

## DAPHNE KOLLER'S UNCERTAINTY RESEARCH

Dr. Daphne Koller, a professor of computer science at Stanford University, recently received an ACM - Infosys Foundation Award in the Computing Sciences. According to the organization, the award was given "for her work on combining relational logic and probability that allows probabilistic reasoning to be applied to a wide range of applications, including robotics, economics, and biology."

Koller's work relates to uncertainty, a central research area in both artificial intelligence and computer science. Koller's results combine relational logic and probability for large systems such as heterogeneous databases, image understanding systems, biological and medical models, and natural language processing systems. Specifically, Koller's research is based on probabilistic graphical models including Bayesian networks, influence diagrams, and Markov decision processes.

The procedures include: representation, inference, learning, and decision making. With its broad applications, her research explores state of the art uncertainty methods including:

1. incorporating hierarchical and object-relational structures in our object-oriented Bayesian networks (OOBNs) and probabilistic relational models (PRMs);
2. extensions to temporal domains using dynamic Bayesian networks;
3. hybrid Bayesian networks involving both discrete and continuous variables;
4. factored MDPs that represent sequential decision problems in a factored way;
5. structured representations for utility functions;
6. multi-agent influence diagrams to represent multi-agent decision problems with incomplete information.

*G. Chechik, G. Heitz, G. Elidan, P. Abbeel, and D. Koller (2008). "Max-margin Classification of Data with Absent Features." Journal of Machine Learning Research, 9, 1-21*

*G. Heitz, S. Gould, A. Saxena, and D. Koller (2008). "Cascaded Classification Models: Combining Models for Holistic Scene Understanding." Advances in Neural Information Processing Systems (NIPS 2008).*