Society for imprecise probabilities *online* school

Credal networks: specifications, algorithms and complexity

Speaker: **Fabio Cozman, Denis Mauá**
Time: **Tuesday 8th December, 11am (GMT)**

The Zoom link will be sent to you by email a few minutes before the lecture

Abstract: Credal networks generalize Bayesian networks to allow for imprecision in probability values. This tutorial reviews the main results on credal networks, in particular under strong independence, as there has been significant progress in the literature during the last decade or so. We focus on computational aspects, summarizing the main algorithms and complexity results for inference and decision making. We address the question "What is really known about strong and epistemic extensions of credal networks?" by looking at theoretical results and by presenting a short summary of real applications.

Fabio G. Cozman is a Professor at the Engineering School (Escola Politénica) at University of Sao Paulo, Brazil, working in the Department of Mechatronics and Mechanical Systems. Originally from Brazil Dr. Cozman took Electrical Engineering (and then a Master in Engineering) at University of Sao Paulo; then went to the Robotics Institute at Carnegie Mellon University. Dr. Cozman was in the VASC group, working with the Lunar Rover project, and more specifically in the Viper system. Dr Cozman's research is within the broad area of artificial intelligence, mostly with machine learning and knowledge representation.

Denis D. Mauá is an Assistant Professor at the Department of Computer Science of the Institute of Mathematics and Statistics of the University of São Paulo. He obtained his PhD from the University of Lugano (2013), and his Masters (2009) and Engineering degrees (2007) from the University of São Paulo. He has authored and co-authored over 50 articles in journals and conference proceedings. His research focuses on the theory of probabilistic reasoning, and its application to artificial intelligence and machine learning.

Timetable (GMT)

11:00am - First part: Basic concepts
      1.1) Credal sets, graphs, and networks.
      1.2) A bit of history.
      1.3) Strong and epistemic extensions.
      1.4) Examples and exercises.
12:00pm - Break
12:30pm - Second part: Advanced topics
      2.1) Algorithms for marginal inference and decision making.
      2.2) The complexity of marginal inference and decision making.
      2.3) Eliciting, learning, and applying credal networks.
2:00pm - Close

Society for imprecise probabilities *online* school
Game-theoretic foundations for statistical testing and imprecise probabilities

Speaker: **Glenn Shafer**
Time: **Wednesday 9th December, 2pm (GMT)**

The Zoom link will be sent to you by email a few minutes before the lecture

Course description We will study the game-theoretic foundation for statistics and its applications to prediction, testing and estimation. It will distinctively employ modern concepts around betting, e-values, and martingales, effectively bridging Bayesian, frequentist and model-free or adversarial perspectives on these topics.

Prerequisites: Advanced undergraduate, or basic graduate probability/statistics.

Timetable (GMT) - Wednesday

2:00pm 9:00am: Lecture 1. Testing predictions by betting against them.
    Reading: Testing by betting: A strategy for statistical and scientific communication, with discussion and response, by Glenn Shafer. To appear in the *Journal of the Royal Statistical Society, Series A*.

3:30pm 10:30 am: Questions and discussion

4:00pm 11:00 am: Break

4:30pm 11:30 am: Lecture 2. Betting protocols.
    Reading: Borel's law of large numbers, Chapter 1 of *Game-Theoretic Foundations for Probability and Finance*, by Glenn Shafer and Vladimir Vovk, Wiley, 2019.

6:00pm 1pm: Close

For additional information on this topic, see these working papers and this syllabus.

Society for imprecise probabilities *online* school
Game-theoretic foundations for statistical testing and imprecise probabilities

Speaker: **Glenn Shafer**
Time: **Thursday 10th December, 2pm (GMT)**

The Zoom link will be sent to you by email a few minutes before the lecture

Course description We will study the game-theoretic foundation for statistics and its applications to prediction, testing and estimation. It will distinctively employ modern concepts around betting, e-values, and martingales, effectively bridging Bayesian, frequentist and model-free or adversarial perspectives on these topics.

Prerequisites: Advanced undergraduate, or basic graduate probability/statistics.

Timetable (GMT) - Thursday

2:00pm 9:00 am: Lecture 3. Basing probability theory on betting.
 Reading: Bernoulli's and De Moivre's theorems, Chapter 2 of _Game-Theoretic Foundations for Probability and Finance_, by Glenn Shafer and Vladimir Vovk, Wiley, 2019.

3:30pm 10:30 am: Questions and discussion

4:00pm 11:00 am: Break

4:30pm 11:30 am: Lecture 4. Making and testing predictions with imprecise probabilities.
 Reading: Betting on a single outcome, Chapter 6 of _Game-Theoretic Foundations for Probability and Finance_, by Glenn Shafer and Vladimir Vovk, Wiley, 2019.

6:00pm 1pm: Close

For additional information on this topic, see these working papers and this syllabus.