Distribution Testing: The New Frontier for Formal Methods

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Abstract—The dominant guiding philosophy in the first sixty years of Computer Science was for designers to design systems that were always correct, and to accept nothing less as users. But times have changed: Users and designers are accustomed to systems with statistical components and behaviors. What does it mean for the formal methods community? In this talk, we argue that such a dramatic change in the acceptance and design of systems presents exciting opportunities to make fundamental contributions: we need to rethink the notions and techniques for the design of specifications and verification methodologies. In particular, we will focus on the systems whose behaviors are not naturally captured by symbolic relations but rather require reliance on probability distributions. We will discuss our recent efforts in designing formal methodologies for testing whether a sampling subroutine generates a desired distribution. We will showcase the challenges, opportunities, and rewards in our journey.