Keynote Talk

The Mathematics of Causal Inference

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Abstract

I will review concepts, principles, and mathematical tools that were found useful in applications involving causal and counterfactual relationships. This semantical framework, enriched with a few ideas from logic and graph theory, gives rise to a complete, coherent, and friendly calculus of causation that unifies the graphical and counterfactual approaches to causation and resolves many long-standing problems in several of the sciences. These include questions of causal effect estimation, policy analysis, and the integration of data from diverse studies. Of special interest to KDD researchers would be the following topics:

1. The Mediation Formula, and what it tells us about direct and indirect effects.
2. What mathematics can tell us about "external validity" or "generalizing from experiments"
3. What can graph theory tell us about recovering from sample-selection bias.

Categories and Subject Descriptors: G.m [Mathematics of Computing]: Miscellaneous
General Terms: Theory

Bio

Judea Pearl is a professor of computer science and statistics at the University of California, Los Angeles. He is a graduate of the Technion, Israel, and has joined the faculty of UCLA in 1970, where he currently directs the Cognitive Systems Laboratory and conducts research in artificial intelligence, causal inference and philosophy of science. He has authored three books: Heuristics (1984), Probabilistic Reasoning (1988), and Causality (2000;2009). A member of the National Academy of Engineering, and a Founding Fellow the American Association for Artificial Intelligence (AAAI), Judea Pearl is the recipient of the 2008 Benjamin Franklin Medal for Computer and Cognitive Science and this year's David Rumelhart Prize from the Cognitive Science Society.

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