovManager and additionally the pellet-1.3\lib\xsdlib\xsdlib.jar file.

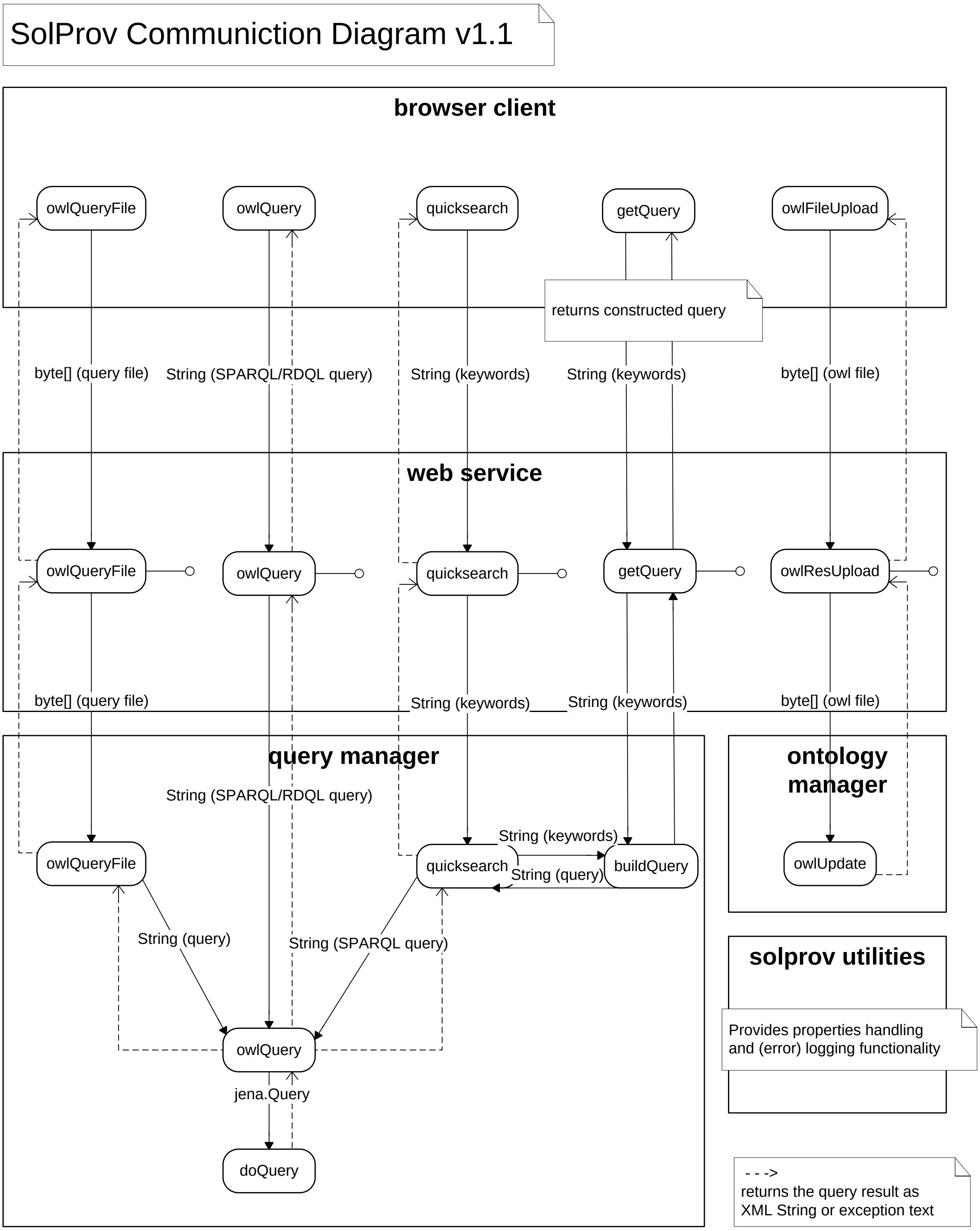

Figure 3-1: 'SolProv' communications diagram

The chart above shows the communication within ‘SolProv’ – between the modules and the functions of the modules. The input for the web service, ‘Query Manager’ and ‘Ontology Manager’ is always a string (keywords, RDQL/SPARQL query or update model). No physical files are passed – just the content as string. Not all implemented functions are shown in the graph.

3.2 SolProv properties file

In order to perform any action with the client or the web service the 'solprov.properties' file must be present in the root directory of the tomcat web server. If a property is not found within the properties file, a 'PropertyNotFoundException' (front end) or a common Java exception (web service) will be thrown.

The routine common to the client and the web service – handling the properties (reading, checking) – is part of the solprov utilities class. As this class is used by both, the client and the web service, the behaviour is the same – concerning properties and logging.
The names (keys) of the properties are case sensitive and must be lowercase. The required properties have to be defined and must not be empty. The value of the properties is not checked in any way.

The obligatory properties:

- serverurl
  URL of the server running the solprov WebService
  test content: http://localhost:8080/

- ontologypath
  Relative path and name (without file extension – is always .OWL) of the NN ontology
  test content: nnont/NNFull

- updfilepath
  Relative path and name of the temporary update files !!! Folders need to exist!!!
  test content: temp/tmpNNupd

- wsaddress
  WS address for the client (solprov front end)
  test content: http://localhost:8080/solprovWA/solprovWS

The optional, binary property 'logmode' ("true" or "false") controls if each position mark within the code will be written to the log file. A warning will be logged and the parameter will be defaulted to "false" when the property is not present or has any other value than "true" (case insensitive).

The optional property 'additionalprops' enables the checking for additional properties without changing the solprov utilities class. Comma separated properties defined here will also be checked whether they are defined and not empty.

Other optional properties (do not have to be defined or can be empty):

- rdfns
  url to the rdf syntax (if rdf:properties, etc. are used)
  default: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

- owlprefix
  url to the owl definition (if owl:properties, etc. are used)
  default: <http://www.w3.org/2002/07/owl#>

- nnabbrev
  namespace abbreviation as used in the ontology
  default: nn:

- nnvarname
  name of the output variable of the net (name)
  default: net

- descrvarname
  name of the output variable of the net description
  default: descr

- urlvarname
  name of the output variable of the ws-url
  default: wsurl

- regexcasesensitive [true|false]
  handle string filter case sensitive?
  default: false

- listsep
  the char or string to separate the property restrictions of quicksearch input
  default: ,

- returnparsedquery
  the returned query string is a printed query object (parsed query) and not just the constructed query (concatenated string)
  default: false

- selvarsep
  The character or string to separate selected variables (if more than two)
  default: ‘ ‘ (blank)

3.2.1 The client

The front end needs one entry: ‘wsaddress’. This property tells the client where the solprov web service is located. It can be used to test the WS locally (see example below) or to easily move it.

Changed values will be read each time the user performs an action. A restart of the server or the session is not needed.

3.2.2 The web service

The properties important for the web service (i.e. for the business logic – the solprov manager) are: ‘serverurl’, ‘ontologypath’ and ‘updfilepath’. For further details please see the descriptions of the properties file ‘Example localhost properties file’ below.

The full path and name of the ontology is retrieved by concatenating the ‘serverurl’ with the ‘ontologypath’ property – as it is the full path and name for temporary update files. The ontology file on the server must have the file extension ‘.owl’. The URL of the ontology at localhost would be according to the following example: http://localhost:8080/nnont/NNFull.owl.

To change the properties the web service needs to be restarted. Once successfully read the properties file will not be re-read. Finding at least one required property missing or empty no properties are read and an exception is thrown. The properties file will be re-read until no error occurred.

Example localhost properties file

(The properties are underlined just to highlight them here.)

```
## OBLIGATORY
## URL of the server with the solprov WebService
serverurl=http://localhost:8080/

## OBLIGATORY
## relativ path and name (without file extension) of the NN ontology
ontologypath=nnont/NNFull

## OBLIGATORY
## relativ path and name of the temporary update files !!! folders need to exist
!!!
updfilepath=temp/tmpNNupd

## resultformat not yet implemented - is always 'xmlstring'
##resultformat=xmlstring
##resultformat=rdf

## OBLIGATORY
## WS address for the client (solprov front end)
wsaddress=http://localhost:8080/solprovWA/solprovWS

## OPTIONAL (FALSE if not indicated or empty)
## prints each position mark to the system output [true|false]
logmode=true
```

```
## OPTIONAL (default <empty>)
## list of all additionally properties
## this list - separated by colon (',') - will be read into the
solprovUtilities.spProps variable
## and they will be checked whether declared and not empty
#additionalprops=

## OPTIONAL (default '<http://www.w3.org/1999/02/22-rdf-syntax-ns#>')
## RDF namespace URL for the SPARQL query
#rdfns=<http://www.w3.org/1999/02/22-rdf-syntax-ns#>

## OPTIONAL (default '<http://www.w3.org/2002/07/owl#>')
## OWL namespace URL for the SPARQL query
#owlns=<http://www.w3.org/2002/07/owl#>

## OPTIONAL (default 'nn:')
## Neuronal Net prefix abbreviation
#nnabbrev=nn:
## OPTIONAL(default 'net')
## Output variable name of the net ID
#nnvarname=net

## OPTIONAL(default 'descr')
## Output variable name of the description literal
#descrvarname=descr

## OPTIONAL(default 'wsurl')
## Output variable name of the WS URL
#urlvarname=wsurl

## OPTIONAL(default false)
## Filter literals case sensitive [true|false]
#regexcasesensitive=false

## OPTIONAL (default ',')
## String that separates the properties to be queried at quicksearch
#listsep=,

## OPTIONAL (default false)
## The returned, constructed query is a printed query object
## and not just the constructed query
#returnparsedquery=false
## OPTIONAL (default ' ')
## The character or string to separate selected variables (if more than two)
#selvarsep=
```

3.3 Solprov browser client

3.3.1 Methods

- quicksearch (search the ontology by keywords [literals, properties]) quicksearch allows also to get the constructed SPARQL query from indicated catchwords.
- owlQuery (search the ontology with a SPARQL or RDQL query)
- owlQueryFile (search the ontology with a SPARQL or RDQL query in a text file)
- owlFileUpload (update the ontology)

3.3.2 Description

Developed with the free IDE from Sun 'Java Studio Creator' 2.1 the front end provides a 'Google' like layout with tab orientated navigation. The tabs 'search', 'advanced search', and 'file upload' provide textboxes to input the keywords or complete SPARQL/RDQL queries. The 'advanced search' tab provides additionally the possibility to upload a text file containing a SPARQL or RDQL query. Similarly, the 'file upload' tab hosts the possibility to upload a text file containing new or updated definitions of neuronal nets. The fourth tab 'links' contains some links to UML-diagrams and javadoc of the project as external links to technology used and related. The search-tabs have both a result text box which displays the RDF/XML formatted query results. At the 'file upload' tab the result box is replaced by a log box displaying the progress of the update process and errors.

The functionality of the site is restricted to pass indicated Strings or files to the web service. No processing is done, neither with the Strings/Files indicated to query/update the ontology nor with the query result returned by the web service. Actually processing is just done by the 'solprov manager' who performs the query and update tasks.

Until now, the site is just tested with 'Mozilla Firefox' 1.5+ and 'Internet Explorer 7'. No confirmation of any kind (signature, etc.) or installation of any software/plug-in is needed to run the site in the browser – not even the 'Java Runtime Environment'.

3.4 Solprov web service

3.4.1 Methods

- quicksearch
- getQuery
- owlQuery
- owlQueryFile
- owlResUpload

3.4.2 Description

The web service serves just as a public interface to access the basic functions of the web application. No processing whatsoever is implemented. The input is passed to the processing layer (‘solprov manager’) unchanged. As is the query result passed back to the caller.

3.5 Solprov manager

3.5.1 Query manager

3.5.1.1 Methods

- public quicksearch
- public buildQuery
- public owlQuery
- public owlQueryFile
- private doQuery

3.5.1.2 Description

The class ‚queryManager’ contains the query logic. The public methods prepare a Jena/ARQ query object initialized with the indicated String. This object is instantiated as RDQL or SPARQL query (property of the object) depending on which type has been passed through.

Additionally, the method ‘quicksearch’ creates a SPARQL query with the comma separated keywords. The user can indicate five types of keywords to control the built query.

1. String
   The where-clause will be expanded to return just nets with this keyword occurring in the description.

2. Property/value pair
   The where-clause will be expanded to return just nets having this property/value pair. Both properties and values need to be prefixed with ‘nn:’.

3. Property/variable name
   The select-clause will be expanded to display also the value of indicated property.
   The variable name needs to be prefixed with a question mark ‘?’.

4. Property/string
   Filters this property with the indicated String

5. rdf:property/owl:object
   Experimental – allows also to use rdf/owl syntax

Are no additional variables indicated, the name (as URI), the description and the URL will be returned. The URL is pointing to the WS implementing the net found.

The keywords need to be separated with the ‘listsep’ string or char as defined in ‘solprov.properties’ file. The default value however is a colon (‘,’).

Example

Querying the test ontology [L3.5.1.2a] with following keywords results in the SPARQL queries built by the ‘owl manager’ and the result displayed below. Indicating these keywords means:

Keywords (search input)

c1, nn:hasInput nn:Binary, nn:inputLayerSize 81, nn:isSupervised ?super, nn:usedFor ?usedFor

> Search the ontology for neuronal nets where the description contains the string ‘c1’ and which have the property ‘nn:hasInput’ with the value ‘nn:Binary’ and an ‘nn:inputLayerSize’ of 81. Additionally to the name, the description, and the URL – which are always returned and printed – the properties ‘nn:isSupervised’ with the binding name ‘super’ and ‘nn:usedFor’ with the binding name ‘usedFor’ is returned and displayed.

The output of above quick search can be found below at ‘The RDF/XML formatted output of this query’. The name of the variables (?super, ?usedFor, etc.) is free to choose. The properties and the possible values are given in the ontology.

The query-string concatenated and expanded:

```
PREFIX nn: <http://localhost:8080/nnont/NNFull#>
SELECT DISTINCT ?net ?descr ?wsurl ?super ?usedFor
WHERE {
 ?net nn:hasDescription ?descr.
 ?net nn:hasEndpointURI ?wsurl.
 ?net nn:isSupervised ?super.
 ?net nn:usedFor ?usedFor.
 ?net nn:hasInput nn:Binary.
 ?net nn:inputLayerSize ?inputLayerSize.
 FILTER ( regex(?descr, 'c1', 'i')
 && regex(?inputLayerSize, '81', 'i')
) }
```

The query-string when the query object is printed:

```
PREFIX  nn:    <http://localhost:8080/nnont/NNFull#>
SELECT DISTINCT  ?net ?descr ?wsurl ?super ?usedFor
WHERE
  { ?net  nn:hasDescription  ?descr ;
          nn:hasEndpointURI  ?wsurl ;
          nn:isSupervised    ?super ;
          nn:usedFor         ?usedFor ;
          nn:hasInput        nn:Binary ;
          nn:inputLayerSize  ?inputLayerSize .
    FILTER ( regex(?descr, "c1", "i") && regex(?inputLayerSize, "81", "i") )
  }
```

The difference between the two above notations is just a syntactical one. Redundant expressions like ‘?net’ have been removed to minimize the string size and single apostrophes have been replaced by double quotes as needed for further internal processing.

The RDF/XML formatted output of this query:

```
<?xml version="1.0"?>
<sparql
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:xs="http://www.w3.org/2001/XMLSchema#"
    xmlns="http://www.w3.org/2005/sparql-results#" >
  <head>
    <variable name="net"/>
    <variable name="descr"/>
    <variable name="wsurl"/>
    <variable name="super"/>
    <variable name="usedFor"/>
  </head>
  <results ordered="false" distinct="true">
    <result>
      <binding name="net">
        <uri>http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC1</uri>
      </binding>
      <binding name="descr">
        <literal>8x10 bit map handwritten cipher cognition C1</literal>
      </binding>
      <binding name="wsurl">
        <literal>http://localhost:8080/hcc/hccws</literal>
      </binding>
      <binding name="super">
        <uri>http://localhost:8080/nnont/NNFull#Supervised</uri>
      </binding>
      <binding name="usedFor">
        <uri>http://localhost:8080/nnont/NNFull#Cognition</uri>
      </binding>
    </result>
  </results>
</sparql>
```

The private method ‘doQuery’, called by each of the public methods with a Jena/ARQ query object, is executing the query and formatting the output to RDF/XML. Right here the reasoning is happening. The reasoner used is the open-source Java based OWL DL reasoner ‘Pellet’.

The more complex the ontology is, i.e. the more OWL properties like ‘complementOf’, ‘disjointWith’, etc. are used, the more inferred knowledge can be reasoned, the more nets will be found without matching exact search criteria.

3.5.2 Ontology manager

3.5.2.1 Methods

public ontologyUpdate

3.5.2.2 Description

The – until know – one and only method of this class provides the functionality to insert/update the definition of neuronal nets in the ontology (insert/update nn individuals). The uploaded text file must contain one or more definitions of updated or new neuronal nets that validate against the ontology.
Updates will just be performed if the ‘previousVersion’ tag of the new net fits the ‘hasVersion’ tag of the old one. Before and after the merger of the two ontologies the validity is checked. The updated ontology will just be written if the new, updated ontology is valid.

Example of an update file (.owl):

```
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF [
    <!ENTITY owl "http://www.w3.org/2002/07/owl#">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#">
]>
<rdf:RDF xml:base="http://localhost:8080/nnont/NNFull#" xmlns="http://localhost:8080/nnont/NNFull#"
xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:xsd="http://www.w3.org/2001/XMLSchema#">
    <NeuronalNet rdf:ID="HandwrittenCipherCognitionC2">
        <hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition C2</hasDescription>
        <usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
        <hasVersion>v0.0.2 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
        <isTrained>true</isTrained>
        <isTrainable>true</isTrainable>
        <trainURL>http://localhost:8080/hcc/hcctrain</trainURL>
        <evalURL>http://localhost:8080/hcc/hcceval</evalURL>
        <definitionURL>http://localhost:8080/hcc/hccdef</definitionURL>
        <inputLayerSize>81</inputLayerSize>
        <hiddenLayerCnt>2</hiddenLayerCnt>
        <outputLayerSize>11</outputLayerSize>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HandwrittenCipherCognition">
        <hasInput rdf:resource="#Real"/>
        <isSupervised rdf:resource="#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition the new one!</hasDescription>
        <usedFor rdf:resource="#Storage"/>
        <hasVersion>v0.0.2 dummy</hasVersion>
        <hasPrevVersion>v0.0.1 dummy</hasPrevVersion>
        <isTrained>false</isTrained>
        <isTrainable>false</isTrainable>
        <trainURL/>
```

```
        <evalURL/>
        <definitionURL/>
        <inputLayerSize/>
        <hiddenLayerCnt/>
        <outputLayerSize/>
    </NeuronalNet>
</rdf:RDF>
```

3.5.2.3 Deletion – not yet implemented

Because this work is meant as a proof-of-concept to insert/update the ontology and to reason about it the deletion of WS descriptions stayed unimplemented. However, a fully fledged product needs also to be able to delete old definitions. The following few paragraphs should give a rough overview of how this could be implemented.

In fact it is no difficult task – one class, the ontologyManager, needs to be enlarged by some logic which is already in use for similar tasks.

The best and simplest way would be to pass the information within the update file as a new child tag – e.g. <tbd/> – of a WS description. This means that no new web service method needs to be added and the client (web based front end) does not need to be touched either – nor does the ontology. If the ontogyManager finds a resource with this child-tag it just needs to delete the resource from the ontology as well as from the uploaded update file.

The Jena command to perform this action is

`Model.remove(java.util.List statements)` which is already used to drop updated nets from the ontology before the updated and new ones get merged into.

Please keep in mind that above description is not tested and may not be able to be implemented this straightforwardly. Problems could arise e.g. from the validation of the uploaded update file if just one tag (which is not defined in the ontology) is given for a resource, etc.

4 Testcases – User perspective

4.1 Quicksearch

This function provides the ability to search the ontology by catchwords separated by colon. By using three different kinds of catchwords the user can define to query the description or a property of the neuronal nets. The third is used to add more properties to the output.
Without defining any additional output just the URI (the name of the net), the description, and the URL of the web service (where the net can be accessed) is returned.

- To query a property a neuronal net property (as defined at the ontology) has to be indicated with a property value.

  Example how to query just supervised nets with binary input:
  nn:hasInput nn:Binary, nn:isSupervised nn:Supervised

- To query the description just a string has to be given.

  Example how to query nets with the description containing 'c2' and binary input:
  c2, nn:hasInput nn:Binary

- To filter any other literal value of the net description the property followed by a string needs to be indicated:
  nn:inputLayerSize 80

- To add more properties to the output without or with querying them the wanted property has to be listed with a variable name used for the output.

  Example how to query nets with the description containing 'c2', binary input, and the additional output of the property 'hasVersion':
  nn:hasInput nn:Binary, nn:hasVersion ?version, c2

The order of the tokens does not matter. Properties can be added to the output and queried at once. Several different strings to query the description are treated as 'AND' concatenated – both need to be part of the description of the net.

4.1.1 Test 1 – No nets found

Input

nn:hasInput nn:Binary, nn:hasVersion ?version, c2

Output (no nets found)

```
<?xml version="1.0"?>
<sparql
   xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
   xmlns:xs="http://www.w3.org/2001/XMLSchema#"
   xmlns="http://www.w3.org/2005/sparql-results#" >
  <head>
    <variable name="net"/>
    <variable name="descr"/>
    <variable name="wsurl"/>
    <variable name="version"/>
  </head>
  <results ordered="false" distinct="true">
  </results>
</sparql>
```

4.1.2 Test 2 – One net found

Input

nn:hasInput nn:Binary, nn:hasVersion ?version, c1, nn:inputLayerSize 81

Output

One net found with additional output of property ‘hasVersion’.

```
<?xml version="1.0"?>
<sparql
   xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
   xmlns:xs="http://www.w3.org/2001/XMLSchema#"
   xmlns="http://www.w3.org/2005/sparql-results#" >
  <head>
    <variable name="net"/>
    <variable name="descr"/>
    <variable name="wsurl"/>
    <variable name="version"/>
  </head>
  <results ordered="false" distinct="true">
    <result>
      <binding name="net">
        <uri>http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC1</uri>
      </binding>
      <binding name="descr">
        <literal>8x10 bit map handwritten cipher cognition C1</literal>
      </binding>
      <binding name="wsurl">
        <literal>http://localhost:8080/hcc/hccws</literal>
      </binding>
      <binding name="version">
        <literal>v0.0.1 dummy</literal>
      </binding>
    </result>
  </results>
</sparql>
```

4.1.3 Test 3 – All nets found

Input

cipher

Output

All – three – nets found with standard output of URI, description, and URL.


```xml
<?xml version="1.0"?>
<sparql
   xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
   xmlns:xs="http://www.w3.org/2001/XMLSchema#"
   xmlns="http://www.w3.org/2005/sparql-results#" >
  <head>
    <variable name="net"/>
    <variable name="descr"/>
    <variable name="wsurl"/>
  </head>
  <results ordered="false" distinct="true">
    <result>
      <binding name="net">
        <uri>http://localhost:8080/nnont/NNFull#HandwrittenCipherCognition</uri>
      </binding>
      <binding name="descr">
        <literal>8x10 bit map handwritten cipher cognition</literal>
      </binding>
      <binding name="wsurl">
        <literal>http://localhost:8080/hcc/hccws</literal>
      </binding>
    </result>
    <result>
      <binding name="net">
        <uri>http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC1</uri>
      </binding>
      <binding name="descr">
        <literal>8x10 bit map handwritten cipher cognition C1</literal>
      </binding>
      <binding name="wsurl">
        <literal>http://localhost:8080/hcc/hccws</literal>
      </binding>
    </result>
    <result>
      <binding name="net">
        <uri>http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC2</uri>
      </binding>
      <binding name="descr">
        <literal>8x10 bit map handwritten cipher cognition C2</literal>
      </binding>
      <binding name="wsurl">
        <literal>http://localhost:8080/hcc/hccws</literal>
      </binding>
    </result>
  </results>
</sparql>
```

4.1.4 Test 4 – Search without description matching

Input

nn:hasInput nn:Real, nn:hasVersion ?version

Output

The Output is the same as at ‘4.1.2 Test 2 – One net found’.

4.2 Advanced Search

As the behavior of the two functions provided by this tab (send a query or a file) is the same I just describe the direct query input and not the query file upload.
The used queries are the queries constructed from tests 4.1.1 to 4.1.4.

4.2.1 Test 1 – No nets found

Input

```
PREFIX nn: <http://localhost:8080/nnont/NNFull#>
SELECT DISTINCT ?neuro ?descr ?url ?version
WHERE {
 ?neuro nn:hasDescription ?descr.
 ?neuro nn:hasEndpointURI ?url.
 ?neuro nn:hasInput nn:Binary.
 ?neuro  nn:hasVersion ?version.
 FILTER regex(?descr, ' c2', 'i')
 }
```

Output

No nets exist matching those criteria.
The Output is the same as at ‘4.1.1

Test 1 – No nets found'.

4.2.2 Test 2 – One net found

Input

```
PREFIX nn: <http://localhost:8080/nnont/NNFull#>
SELECT DISTINCT ?neuro ?descr ?url ?version
WHERE {
 ?neuro nn:hasDescription ?descr.
 ?neuro nn:hasEndpointURI ?url.
 ?neuro nn:hasInput nn:Real.
 ?neuro  nn:hasVersion ?version.
 FILTER regex(?descr, ' c2', 'i')
 }
```

Output

The Output is the same as at '4.1.2 Test 2 – One net found'.

4.2.3 Test 3 – all nets found

Input

```
PREFIX nn: <http://localhost:8080/nnont/NNFull#>
SELECT DISTINCT ?neuro ?descr ?url
WHERE {
 ?neuro nn:hasDescription ?descr.
 ?neuro nn:hasEndpointURI ?url.
 FILTER regex(?descr, 'cipher', 'i')
 }
```

Output

The Output is the same as at '4.1.3

Test 3 – All nets found'.

4.2.4 Test 3 – Successful search without description matching

Input

```
PREFIX nn: <http://localhost:8080/nnont/NNFull#>
SELECT DISTINCT ?neuro ?descr ?url ?version
WHERE {
 ?neuro nn:hasDescription ?descr.
 ?neuro nn:hasEndpointURI ?url.
 ?neuro nn:hasInput nn:Real.
 ?neuro  nn:hasVersion ?version.
 FILTER regex(?descr, '')
 }
```

Output

The Output is the same as at '4.1.2 Test 2 – One net found'.

Important here is the FILTER-expression in the where clause.

Even without a string to look for it is needed to return the proper net.

4.2.5 Test 4 – Unsuccessful search without description matching

Input

```
PREFIX nn: <http://localhost:8080/nnont/NNFull#>
SELECT DISTINCT ?neuro ?descr ?url ?version
WHERE {
 ?neuro nn:hasDescription ?descr.
 ?neuro nn:hasEndpointURI ?url.
 ?neuro nn:hasInput nn:Real.
 ?neuro  nn:hasVersion ?version.
 }
```

Output

The Output is the same as at '4.1.1

Test 1 – No nets found'.
Without an empty FILTER-expression the net is not found though one matching the given criteria exists.

4.3 Ontology update

The original, manually constructed ontology given in 'Appendix A – Original ontology at localhost' will be updated twice to show the effect of version mismatching.
The third test is performed with an update file with a false 'xml base' which results in abruption of the process.

4.3.1 Test 1 – Insert, update, and version mismatch

To check the insert/update function, query the nets before and after the update and compare the results. Query e.g. 'quicksearch' with 'handwritten' to find all nets in the ontology.
The net 'HandwrittenCipherCognition' will be updated, the net '…C4' inserted and the net '…C2' stays unchanged.

Input


```
<?xml version="1.0"?>
<rdf:RDF xmlns:j.0="http://localhost:8080/nnont/NNFull#" xmlns:j.1="http://localhost:8080/nnont/"
xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">
    <rdf:Description rdf:nodeID="A0">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Thing">
        <owl:equivalentClass rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <owl:complementOf rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#isTrainable">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#isTrainable"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#isTrainable"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A1">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Classification"/>
        <rdf:rest rdf:nodeID="A2"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#ResourceDistribution">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A3">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A4">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
```

```
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC1">
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
        <j.0:hasDescription>8x10 bit map handwritten cipher cognition C1</j.0:hasDescription>
        <j.0:hasVersion>v0.0.1 dummy</j.0:hasVersion>
        <j.0:hiddenLayerCnt>2</j.0:hiddenLayerCnt>
        <j.0:outputLayerSize>11</j.0:outputLayerSize>
        <j.0:trainURL>http://localhost:8080/hcc/hcctrain</j.0:trainURL>
        <j.0:hasPrevVersion>v0.0.0 dummy</j.0:hasPrevVersion>
        <j.0:definitionURL>http://localhost:8080/hcc/hccdef</j.0:definitionURL>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:evalURL>http://localhost:8080/hcc/hcceval</j.0:evalURL>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
        <j.0:isTrainable>true</j.0:isTrainable>
        <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
        <j.0:isTrained>true</j.0:isTrained>
        <j.0:inputLayerSize>81</j.0:inputLayerSize>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A5">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#inputLayerSize"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A6">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
        <rdf:rest rdf:nodeID="A7"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#outputLayerSize">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#outputLayerSize"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#outputLayerSize"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#UseCase">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:oneOf rdf:nodeID="A1"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#inputLayerSize">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#inputLayerSize"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#inputLayerSize"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A8">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Classification"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC2">
        <j.0:hasVersion>v0.0.1 dummy</j.0:hasVersion>
        <j.0:hiddenLayerCnt/>
```

```
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
        <j.0:trainURL/>
        <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
        <j.0:isTrained>false</j.0:isTrained>
        <j.0:isTrainable>false</j.0:isTrainable>
        <j.0:outputLayerSize/>
        <j.0:definitionURL/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:inputLayerSize/>
        <j.0:evalURL/>
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
        <j.0:hasPrevVersion>v0.0.0 dummy</j.0:hasPrevVersion>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <j.0:hasDescription>8x10 bit map handwritten cipher cognition C2</j.0:hasDescription>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A9">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasVersion"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A10">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdf:rest rdf:nodeID="A11"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#FeatureExtraction">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A12">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
        <rdf:rest rdf:nodeID="A13"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A14">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Reconstruction"/>
        <rdf:rest rdf:nodeID="A6"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A15">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#trainURL"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A11">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdf:rest rdf:nodeID="A16"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A17">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Supervision">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:oneOf rdf:nodeID="A18"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A19">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hiddenLayerCnt"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
```

```
<rdf:Description rdf:nodeID="A20">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
    <rdf:rest rdf:nodeID="A14"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#PatternRestore">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A21">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:allValuesFrom rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A22">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#DataProperties"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#ClusterAnalysis">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A2">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Prognose"/>
    <rdf:rest rdf:nodeID="A23"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A24">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#FeatureExtraction"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A25">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A7">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ClusterAnalysis"/>
    <rdf:rest rdf:nodeID="A26"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A27">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdf:rest rdf:nodeID="A28"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Hamming">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <rdfs:subClassOf rdf:nodeID="A3"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdfs:subClassOf rdf:nodeID="A29"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:nodeID="A30"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A31">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
</rdf:Description>
```

```xml
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasPrevVersion">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasPrevVersion"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasPrevVersion"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A26">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ResourceDistribution"/>
    <rdf:rest rdf:nodeID="A32"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Optimization">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A33">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Reconstruction"/>
    <rdf:rest rdf:nodeID="A34"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A35">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A36">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    <rdf:rest rdf:nodeID="A37"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#DataProperties">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#trainURL">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#trainURL"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#trainURL"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#evalURL">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#evalURL"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#evalURL"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A32">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#FeatureDetection"/>
    <rdf:rest rdf:nodeID="A38"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A39">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Approximation"/>
    <rdf:rest rdf:nodeID="A12"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A40">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <rdf:rest rdf:nodeID="A27"/>
</rdf:Description>
```

```
    <rdf:Description rdf:nodeID="A41">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdf:rest rdf:nodeID="A42"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A43">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ResourceDistribution"/>
        <rdf:rest rdf:nodeID="A44"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#CarpenterGrossberg">
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:nodeID="A45"/>
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdfs:subClassOf rdf:nodeID="A46"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:nodeID="A31"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A47">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
        <owl:distinctMembers rdf:nodeID="A48"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A49">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A44">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#FeatureDetection"/>
        <rdf:rest rdf:nodeID="A22"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Ontology"/>
        <rdfs:comment>A schema Ontology describing Neuronal Nets and their WebService
endpoint</rdfs:comment>
        <owl:versionInfo>0.0.2</owl:versionInfo>
        <owl:priorVersion rdf:resource="http://localhost:8080/nnont/NNFull"/>
        <rdfs:comment>
            pre release test ontology (schema and data in one)
        </rdfs:comment>
        <rdfs:label>Neutornal Net Ontology</rdfs:label>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A50">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdf:rest rdf:nodeID="A41"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC4">
        <j.0:hasPrevVersion>v0.0.0 dummy</j.0:hasPrevVersion>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
        <j.0:hasVersion>v0.0.1 dummy</j.0:hasVersion>
        <j.0:inputLayerSize/>
        <j.0:isTrainable>false</j.0:isTrainable>
        <j.0:definitionURL/>
        <j.0:evalURL/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <j.0:hiddenLayerCnt/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
```

```
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <j.0:hasDescription>8x10 bit map handwritten cipher cognition C4</j.0:hasDescription>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:outputLayerSize/>
        <j.0:isTrained>false</j.0:isTrained>
        <j.0:trainURL/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognition">
        <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <j.0:evalURL/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <j.0:hasPrevVersion>v0.0.1 dummy</j.0:hasPrevVersion>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:trainURL/>
        <j.0:hiddenLayerCnt/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <j.0:hasVersion>v0.0.2 dummy</j.0:hasVersion>
        <j.0:inputLayerSize/>
        <j.0:isTrained>false</j.0:isTrained>
        <j.0:isTrainable>false</j.0:isTrainable>
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Storage"/>
        <j.0:hasDescription>8x10 bit map handwritten cipher cognition the new one!</j.0:hasDescription>
        <j.0:definitionURL/>
        <j.0:outputLayerSize/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A18">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <rdf:rest rdf:nodeID="A0"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A48">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <rdf:rest rdf:nodeID="A50"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasDescription">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasDescription"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasDescription"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A51">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasPrevVersion"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#isSupervised">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#usedFor">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
```

```
</rdf:Description>
<rdf:Description rdf:nodeID="A38">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#DataProperties"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A52">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Binary">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A53">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
    <owl:allValuesFrom rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A54">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    <rdf:rest rdf:nodeID="A55"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#NeuronalNet">
    <rdfs:subClassOf rdf:nodeID="A9"/>
    <rdfs:subClassOf rdf:nodeID="A56"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <rdfs:subClassOf rdf:nodeID="A15"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:subClassOf rdf:nodeID="A19"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdfs:subClassOf rdf:nodeID="A57"/>
    <rdfs:subClassOf rdf:nodeID="A51"/>
    <rdfs:subClassOf rdf:nodeID="A17"/>
    <rdfs:subClassOf rdf:nodeID="A53"/>
    <rdfs:subClassOf rdf:nodeID="A58"/>
    <rdfs:subClassOf rdf:nodeID="A59"/>
    <rdfs:subClassOf rdf:nodeID="A21"/>
    <rdfs:subClassOf rdf:nodeID="A60"/>
    <rdfs:subClassOf rdf:nodeID="A5"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Prognose">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A61">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
    <owl:distinctMembers rdf:nodeID="A62"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A29">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A37">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A63">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ClusterAnalysis"/>
    <rdf:rest rdf:nodeID="A43"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A56">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
```

```
    <owl:allValuesFrom rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A64">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdf:rest rdf:nodeID="A65"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A30">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A66">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Prognose"/>
    <rdf:rest rdf:nodeID="A39"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#NotSupervised">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A28">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdf:rest rdf:nodeID="A10"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasVersion">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasVersion"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasVersion"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A65">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#definitionURL">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#definitionURL"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#definitionURL"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A67">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A68">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Approximation"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#FeatureDetection">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Classification">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NeuronalNet">
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
```

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        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A69">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Storage"/>
        <rdf:rest rdf:nodeID="A70"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A71">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
        <owl:distinctMembers rdf:nodeID="A36"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hiddenLayerCnt">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hiddenLayerCnt"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hiddenLayerCnt"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A70">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <rdf:rest rdf:nodeID="A33"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A60">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#outputLayerSize"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A34">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
        <rdf:rest rdf:nodeID="A63"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A72">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A73">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
        <owl:distinctMembers rdf:nodeID="A74"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Hopfield">
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdfs:subClassOf rdf:nodeID="A67"/>
        <rdfs:subClassOf rdf:nodeID="A4"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:nodeID="A52"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#NetType">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
```

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    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:oneOf rdf:nodeID="A40"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Approximation">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A74">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    <rdf:rest rdf:nodeID="A75"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Kohonen">
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdfs:subClassOf rdf:nodeID="A49"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:nodeID="A24"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdfs:subClassOf rdf:nodeID="A35"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A75">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A76">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
    <rdf:rest rdf:nodeID="A69"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#isTrained">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#isTrained"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#isTrained"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A77">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Perceptron">
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <rdfs:subClassOf rdf:nodeID="A72"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdfs:subClassOf rdf:nodeID="A78"/>
    <rdfs:subClassOf rdf:nodeID="A8"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
```

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        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A13">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Storage"/>
        <rdf:rest rdf:nodeID="A20"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A16">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://www.w3.org/2001/XMLSchema#String">
        <owl:equivalentClass rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Supervised">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasEndpointURI">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasEndpointURI"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasEndpointURI"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A55">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A23">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Approximation"/>
        <rdf:rest rdf:nodeID="A76"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Input">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:oneOf rdf:nodeID="A54"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A78">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Storage">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A57">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#evalURL"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Nothing">
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        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <owl:complementOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <owl:equivalentClass rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HopfieldGoodTest">
        <j.0:hasPrevVersion>v0.0.0</j.0:hasPrevVersion>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <j.0:outputLayerSize/>
        <j.0:hasVersion>v0.0.1</j.0:hasVersion>
        <j.0:trainURL/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:hasDescription>Hopfield good test</j.0:hasDescription>
        <j.0:definitionURL/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <j.0:inputLayerSize/>
        <j.0:isTrainable>false</j.0:isTrainable>
        <j.0:isTrained>false</j.0:isTrained>
        <j.0:hiddenLayerCnt/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
        <j.0:hasEndpointURI>http://localhost:8080/hgt</j.0:hasEndpointURI>
        <j.0:evalURL/>
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Cognition">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A58">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasDescription"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A42">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdf:rest rdf:nodeID="A64"/>
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    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Real">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron">
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:nodeID="A68"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:nodeID="A77"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <rdfs:subClassOf rdf:nodeID="A25"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A62">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Classification"/>
        <rdf:rest rdf:nodeID="A66"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Reconstruction">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A59">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasEndpointURI"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A45">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasInput">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A46">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
    </rdf:Description>
</rdf:RDF>
```


Appendix C – Ontology update file for localhost

Output

The updated ontology can be found at 'Appendix B – Updated ontology at localhost'.

[Mi, 22 Nov 2006 04:11:56.187, fileManager v0.2.0 beta, owlUpdate(byte[])] -- Pos: starting to update ontology
Indicated update model is valid!

Nets to insert/update:
  HandwrittenCipherCognition, previous Version: v0.0.1 dummy
  HandwrittenCipherCognitionC4, previous Version: v0.0.0 dummy
  HandwrittenCipherCognitionC2, previous Version: v0.0.0 dummy
!!! HandwrittenCipherCognitionC2: skipped due to version mismatch!
  HandwrittenCipherCognitionC2: current net has version: v0.0.1 dummy
HandwrittenCipherCognitionC4 will be inserted
HandwrittenCipherCognition: version matched, will be updated
Updated model is valid!

4.3.2 Test 2 – Update new ontology with the same file

Input


```
<?xml version="1.0"?>
<rdf:RDF xmlns:j.0="http://localhost:8080/nnont/NNFull#"
xmlns:j.1="http://localhost:8080/nnont/"
xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">
  <rdf:Description rdf:nodeID="A0">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Thing">
    <owl:equivalentClass rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <owl:complementOf rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#isTrainable">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#isTrainable"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#isTrainable"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A1">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Classification"/>
    <rdf:rest rdf:nodeID="A2"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#ResourceDistribution">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A3">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A4">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC1">
    <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
    <j.0:hasDescription>8x10 bit map handwritten cipher cognition C1</j.0:hasDescription>
    <j.0:hasVersion>v0.0.1 dummy</j.0:hasVersion>
    <j.0:hiddenLayerCnt>2</j.0:hiddenLayerCnt>
    <j.0:outputLayerSize>11</j.0:outputLayerSize>
```

```
        <j.0:trainURL>http://localhost:8080/hcc/hcctrain</j.0:trainURL>
        <j.0:hasPrevVersion>v0.0.0 dummy</j.0:hasPrevVersion>
        <j.0:definitionURL>http://localhost:8080/hcc/hccdef</j.0:definitionURL>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:evalURL>http://localhost:8080/hcc/hcceval</j.0:evalURL>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
        <j.0:isTrainable>true</j.0:isTrainable>
        <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
        <j.0:isTrained>true</j.0:isTrained>
        <j.0:inputLayerSize>81</j.0:inputLayerSize>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A5">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#inputLayerSize"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A6">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
        <rdf:rest rdf:nodeID="A7"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#outputLayerSize">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#outputLayerSize"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#outputLayerSize"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#UseCase">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:oneOf rdf:nodeID="A1"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#inputLayerSize">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#inputLayerSize"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#inputLayerSize"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A8">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Classification"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC2">
        <j.0:hasVersion>v0.0.1 dummy</j.0:hasVersion>
        <j.0:hiddenLayerCnt/>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
        <j.0:trainURL/>
        <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
        <j.0:isTrained>false</j.0:isTrained>
        <j.0:isTrainable>false</j.0:isTrainable>
        <j.0:outputLayerSize/>
        <j.0:definitionURL/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
```

```
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:inputLayerSize/>
        <j.0:evalURL/>
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
        <j.0:hasPrevVersion>v0.0.0 dummy</j.0:hasPrevVersion>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <j.0:hasDescription>8x10 bit map handwritten cipher cognition C2</j.0:hasDescription>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A9">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasVersion"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A10">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdf:rest rdf:nodeID="A11"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#FeatureExtraction">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A12">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
        <rdf:rest rdf:nodeID="A13"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A14">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Reconstruction"/>
        <rdf:rest rdf:nodeID="A6"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A15">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#trainURL"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A11">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdf:rest rdf:nodeID="A16"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A17">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Supervision">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:oneOf rdf:nodeID="A18"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A19">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hiddenLayerCnt"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A20">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <rdf:rest rdf:nodeID="A14"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#PatternRestore">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
```

```
<rdf:Description rdf:nodeID="A21">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:allValuesFrom rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A22">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#DataProperties"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#ClusterAnalysis">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A2">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Prognose"/>
    <rdf:rest rdf:nodeID="A23"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A24">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#FeatureExtraction"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A25">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A7">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ClusterAnalysis"/>
    <rdf:rest rdf:nodeID="A26"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A27">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdf:rest rdf:nodeID="A28"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Hamming">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <rdfs:subClassOf rdf:nodeID="A3"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdfs:subClassOf rdf:nodeID="A29"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:nodeID="A30"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A31">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasPrevVersion">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasPrevVersion"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasPrevVersion"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
```

```
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A26">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ResourceDistribution"/>
    <rdf:rest rdf:nodeID="A32"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Optimization">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A33">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Reconstruction"/>
    <rdf:rest rdf:nodeID="A34"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A35">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A36">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    <rdf:rest rdf:nodeID="A37"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#DataProperties">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#trainURL">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#trainURL"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#trainURL"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#evalURL">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#evalURL"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#evalURL"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A32">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#FeatureDetection"/>
    <rdf:rest rdf:nodeID="A38"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A39">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Approximation"/>
    <rdf:rest rdf:nodeID="A12"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A40">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <rdf:rest rdf:nodeID="A27"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A41">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdf:rest rdf:nodeID="A42"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A43">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ResourceDistribution"/>
    <rdf:rest rdf:nodeID="A44"/>
</rdf:Description>
```

```
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#CarpenterGrossberg">
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:nodeID="A45"/>
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdfs:subClassOf rdf:nodeID="A46"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:nodeID="A31"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A47">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
        <owl:distinctMembers rdf:nodeID="A48"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A49">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A44">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#FeatureDetection"/>
        <rdf:rest rdf:nodeID="A22"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Ontology"/>
        <rdfs:comment>A schema Ontology describing Neuronal Nets and their WebService
endpoint</rdfs:comment>
        <owl:versionInfo>0.0.2</owl:versionInfo>
        <owl:priorVersion rdf:resource="http://localhost:8080/nnont/NNFull"/>
        <rdfs:comment>
            pre release test ontology (schema and data in one)
        </rdfs:comment>
        <rdfs:label>Neutornal Net Ontology</rdfs:label>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A50">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdf:rest rdf:nodeID="A41"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC4">
        <j.0:hasPrevVersion>v0.0.0 dummy</j.0:hasPrevVersion>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
        <j.0:hasVersion>v0.0.1 dummy</j.0:hasVersion>
        <j.0:inputLayerSize/>
        <j.0:isTrainable>false</j.0:isTrainable>
        <j.0:definitionURL/>
        <j.0:evalURL/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <j.0:hiddenLayerCnt/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <j.0:hasDescription>8x10 bit map handwritten cipher cognition C4</j.0:hasDescription>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:outputLayerSize/>
        <j.0:isTrained>false</j.0:isTrained>
        <j.0:trainURL/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognition">
```

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        <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <j.0:evalURL/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <j.0:hasPrevVersion>v0.0.1 dummy</j.0:hasPrevVersion>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:trainURL/>
        <j.0:hiddenLayerCnt/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <j.0:hasVersion>v0.0.2 dummy</j.0:hasVersion>
        <j.0:inputLayerSize/>
        <j.0:isTrained>false</j.0:isTrained>
        <j.0:isTrainable>false</j.0:isTrainable>
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Storage"/>
        <j.0:hasDescription>8x10 bit map handwritten cipher cognition the new one!</j.0:hasDescription>
        <j.0:definitionURL/>
        <j.0:outputLayerSize/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A18">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <rdf:rest rdf:nodeID="A0"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A48">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <rdf:rest rdf:nodeID="A50"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasDescription">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasDescription"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasDescription"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A51">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasPrevVersion"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#isSupervised">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#usedFor">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A38">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#DataProperties"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A52">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
```

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    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Binary">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A53">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
    <owl:allValuesFrom rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A54">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    <rdf:rest rdf:nodeID="A55"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#NeuronalNet">
    <rdfs:subClassOf rdf:nodeID="A9"/>
    <rdfs:subClassOf rdf:nodeID="A56"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <rdfs:subClassOf rdf:nodeID="A15"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:subClassOf rdf:nodeID="A19"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdfs:subClassOf rdf:nodeID="A57"/>
    <rdfs:subClassOf rdf:nodeID="A51"/>
    <rdfs:subClassOf rdf:nodeID="A17"/>
    <rdfs:subClassOf rdf:nodeID="A53"/>
    <rdfs:subClassOf rdf:nodeID="A58"/>
    <rdfs:subClassOf rdf:nodeID="A59"/>
    <rdfs:subClassOf rdf:nodeID="A21"/>
    <rdfs:subClassOf rdf:nodeID="A60"/>
    <rdfs:subClassOf rdf:nodeID="A5"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Prognose">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A61">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
    <owl:distinctMembers rdf:nodeID="A62"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A29">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A37">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A63">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ClusterAnalysis"/>
    <rdf:rest rdf:nodeID="A43"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A56">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:allValuesFrom rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A64">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdf:rest rdf:nodeID="A65"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A30">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
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    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A66">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Prognose"/>
    <rdf:rest rdf:nodeID="A39"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#NotSupervised">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A28">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdf:rest rdf:nodeID="A10"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasVersion">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasVersion"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasVersion"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A65">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#definitionURL">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#definitionURL"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#definitionURL"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A67">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A68">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Approximation"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#FeatureDetection">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Classification">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NeuronalNet">
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A69">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Storage"/>
    <rdf:rest rdf:nodeID="A70"/>
</rdf:Description>
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<rdf:Description rdf:nodeID="A71">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
    <owl:distinctMembers rdf:nodeID="A36"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hiddenLayerCnt">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hiddenLayerCnt"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hiddenLayerCnt"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A70">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
    <rdf:rest rdf:nodeID="A33"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A60">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#outputLayerSize"/>
    <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
</rdf:Description>
<rdf:Description rdf:nodeID="A34">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
    <rdf:rest rdf:nodeID="A63"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A72">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A73">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
    <owl:distinctMembers rdf:nodeID="A74"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Hopfield">
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdfs:subClassOf rdf:nodeID="A67"/>
    <rdfs:subClassOf rdf:nodeID="A4"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:nodeID="A52"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#NetType">
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:oneOf rdf:nodeID="A40"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Approximation">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
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</rdf:Description>
<rdf:Description rdf:nodeID="A74">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    <rdf:rest rdf:nodeID="A75"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Kohonen">
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdfs:subClassOf rdf:nodeID="A49"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:nodeID="A24"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdfs:subClassOf rdf:nodeID="A35"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A75">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A76">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
    <rdf:rest rdf:nodeID="A69"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#isTrained">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#isTrained"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#isTrained"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A77">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Perceptron">
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <rdfs:subClassOf rdf:nodeID="A72"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdfs:subClassOf rdf:nodeID="A78"/>
    <rdfs:subClassOf rdf:nodeID="A8"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A13">
```

```
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Storage"/>
        <rdf:rest rdf:nodeID="A20"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A16">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://www.w3.org/2001/XMLSchema#String">
        <owl:equivalentClass rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Supervised">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasEndpointURI">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasEndpointURI"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasEndpointURI"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A55">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A23">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Approximation"/>
        <rdf:rest rdf:nodeID="A76"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Input">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:oneOf rdf:nodeID="A54"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A78">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Storage">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A57">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#evalURL"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Nothing">
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <owl:complementOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
```

```
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <owl:equivalentClass rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HopfieldGoodTest">
        <j.0:hasPrevVersion>v0.0.0</j.0:hasPrevVersion>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <j.0:outputLayerSize/>
        <j.0:hasVersion>v0.0.1</j.0:hasVersion>
        <j.0:trainURL/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:hasDescription>Hopfield good test</j.0:hasDescription>
        <j.0:definitionURL/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <j.0:inputLayerSize/>
        <j.0:isTrainable>false</j.0:isTrainable>
        <j.0:isTrained>false</j.0:isTrained>
        <j.0:hiddenLayerCnt/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
        <j.0:hasEndpointURI>http://localhost:8080/hgt</j.0:hasEndpointURI>
        <j.0:evalURL/>
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Cognition">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A58">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasDescription"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A42">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdf:rest rdf:nodeID="A64"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Real">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron">
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
```

```
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:nodeID="A68"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:nodeID="A77"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <rdfs:subClassOf rdf:nodeID="A25"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A62">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Classification"/>
        <rdf:rest rdf:nodeID="A66"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Reconstruction">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A59">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasEndpointURI"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A45">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasInput">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A46">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
    </rdf:Description>
</rdf:RDF>
```


Appendix C – Ontology update file for localhost

Output

As the update process is cancelled the ontology will not be modified in any way.

```
[Mi, 22 Nov 2006 04:13:06.718, fileManager v0.2.0 beta, owlUpdate(byte[])] -- Pos: starting to update
ontology
Indicated update model is valid!
Nets to insert/update:
   HandwrittenCipherCognition, previous Version: v0.0.1 dummy
   HandwrittenCipherCognitionC4, previous Version: v0.0.0 dummy
   HandwrittenCipherCognitionC2, previous Version: v0.0.0 dummy
!!! HandwrittenCipherCognitionC2: skipped due to version mismatch!
   HandwrittenCipherCognitionC2: current net has version: v0.0.1 dummy
!!! HandwrittenCipherCognitionC4: skipped due to version mismatch!
   HandwrittenCipherCognitionC4: current net has version: v0.0.1 dummy
```

!!! HandwrittenCipherCognition: skipped due to version mismatch!
    HandwrittenCipherCognition: current net has version: v0.0.2 dummy

No nets rest to be updated!
Update cancelled!

4.3.3 Test 3 – Update original ontology with wrong update file

Input

Appendix D – Ontology update file for another server

Output

As the update process is cancelled the ontology will not be modified in any way.

[Mi, 22 Nov 2006 04:15:54.984, fileManager v0.2.0 beta, owlUpdate(byte[])] -- Pos: starting to update ontology
Indicated update model is valid!
Nets to insert/update:

No nets found to insert/update!
Please check your xml base - has to match the ontology.
Update cancelled!

4.3.4 Test 4 – Update original ontology with bad update file

Input

Appendix E – Bad Ontology update file (Hopfield has wrong input value)

Output

[Fr, 9 Feb 2007 07:02:40.640, ontologyManager v0.2.6 beta, ontologyUpdate(byte[])] -- Pos: starting to update ontology
Indicated update model is valid!
Nets to insert/update:
    HandwrittenCipherCognition, previous Version: v0.0.1 dummy
    HandwrittenCipherCognitionC4, previous Version: v0.0.0 dummy
    HandwrittenCipherCognitionC2, previous Version: v0.0.0 dummy
    HopfieldBadTest, previous Version: v0.0.0
!!! HandwrittenCipherCognitionC2: skipped due to version mismatch!
    HandwrittenCipherCognitionC2: current net has version: v0.0.1 dummy
HandwrittenCipherCognitionC4 will be inserted
HandwrittenCipherCognition: version matched, will be updated
HopfieldBadTest will be inserted
Conflicts in new model - abort operation:
 - Error (KB is inconsistent!): Individual http://localhost:8080/nnont/NNFull#HopfieldBadTest has more than one value for the functional property http://localhost:8080/nnont/NNFull#hasInput

4.4 SolProv properties file error testing

SolProv has been tested with Tomcat 5.5 running on Windows and Linux. The ‘solprov.properties’ file must be in the current user directory. On Windows – started by the service – this is ‘CATALINA_HOME’ – the installation directory of tomcat. Otherwise it is like on Linux: the directory from which the server was started. E.g. the current user directory started from within NetBeans is <CATALINA_HOME>\bin – the properties file must be present there if this integrated mode is chosen.

Example:

Starting the server from CATALINA_HOME: /home/<user>/tomcat5517 with

sh bin/catalina.sh start

sets the current user directory to /home/<user>/tomcat5517 and the ‘solprov.properties’ file has to be located there.

4.4.1 Test 1 – Missing solprov.properties file

Input

Any OWL-file to update the ontology

Output

ERROR: [Mi, 22 Nov 2006 23:32:08.609, SolProvFE v0.2.0 beta, owlFileUpload_btn_action()] -- Pos: reading properties
 -- Error: java.io.FileNotFoundException: solprov.properties (Das System kann die angegebene Datei nicht finden)

4.4.2 Test 2 – Missing required property

Input

Any keywords (quicksearch)

Output

ServerURL was missing

ERROR: [Mi, 22 Nov 2006 15:43:31.453, SolProvFE v0.2.0 beta, quicksearchSend_btn_action()] -- Pos: reading properties
 -- Error: java.lang.Exception: java.lang.Exception: Property 'serverurl' has not been found in 'solprov.properties' file or is empty!

4.4.3 Test 3 – Empty required property

Input

Any query (advanced search)

Output

ServerURL has been empty, ontologypath missing

ERROR: [Mi, 22 Nov 2006 15:47:52.625, SolProvFE v0.2.0 beta, owlQuerySend_btn_action()] -- Pos: reading properties
 -- Error: java.lang.Exception: java.lang.Exception: Properties 'serverurl', 'ontologypath' have not been found in 'solprov.properties' file or are empty!

4.5 Appendix A – Original ontology at localhost


```
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF [
    <!ENTITY owl "http://www.w3.org/2002/07/owl#">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#">
]>
<rdf:RDF xml:base="http://localhost:8080/nnont/NNFull#" xmlns="http://localhost:8080/nnont/NNFull#"
xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-
schema#" xmlns:sp="http://localhost:8080/nnont/NNFull#">
    <owl:Ontology rdf:about="http://localhost:8080/nnont/NNFull">
        <rdfs:comment>A schema Ontology describing Neuronal Nets and their WebService
endpoint</rdfs:comment>
        <owl:versionInfo>0.0.2</owl:versionInfo>
        <owl:priorVersion>
            <owl:Ontology rdf:about="http://localhost:8080/nnont/NNFull"/>
        </owl:priorVersion>
        <rdfs:comment>
            pre release test ontology (schema and data in one)
        </rdfs:comment>
        <rdfs:label>Neutornal Net Ontology</rdfs:label>
    </owl:Ontology>
    <!-- NeuronalNert class definition -->
    <owl:Class rdf:ID="NeuronalNet">
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#hasInput"/>
                <owl:allValuesFrom rdf:resource="#Input"/>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#isSupervised"/>
                <owl:allValuesFrom rdf:resource="#Supervision"/>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#hasEndpointURI"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#hasDescription"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#usedFor"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#usedFor"/>
                <owl:allValuesFrom rdf:resource="#UseCase"/>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#hasVersion"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
```

```
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#hasPrevVersion"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#trainURL"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#evalURL"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#inputLayerSize"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#hiddenLayerCnt"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#outputLayerSize"/>
                <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:cardinality>
            </owl:Restriction>
        </rdfs:subClassOf>
    </owl:Class>
    <!-- Hopfield net definition -->
    <owl:Class rdf:ID="Hopfield">
        <rdfs:subClassOf rdf:resource="NeuronalNet"/>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#hasInput"/>
                <owl:hasValue rdf:resource="#Binary"/>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#isSupervised"/>
                <owl:hasValue rdf:resource="#Supervised"/>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#usedFor"/>
                <owl:hasValue rdf:resource="#PatternRestore"/>
            </owl:Restriction>
        </rdfs:subClassOf>
    </owl:Class>
    <!-- Hamming net definition -->
    <owl:Class rdf:ID="Hamming">
        <rdfs:subClassOf rdf:resource="NeuronalNet"/>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#hasInput"/>
                <owl:hasValue rdf:resource="#Binary"/>
```

```
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="#isSupervised"/>
            <owl:hasValue rdf:resource="#Supervised"/>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="#usedFor"/>
            <owl:hasValue rdf:resource="#Optimization"/>
        </owl:Restriction>
    </rdfs:subClassOf>
</owl:Class>
<!-- CarpenterGrossberg net definition -->
<owl:Class rdf:ID="CarpenterGrossberg">
    <rdfs:subClassOf rdf:resource="NeuronalNet"/>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="#hasInput"/>
            <owl:hasValue rdf:resource="#Binary"/>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="#isSupervised"/>
            <owl:hasValue rdf:resource="#NotSupervised"/>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="#usedFor"/>
            <owl:hasValue rdf:resource="#Optimization"/>
        </owl:Restriction>
    </rdfs:subClassOf>
</owl:Class>
<!-- Perceptron net definition -->
<owl:Class rdf:ID="Perceptron">
    <rdfs:subClassOf rdf:resource="NeuronalNet"/>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="#hasInput"/>
            <owl:hasValue rdf:resource="#Real"/>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="#isSupervised"/>
            <owl:hasValue rdf:resource="#Supervised"/>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="#usedFor"/>
            <owl:hasValue rdf:resource="#Classification"/>
        </owl:Restriction>
    </rdfs:subClassOf>
</owl:Class>
<!-- MultiLayerPerceptron net definition -->
<owl:Class rdf:ID="MultiLayerPerceptron">
    <rdfs:subClassOf rdf:resource="NeuronalNet"/>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="#hasInput"/>
            <owl:hasValue rdf:resource="#Real"/>
        </owl:Restriction>
```

```
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#isSupervised"/>
                <owl:hasValue rdf:resource="#Supervised"/>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#usedFor"/>
                <owl:hasValue rdf:resource="#Approximation"/>
            </owl:Restriction>
        </rdfs:subClassOf>
    </owl:Class>
    <!-- Kohonen net definition -->
    <owl:Class rdf:ID="Kohonen">
        <rdfs:subClassOf rdf:resource="NeuronalNet"/>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#hasInput"/>
                <owl:hasValue rdf:resource="#Real"/>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#isSupervised"/>
                <owl:hasValue rdf:resource="#NotSupervised"/>
            </owl:Restriction>
        </rdfs:subClassOf>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="#usedFor"/>
                <owl:hasValue rdf:resource="#FeatureExtraction"/>
            </owl:Restriction>
        </rdfs:subClassOf>
    </owl:Class>
    <!-- ObjectProperties -->
    <!-- relations between instances of two classes -->
    <owl:ObjectProperty rdf:ID="hasInput">
        <rdf:type rdf:resource="&owl;FunctionalProperty"/>
        <rdfs:domain rdf:resource="#NeuronalNet"/>
        <rdfs:range rdf:resource="#Input"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="isSupervised">
        <rdf:type rdf:resource="&owl;FunctionalProperty"/>
        <rdfs:domain rdf:resource="#NeuronalNet"/>
        <rdfs:range rdf:resource="#Supervision"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="usedFor">
        <rdf:type rdf:resource="&owl;FunctionalProperty"/>
        <rdfs:domain rdf:resource="#NeuronalNet"/>
        <rdfs:range rdf:resource="#UseCase"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="hasEndpointURI">
        <rdf:type rdf:resource="&owl;FunctionalProperty"/>
        <rdfs:domain rdf:resource="#NeuronalNet"/>
        <rdfs:range rdf:resource="&xsd;String"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="hasDescription">
        <rdf:type rdf:resource="&owl;FunctionalProperty"/>
        <rdfs:domain rdf:resource="#NeuronalNet"/>
        <rdfs:range rdf:resource="&xsd;String"/>
    </owl:ObjectProperty>
    <owl:ObjectProperty rdf:ID="hasVersion">
        <rdf:type rdf:resource="&owl;FunctionalProperty"/>
        <rdfs:domain rdf:resource="#NeuronalNet"/>
        <rdfs:range rdf:resource="&xsd;String"/>
```

```
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="hasPrevVersion">
    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="#NeuronalNet"/>
    <rdfs:range rdf:resource="&xsd;String"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="isTrained">
    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="#NeuronalNet"/>
    <rdfs:range rdf:resource="&xsd;String"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="isTrainable">
    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="#NeuronalNet"/>
    <rdfs:range rdf:resource="&xsd;String"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="trainURL">
    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="#NeuronalNet"/>
    <rdfs:range rdf:resource="&xsd;String"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="evalURL">
    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="#NeuronalNet"/>
    <rdfs:range rdf:resource="&xsd;String"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="definitionURL">
    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="#NeuronalNet"/>
    <rdfs:range rdf:resource="&xsd;String"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="inputLayerSize">
    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="#NeuronalNet"/>
    <rdfs:range rdf:resource="&xsd;String"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="hiddenLayerCnt">
    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="#NeuronalNet"/>
    <rdfs:range rdf:resource="&xsd;String"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="outputLayerSize">
    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="#NeuronalNet"/>
    <rdfs:range rdf:resource="&xsd;String"/>
</owl:ObjectProperty>
<!-- Collections -->
<owl:Class rdf:ID="Input">
    <owl:oneOf rdf:parseType="Collection">
        <owl:Thing rdf:about="#Real"/>
        <owl:Thing rdf:about="#Binary"/>
    </owl:oneOf>
</owl:Class>
<owl:Class rdf:ID="Supervision">
    <owl:oneOf rdf:parseType="Collection">
        <owl:Thing rdf:about="#Supervised"/>
        <owl:Thing rdf:about="#NotSupervised"/>
    </owl:oneOf>
</owl:Class>
<owl:Class rdf:ID="UseCase">
    <owl:oneOf rdf:parseType="Collection">
        <owl:Thing rdf:about="#Classification"/>
        <owl:Thing rdf:about="#Prognose"/>
        <owl:Thing rdf:about="#Approximation"/>
        <owl:Thing rdf:about="#Cognition"/>
        <owl:Thing rdf:about="#Storage"/>
        <owl:Thing rdf:about="#PatternRestore"/>
```

```
            <owl:Thing rdf:about="#Reconstruction"/>
            <owl:Thing rdf:about="#Optimization"/>
            <owl:Thing rdf:about="#ClusterAnalysis"/>
            <owl:Thing rdf:about="#ResourceDistribution"/>
            <owl:Thing rdf:about="#FeatureDetection"/>
            <owl:Thing rdf:about="#DataProperties"/>
        </owl:oneOf>
    </owl:Class>
    <owl:Class rdf:ID="NetType">
        <owl:oneOf rdf:parseType="Collection">
            <owl:Thing rdf:about="#Hopfield"/>
            <owl:Thing rdf:about="#Hamming"/>
            <owl:Thing rdf:about="#CarpenterGrossberg"/>
            <owl:Thing rdf:about="#Perceptron"/>
            <owl:Thing rdf:about="#MultiLayerPerceptron"/>
            <owl:Thing rdf:about="#Kohonen"/>
        </owl:oneOf>
    </owl:Class>
    <!-- disjoint -->
    <owl:AllDifferent>
        <owl:distinctMembers rdf:parseType="Collection">
            <sp:Input rdf:about="#Real"/>
            <sp:Input rdf:about="#Binary"/>
        </owl:distinctMembers>
    </owl:AllDifferent>
    <owl:AllDifferent>
        <owl:distinctMembers rdf:parseType="Collection">
            <sp:Supervision rdf:about="#Supervised"/>
            <sp:Supervision rdf:about="#NotSupervised"/>
        </owl:distinctMembers>
    </owl:AllDifferent>
    <owl:AllDifferent>
        <owl:distinctMembers rdf:parseType="Collection">
            <sp:UseCase rdf:about="#Classification"/>
            <sp:UseCase rdf:about="#Prognose"/>
            <sp:UseCase rdf:about="#Approximation"/>
            <sp:UseCase rdf:about="#Cognition"/>
            <sp:UseCase rdf:about="#Storage"/>
            <sp:UseCase rdf:about="#PatternRestore"/>
            <sp:UseCase rdf:about="#Reconstruction"/>
            <sp:UseCase rdf:about="#Optimization"/>
            <sp:UseCase rdf:about="#ClusterAnalysis"/>
            <sp:UseCase rdf:about="#ResourceDistribution"/>
            <sp:UseCase rdf:about="#FeatureDetection"/>
            <sp:UseCase rdf:about="#DataProperties"/>
        </owl:distinctMembers>
    </owl:AllDifferent>
    <owl:AllDifferent>
        <owl:distinctMembers rdf:parseType="Collection">
            <sp:NetType rdf:about="#Hopfield"/>
            <sp:NetType rdf:about="#Hamming"/>
            <sp:NetType rdf:about="#CarpenterGrossberg"/>
            <sp:NetType rdf:about="#Perceptron"/>
            <sp:NetType rdf:about="#MultiLayerPerceptron"/>
            <sp:NetType rdf:about="#Kohonen"/>
        </owl:distinctMembers>
    </owl:AllDifferent>
    <NeuronalNet rdf:ID="HandwrittenCipherCognition">
        <hasInput rdf:resource="#Binary"/>
        <isSupervised rdf:resource="#NotSupervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition</hasDescription>
        <usedFor rdf:resource="#Cognition"/>
        <hasVersion>v0.0.1 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
        <isTrained>false</isTrained>
        <isTrainable>false</isTrainable>
```

```
        <trainURL/>
        <evalURL/>
        <inputLayerSize>80</inputLayerSize>
        <hiddenLayerCnt>1</hiddenLayerCnt>
        <outputLayerSize>10</outputLayerSize>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HandwrittenCipherCognitionC1">
        <hasInput rdf:resource="#Binary"/>
        <isSupervised rdf:resource="#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition C1</hasDescription>
        <usedFor rdf:resource="#Cognition"/>
        <hasVersion>v0.0.1 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
        <isTrained>true</isTrained>
        <isTrainable>true</isTrainable>
        <trainURL>http://localhost:8080/hcc/hcctrain</trainURL>
        <evalURL>http://localhost:8080/hcc/hcceval</evalURL>
        <definitionURL>http://localhost:8080/hcc/hccdef</definitionURL>
        <inputLayerSize>81</inputLayerSize>
        <hiddenLayerCnt>2</hiddenLayerCnt>
        <outputLayerSize>11</outputLayerSize>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HandwrittenCipherCognitionC2">
        <hasInput rdf:resource="#Real"/>
        <isSupervised rdf:resource="#NotSupervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition C2</hasDescription>
        <usedFor rdf:resource="#Optimization"/>
        <rdf:type rdf:resource="#NeuronalNet"/>
        <hasVersion>v0.0.1 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
        <isTrained>false</isTrained>
        <isTrainable>false</isTrainable>
        <trainURL/>
        <evalURL/>
        <definitionURL/>
        <inputLayerSize/>
        <hiddenLayerCnt/>
        <outputLayerSize/>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HopfieldGoodTest">
        <hasInput rdf:resource="#Binary"/>
        <isSupervised rdf:resource="#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hgt</hasEndpointURI>
        <hasDescription>Hopfield good test</hasDescription>
        <usedFor rdf:resource="#PatternRestore"/>
        <rdf:type rdf:resource="#Hopfield"/>
        <hasVersion>v0.0.1</hasVersion>
        <hasPrevVersion>v0.0.0</hasPrevVersion>
        <isTrained>false</isTrained>
        <isTrainable>false</isTrainable>
        <trainURL/>
        <evalURL/>
        <definitionURL/>
        <inputLayerSize/>
        <hiddenLayerCnt/>
        <outputLayerSize/>
    </NeuronalNet>
</rdf:RDF>
```


4.6 Appendix B – Updated ontology at localhost


```
<?xml version="1.0"?>
<rdf:RDF xmlns:j.0="http://localhost:8080/nnont/NNFull#" xmlns:j.1="http://localhost:8080/nnont/"
xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">
```

```
    <rdf:Description rdf:nodeID="A0">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Thing">
        <owl:equivalentClass rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <owl:complementOf rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#isTrainable">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#isTrainable"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#isTrainable"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A1">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Classification"/>
        <rdf:rest rdf:nodeID="A2"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#ResourceDistribution">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A3">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A4">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC1">
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
        <j.0:hasDescription>8x10 bit map handwritten cipher cognition C1</j.0:hasDescription>
        <j.0:hasVersion>v0.0.1 dummy</j.0:hasVersion>
        <j.0:hiddenLayerCnt>2</j.0:hiddenLayerCnt>
        <j.0:outputLayerSize>11</j.0:outputLayerSize>
        <j.0:trainURL>http://localhost:8080/hcc/hcctrain</j.0:trainURL>
        <j.0:hasPrevVersion>v0.0.0 dummy</j.0:hasPrevVersion>
        <j.0:definitionURL>http://localhost:8080/hcc/hccdef</j.0:definitionURL>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:evalURL>http://localhost:8080/hcc/hcceval</j.0:evalURL>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
        <j.0:isTrainable>true</j.0:isTrainable>
        <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
        <j.0:isTrained>true</j.0:isTrained>
        <j.0:inputLayerSize>81</j.0:inputLayerSize>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A5">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#inputLayerSize"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A6">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
        <rdf:rest rdf:nodeID="A7"/>
    </rdf:Description>
```

```
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#outputLayerSize">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#outputLayerSize"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#outputLayerSize"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#UseCase">
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:oneOf rdf:nodeID="A1"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#inputLayerSize">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#inputLayerSize"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#inputLayerSize"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A8">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Classification"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC2">
    <j.0:hasVersion>v0.0.1 dummy</j.0:hasVersion>
    <j.0:hiddenLayerCnt/>
    <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
    <j.0:trainURL/>
    <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
    <j.0:isTrained>false</j.0:isTrained>
    <j.0:isTrainable>false</j.0:isTrainable>
    <j.0:outputLayerSize/>
    <j.0:definitionURL/>
    <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <j.0:inputLayerSize/>
    <j.0:evalURL/>
    <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
    <j.0:hasPrevVersion>v0.0.0 dummy</j.0:hasPrevVersion>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <j.0:hasDescription>8x10 bit map handwritten cipher cognition C2</j.0:hasDescription>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A9">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasVersion"/>
    <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A10">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdf:rest rdf:nodeID="A11"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#FeatureExtraction">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A12">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
```

```
        <rdf:rest rdf:nodeID="A13"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A14">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Reconstruction"/>
        <rdf:rest rdf:nodeID="A6"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A15">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#trainURL"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A11">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdf:rest rdf:nodeID="A16"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A17">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Supervision">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:oneOf rdf:nodeID="A18"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A19">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hiddenLayerCnt"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A20">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <rdf:rest rdf:nodeID="A14"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#PatternRestore">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A21">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:allValuesFrom rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A22">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#DataProperties"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#ClusterAnalysis">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A2">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Prognose"/>
        <rdf:rest rdf:nodeID="A23"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A24">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#FeatureExtraction"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A25">
```

```xml
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A7">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ClusterAnalysis"/>
        <rdf:rest rdf:nodeID="A26"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A27">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdf:rest rdf:nodeID="A28"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Hamming">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <rdfs:subClassOf rdf:nodeID="A3"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:nodeID="A29"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:nodeID="A30"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A31">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasPrevVersion">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasPrevVersion"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasPrevVersion"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A26">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ResourceDistribution"/>
        <rdf:rest rdf:nodeID="A32"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Optimization">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A33">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Reconstruction"/>
        <rdf:rest rdf:nodeID="A34"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A35">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A36">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <rdf:rest rdf:nodeID="A37"/>
    </rdf:Description>
```

```xml
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#DataProperties">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#trainURL">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#trainURL"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#trainURL"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#evalURL">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#evalURL"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#evalURL"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A32">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#FeatureDetection"/>
    <rdf:rest rdf:nodeID="A38"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A39">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Approximation"/>
    <rdf:rest rdf:nodeID="A12"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A40">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <rdf:rest rdf:nodeID="A27"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A41">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdf:rest rdf:nodeID="A42"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A43">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ResourceDistribution"/>
    <rdf:rest rdf:nodeID="A44"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#CarpenterGrossberg">
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdfs:subClassOf rdf:nodeID="A45"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdfs:subClassOf rdf:nodeID="A46"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdfs:subClassOf rdf:nodeID="A31"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A47">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
    <owl:distinctMembers rdf:nodeID="A48"/>
</rdf:Description>
```

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<rdf:Description rdf:nodeID="A49">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A44">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#FeatureDetection"/>
    <rdf:rest rdf:nodeID="A22"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Ontology"/>
    <rdfs:comment>A schema Ontology describing Neuronal Nets and their WebService
endpoint</rdfs:comment>
    <owl:versionInfo>0.0.2</owl:versionInfo>
    <owl:priorVersion rdf:resource="http://localhost:8080/nnont/NNFull"/>
    <rdfs:comment>
        pre release test ontology (schema and data in one)
    </rdfs:comment>
    <rdfs:label>Neutornal Net Ontology</rdfs:label>
</rdf:Description>
<rdf:Description rdf:nodeID="A50">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdf:rest rdf:nodeID="A41"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognitionC4">
    <j.0:hasPrevVersion>v0.0.0 dummy</j.0:hasPrevVersion>
    <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
    <j.0:hasVersion>v0.0.1 dummy</j.0:hasVersion>
    <j.0:inputLayerSize/>
    <j.0:isTrainable>false</j.0:isTrainable>
    <j.0:definitionURL/>
    <j.0:evalURL/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <j.0:hiddenLayerCnt/>
    <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
    <j.0:hasDescription>8x10 bit map handwritten cipher cognition C4</j.0:hasDescription>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <j.0:outputLayerSize/>
    <j.0:isTrained>false</j.0:isTrained>
    <j.0:trainURL/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HandwrittenCipherCognition">
    <j.0:hasEndpointURI>http://localhost:8080/hcc/hccws</j.0:hasEndpointURI>
    <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    <j.0:evalURL/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <j.0:hasPrevVersion>v0.0.1 dummy</j.0:hasPrevVersion>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <j.0:trainURL/>
    <j.0:hiddenLayerCnt/>
    <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    <j.0:hasVersion>v0.0.2 dummy</j.0:hasVersion>
    <j.0:inputLayerSize/>
    <j.0:isTrained>false</j.0:isTrained>
    <j.0:isTrainable>false</j.0:isTrainable>
    <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Storage"/>
    <j.0:hasDescription>8x10 bit map handwritten cipher cognition the new one!</j.0:hasDescription>
    <j.0:definitionURL/>
    <j.0:outputLayerSize/>
</rdf:Description>
<rdf:Description rdf:nodeID="A18">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    <rdf:rest rdf:nodeID="A0"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A48">
```

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        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <rdf:rest rdf:nodeID="A50"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasDescription">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasDescription"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasDescription"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A51">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasPrevVersion"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#isSupervised">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#usedFor">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A38">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#DataProperties"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A52">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Binary">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A53">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:allValuesFrom rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A54">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <rdf:rest rdf:nodeID="A55"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#NeuronalNet">
        <rdfs:subClassOf rdf:nodeID="A9"/>
        <rdfs:subClassOf rdf:nodeID="A56"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <rdfs:subClassOf rdf:nodeID="A15"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:subClassOf rdf:nodeID="A19"/>
```

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        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:nodeID="A57"/>
        <rdfs:subClassOf rdf:nodeID="A51"/>
        <rdfs:subClassOf rdf:nodeID="A17"/>
        <rdfs:subClassOf rdf:nodeID="A53"/>
        <rdfs:subClassOf rdf:nodeID="A58"/>
        <rdfs:subClassOf rdf:nodeID="A59"/>
        <rdfs:subClassOf rdf:nodeID="A21"/>
        <rdfs:subClassOf rdf:nodeID="A60"/>
        <rdfs:subClassOf rdf:nodeID="A5"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Prognose">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A61">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
        <owl:distinctMembers rdf:nodeID="A62"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A29">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A37">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A63">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#ClusterAnalysis"/>
        <rdf:rest rdf:nodeID="A43"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A56">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <owl:allValuesFrom rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A64">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdf:rest rdf:nodeID="A65"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A30">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A66">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Prognose"/>
        <rdf:rest rdf:nodeID="A39"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#NotSupervised">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A28">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdf:rest rdf:nodeID="A10"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasVersion">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasVersion"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasVersion"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
```

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        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A65">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#definitionURL">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#definitionURL"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#definitionURL"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A67">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A68">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#usedFor"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Approximation"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#FeatureDetection">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Classification">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NeuronalNet">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A69">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Storage"/>
        <rdf:rest rdf:nodeID="A70"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A71">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
        <owl:distinctMembers rdf:nodeID="A36"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hiddenLayerCnt">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hiddenLayerCnt"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hiddenLayerCnt"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A70">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <rdf:rest rdf:nodeID="A33"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A60">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#outputLayerSize"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
```

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  </rdf:Description>
  <rdf:Description rdf:nodeID="A34">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Optimization"/>
    <rdf:rest rdf:nodeID="A63"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A72">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A73">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#AllDifferent"/>
    <owl:distinctMembers rdf:nodeID="A74"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Hopfield">
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdfs:subClassOf rdf:nodeID="A67"/>
    <rdfs:subClassOf rdf:nodeID="A4"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:nodeID="A52"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#NetType">
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:oneOf rdf:nodeID="A40"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Approximation">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="A74">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
    <rdf:rest rdf:nodeID="A75"/>
  </rdf:Description>
  <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Kohonen">
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdfs:subClassOf rdf:nodeID="A49"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:nodeID="A24"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <rdfs:subClassOf rdf:nodeID="A35"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
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</rdf:Description>
<rdf:Description rdf:nodeID="A75">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A76">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
    <rdf:rest rdf:nodeID="A69"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#isTrained">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#isTrained"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#isTrained"/>
    <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A77">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
    <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
    <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Perceptron">
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
    <rdfs:subClassOf rdf:nodeID="A72"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
    <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
    <rdfs:subClassOf rdf:nodeID="A78"/>
    <rdfs:subClassOf rdf:nodeID="A8"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A13">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Storage"/>
    <rdf:rest rdf:nodeID="A20"/>
</rdf:Description>
<rdf:Description rdf:nodeID="A16">
    <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
</rdf:Description>
<rdf:Description rdf:about="http://www.w3.org/2001/XMLSchema#String">
    <owl:equivalentClass rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
    <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Supervised">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
</rdf:Description>
<rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasEndpointURI">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasEndpointURI"/>
    <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasEndpointURI"/>
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        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A55">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
        <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A23">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Approximation"/>
        <rdf:rest rdf:nodeID="A76"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Input">
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <owl:oneOf rdf:nodeID="A54"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A78">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Storage">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A57">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#evalURL"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Nothing">
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <owl:complementOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <owl:equivalentClass rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Supervision"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2001/XMLSchema#String"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
```

```
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#HopfieldGoodTest">
        <j.0:hasPrevVersion>v0.0.0</j.0:hasPrevVersion>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <j.0:outputLayerSize/>
        <j.0:hasVersion>v0.0.1</j.0:hasVersion>
        <j.0:trainURL/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <j.0:hasDescription>Hopfield good test</j.0:hasDescription>
        <j.0:definitionURL/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <j.0:inputLayerSize/>
        <j.0:isTrainable>false</j.0:isTrainable>
        <j.0:isTrained>false</j.0:isTrained>
        <j.0:hiddenLayerCnt/>
        <j.0:hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
        <j.0:hasEndpointURI>http://localhost:8080/hgt</j.0:hasEndpointURI>
        <j.0:evalURL/>
        <j.0:usedFor rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <j.0:isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Cognition">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A58">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasDescription"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A42">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <rdf:rest rdf:nodeID="A64"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Real">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron">
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Kohonen"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Perceptron"/>
        <owl:equivalentClass rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <rdfs:subClassOf rdf:nodeID="A68"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NNFull#MultiLayerPerceptron"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#CarpenterGrossberg"/>
        <rdfs:subClassOf rdf:nodeID="A77"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class"/>
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#NetType"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hopfield"/>
        <rdfs:subClassOf rdf:resource="http://localhost:8080/nnont/NeuronalNet"/>
        <rdfs:subClassOf rdf:nodeID="A25"/>
        <owl:disjointWith rdf:resource="http://www.w3.org/2002/07/owl#Nothing"/>
        <owl:disjointWith rdf:resource="http://localhost:8080/nnont/NNFull#Hamming"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A62">
        <rdf:first rdf:resource="http://localhost:8080/nnont/NNFull#Classification"/>
        <rdf:rest rdf:nodeID="A66"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#Reconstruction">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
        <rdf:type rdf:resource="http://localhost:8080/nnont/NNFull#UseCase"/>
```

```
    </rdf:Description>
    <rdf:Description rdf:nodeID="A59">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasEndpointURI"/>
        <owl:cardinality
rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1</owl:cardinality>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A45">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#Binary"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://localhost:8080/nnont/NNFull#hasInput">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
        <owl:equivalentProperty rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <rdfs:subPropertyOf rdf:resource="http://localhost:8080/nnont/NNFull#hasInput"/>
        <rdfs:domain rdf:resource="http://localhost:8080/nnont/NNFull#NeuronalNet"/>
        <rdfs:range rdf:resource="http://localhost:8080/nnont/NNFull#Input"/>
    </rdf:Description>
    <rdf:Description rdf:nodeID="A46">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction"/>
        <owl:onProperty rdf:resource="http://localhost:8080/nnont/NNFull#isSupervised"/>
        <owl:hasValue rdf:resource="http://localhost:8080/nnont/NNFull#NotSupervised"/>
    </rdf:Description>
</rdf:RDF>
```


4.7 Appendix C – Ontology update file for localhost


```
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF [
    <!ENTITY owl "http://www.w3.org/2002/07/owl#">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#">
]>
<rdf:RDF xml:base="http://localhost:8080/nnont/NNFull#" xmlns="http://localhost:8080/nnont/NNFull#"
xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:xsd="http://www.w3.org/2001/XMLSchema#">
    <NeuronalNet rdf:ID="HandwrittenCipherCognitionC2">
        <hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition C2</hasDescription>
        <usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
        <hasVersion>v0.0.2 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
        <isTrained>true</isTrained>
        <isTrainable>true</isTrainable>
        <trainURL>http://localhost:8080/hcc/hcctrain</trainURL>
        <evalURL>http://localhost:8080/hcc/hcceval</evalURL>
        <definitionURL>http://localhost:8080/hcc/hccdef</definitionURL>
        <inputLayerSize>81</inputLayerSize>
        <hiddenLayerCnt>2</hiddenLayerCnt>
        <outputLayerSize>11</outputLayerSize>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HandwrittenCipherCognitionC4">
        <hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition C4</hasDescription>
        <usedFor rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <hasVersion>v0.0.1 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
        <isTrained>false</isTrained>
        <isTrainable>false</isTrainable>
        <trainURL/>
```

```xml
        <evalURL/>
        <definitionURL/>
        <inputLayerSize/>
        <hiddenLayerCnt/>
        <outputLayerSize/>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HandwrittenCipherCognition">
        <hasInput rdf:resource="#Real"/>
        <isSupervised rdf:resource="#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition the new one!</hasDescription>
        <usedFor rdf:resource="#Storage"/>
        <hasVersion>v0.0.2 dummy</hasVersion>
        <hasPrevVersion>v0.0.1 dummy</hasPrevVersion>
        <isTrained>false</isTrained>
        <isTrainable>false</isTrainable>
        <trainURL/>
        <evalURL/>
        <definitionURL/>
        <inputLayerSize/>
        <hiddenLayerCnt/>
        <outputLayerSize/>
    </NeuronalNet>
</rdf:RDF>
```


4.8 Appendix D – Ontology update file for another server


```xml
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF [
    <!ENTITY owl "http://www.w3.org/2002/07/owl#">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#">
]>
<rdf:RDF xml:base="http://big.pri.univie.ac.at:8888/nnont/NNFull#"
xmlns="http://big.pri.univie.ac.at:8888/nnont/NNFull#" xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-
schema#" xmlns:xsd="http://www.w3.org/2001/XMLSchema#">
    <NeuronalNet rdf:ID="HandwrittenCipherCognitionC2">
        <hasInput rdf:resource="http://big.pri.univie.ac.at:8888/nnont/NNFull#Real"/>
        <isSupervised rdf:resource="http://big.pri.univie.ac.at:8888/nnont/NNFull#Supervised"/>
        <hasEndpointURI>http://big.pri.univie.ac.at:8888/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition C2</hasDescription>
        <usedFor rdf:resource="http://big.pri.univie.ac.at:8888/nnont/NNFull#Cognition"/>
        <hasVersion>v0.0.2 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
        <isTrained>true</isTrained>
        <isTrainable>true</isTrainable>
        <trainURL>http://localhost:8080/hcc/hcctrain</trainURL>
        <evalURL>http://localhost:8080/hcc/hcceval</evalURL>
        <definitionURL>http://localhost:8080/hcc/hccdef</definitionURL>
        <inputLayerSize>81</inputLayerSize>
        <hiddenLayerCnt>2</hiddenLayerCnt>
        <outputLayerSize>11</outputLayerSize>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HandwrittenCipherCognitionC4">
        <hasInput rdf:resource="http://big.pri.univie.ac.at:8888/nnont/NNFull#Real"/>
        <isSupervised rdf:resource="http://big.pri.univie.ac.at:8888/nnont/NNFull#Supervised"/>
        <hasEndpointURI>http://big.pri.univie.ac.at:8888/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition C4</hasDescription>
        <usedFor rdf:resource="http://big.pri.univie.ac.at:8888/nnont/NNFull#PatternRestore"/>
        <hasVersion>v0.0.1 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
        <isTrained>true</isTrained>
        <isTrainable>true</isTrainable>
        <trainURL>http://localhost:8080/hcc/hcctrain</trainURL>
        <evalURL>http://localhost:8080/hcc/hcceval</evalURL>
        <definitionURL>http://localhost:8080/hcc/hccdef</definitionURL>
        <inputLayerSize>81</inputLayerSize>
```

```
        <hiddenLayerCnt>2</hiddenLayerCnt>
        <outputLayerSize>11</outputLayerSize>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HandwrittenCipherCognition">
        <hasInput rdf:resource="#Real"/>
        <isSupervised rdf:resource="#Supervised"/>
        <hasEndpointURI>http://big.pri.univie.ac.at:8888/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition the new one!</hasDescription>
        <usedFor rdf:resource="#Storage"/>
        <hasVersion>v0.0.2 dummy</hasVersion>
        <hasPrevVersion>v0.0.1 dummy</hasPrevVersion>
        <isTrained>true</isTrained>
        <isTrainable>true</isTrainable>
        <trainURL>http://localhost:8080/hcc/hcctrain</trainURL>
        <evalURL>http://localhost:8080/hcc/hcceval</evalURL>
        <definitionURL>http://localhost:8080/hcc/hccdef</definitionURL>
        <inputLayerSize>81</inputLayerSize>
        <hiddenLayerCnt>2</hiddenLayerCnt>
        <outputLayerSize>11</outputLayerSize>
    </NeuronalNet>
</rdf:RDF>
```

4.9 Appendix E – Bad output file

```
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF [
    <!ENTITY owl "http://www.w3.org/2002/07/owl#">
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#">
]>
<rdf:RDF xml:base="http://localhost:8080/nnont/NNFull#" xmlns="http://localhost:8080/nnont/NNFull#"
xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:xsd="http://www.w3.org/2001/XMLSchema#">
    <NeuronalNet rdf:ID="HandwrittenCipherCognitionC2">
        <hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition C2</hasDescription>
        <usedFor rdf:resource="http://localhost:8080/nnont/NNFull#Cognition"/>
        <hasVersion>v0.0.2 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HandwrittenCipherCognitionC4">
        <hasInput rdf:resource="http://localhost:8080/nnont/NNFull#Real"/>
        <isSupervised rdf:resource="http://localhost:8080/nnont/NNFull#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition C4</hasDescription>
        <usedFor rdf:resource="http://localhost:8080/nnont/NNFull#PatternRestore"/>
        <hasVersion>v0.0.1 dummy</hasVersion>
        <hasPrevVersion>v0.0.0 dummy</hasPrevVersion>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HandwrittenCipherCognition">
        <hasInput rdf:resource="#Real"/>
        <isSupervised rdf:resource="#Supervised"/>
        <hasEndpointURI>http://localhost:8080/hcc/hccws</hasEndpointURI>
        <hasDescription>8x10 bit map handwritten cipher cognition the new one!</hasDescription>
        <usedFor rdf:resource="#Storage"/>
        <hasVersion>v0.0.2 dummy</hasVersion>
        <hasPrevVersion>v0.0.1 dummy</hasPrevVersion>
    </NeuronalNet>
    <NeuronalNet rdf:ID="HopfieldBadTest">
        <hasInput rdf:resource="#Real"/>
        <isSupervised rdf:resource="#Supervised"/>
        <hasEndpointURI>http://big.pri.univie.ac.at:8888/hgt</hasEndpointURI>
        <hasDescription>Hopfield good test</hasDescription>
        <usedFor rdf:resource="#PatternRestore"/>
        <rdf:type rdf:resource="#Hopfield"/>
```

```
        <hasVersion>v0.0.1</hasVersion>
        <hasPrevVersion>v0.0.0</hasPrevVersion>
    </NeuronalNet>
</rdf:RDF>
```

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http://www.semgrid.net/Citation-Before-2006.1/++ComputationalIntelligence1.pdf (2007-05-28)

6 Links

[L1.1a] http://big.pri.univie.ac.at:8888/solprovFE/
'SolProv' demo site of the University of Vienna ('SolProv' front end)
26 September 2007

[L1.1c] http://www.w3.org/TR/ws-arch/
Web Service Architecture
"This document defines the Web Services Architecture. It identifies the functional components and defines the relationships among those components to affect the desired properties of the overall architecture…"
26 September 2007

[L1.1d] http://en.wikipedia.org/wiki/Artificial_neural_network
Wikipedia article about artificial neuronal networks
This article gives a basic understanding of artificial neuronal networks (in contrary to biological neuronal networks as our brain).
26 September 2007

[L1.1e] http://jena.sourceforge.net
Jena – A Semantic Web Framework for Java
"Jena is a Java framework for building Semantic Web applications. It provides a programmatic environment for RDF, RDFS and OWL, SPARQL and includes a rule-based inference engine."
26 September 2007

[L1.1f] http://en.wikipedia.org/wiki/Ontology_%28computer_science%29
Wikipedia article about 'Ontology (computer science)'
This article explains general ontology's as used in this project.
26 September 2007

[L1.2a] http://www.w3.org/TR/owl-guide/#term_individual
OWL Web Ontology Language – Guide
In depth definition of an 'individual' as used in ontology's
26 September 2007

[L1.2.1.1a] http://jena.sourceforge.net/ARQ/
ARQ – A SPARQL Processor for Jena
"ARQ is a query engine for Jena that supports the SPARQL RDF Query language."
26 September 2007

[L1.2.1.1b] http://www.w3.org/International/O-URL-and-ident.html
W3C paper about URIs and IRIs
"Internationalized Resource Identifiers (IRIs) are a new protocol element, a complement to URIs…"
26 September 2007

[L1.2.3.1a] http://owl.man.ac.uk/2003/why/latest/
OWL Reasoning Examples, Sean Bechhofer, University of Manchester
"This document presents simple example OWL ontologies and discusses some of the inferences that can be made about the classes and individuals in those ontologies."
26 September 2007

[L1.2.3.1b] http://www.w3.org/2003/08/owl-systems/test-results-out
OWL Test Results
This page gives an overview comparison between several reasoner performing several test scenarios.
26 September 2007

[L1.2.3.1c] http://www.mindswap.org/2004/multipleOnt/
Mindswap e-connections
This paper gives an introduction on e-connections to reason about multiple ontology's. "An E-Connection is a knowledge representation language defined as a combination of other logical formalisms."
26 September 2007

[L1.2.3.1d] http://www.w3.org/TR/2004/REC-owl-guide-20040210/#OwlVarieties
W3C Web Ontology Language – Guide; The Species of OWL
"The OWL language provides three increasingly expressive sublanguages designed for use by specific communities of implementers and users."
26 September 2007

[L1.4a] http://www.w3.org/Submission/OWL-S/
OWL-S: Semantic Markup for Web Services
"The Semantic Web should enable greater access not only to content but also to services on the Web. Users and software agents should be able to discover, invoke, compose, and monitor Web resources offering particular services and having particular properties, and should be able to do so with a high degree of automation if desired. Powerful tools should be enabled by service descriptions, across the Web service lifecycle. OWL-S (formerly DAML-S) is an ontology of services that makes these functionalities possible."
26 September 2007

[L3.1.1a] http://jakarta.apache.org/site/downloads/downloads_taglibs-standard.cgi
Standard 1.1 Taglib Downloads
At this site the taglibs for the tomcat server needed for 'SolProv' can be downloaded.
26 September 2007

[L3.5.1.2a] http://big.pri.univie.ac.at:8888/nnont/NNFull.owl
The 'SolProv' test ontology
This is the complete ontology used for implementation and testing of 'SolProv'.
26 September 2007