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Leveraging Machine Learning for Advanced Geodetic Data Analysis

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Geodetic data analysis has traditionally relied on geophysical models and statistical methods to quantify Earth's deformation, correct for atmospheric effects, and refine measurement uncertainties. However, with the increasing volume and complexity of geodetic observations, machine learning (ML) may offer a better alternative for modelling non-linear motions of geodetic sites by capturing environmental effects and providing corrections for unmodelled influences.

ML has applications across various domains of geodesy, including coordinate time series analysis, geophysical deformation modelling, atmospheric and hydrological loading corrections, prediction of Earth orientation parameters, and tropospheric delay modelling. This study explores the use of ML techniques in geodetic data processing, focusing on modelling station height variations due to non-tidal loading (NTL) and other unmodelled effects in Very Long Baseline Interferometry (VLBI) data analysis using meteorological and land surface state variables.

Different ML approaches, including ensemble methods and neural networks, are examined to understand how well they can model displacement of geodetic sites due to meteorological and land surface state variables responsible for the redistribution of geophysical fluids on Earth. The study aims to compare these methods, highlighting their strengths and limitations in geodetic applications. By providing a broad perspective on ML integration in geodesy, this work contributes to the ongoing discussion on data-driven approaches for improving geodetic modelling and analysis.