Probability, Recursion, and the Computation of Fixed Points

Mihalis Yannakakis  
Columbia University  
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Abstract

Many problems from different areas can be formulated as problems of computing a fixed point of a suitable function. For many of these problems, the function in the fixed point formulation is monotone, and the objects we want to compute are given by a specific fixed point, namely the least fixed point (or the greatest fixed point) of the function. Many models and problems from a variety of areas fit in this framework, including in particular the analysis of various probabilistic models, especially models that combine recursion and probability, problems in stochastic optimization, and games. It turns out that for some classes of functions we can compute the fixed point in polynomial time and thus we can analyze efficiently several of these models, while for others there are strong indications that they cannot be solved in polynomial time, and for yet others the question remains open. In this talk we will discuss progress in this area. The talk is based on a series of works with Kousha Etessami and Alistair Stewart.

Bio

Mihalis Yannakakis is the Percy K. and Vida L. W. Hudson Professor of Computer Science at Columbia University. Prior to joining Columbia, he was Head of the Computing Principles Research Department at Bell Labs, and Professor of Computer Science at Stanford University. Dr. Yannakakis received his PhD from Princeton University. He has served on the editorial boards of several journals, including as the editor-in-chief of the SIAM Journal on Computing, and has chaired various conferences, including the IEEE Symposium on Foundations of Computer Science, the ACM Symposium on Theory of Computing and the ACM Symposium on Principles of Database Systems. Dr. Yannakakis is a recipient of the Knuth Prize, a member of the National Academy of Engineering, and of Academia Europaea, a Fellow of the ACM, and a Bell Labs Fellow.

http://www.cs.columbia.edu/~mihalis/