Dr. Fabrício Oliveira

Multi-stage decision problems under uncertainty can be represented as influence diagrams that are converted into decision trees. These trees can then be solved using dynamic programming if the optimal strategy within a given branch does not depend on the decisions in other non-overlapping branches. To address these shortfalls, we propose Decision Programming, a framework which can efficiently address this 'no forgetting' assumption and retain outcome distribution information. In this, we convert decision problems into equivalent mixed-integer linear programs that can be efficiently solved, including in the presence of multiple objectives, endogenous uncertainty, and other dependency conditions.

Bio: Fabricio Oliveira is an Associate Professor of Operations Research in the School of Science at Aalto University (Finland). He is also the leader of the Group of Applied Mathematical Modelling and Optimization (Gamma-opt). He holds a B.Sc. (2008) and a DSc (2012) in Production Engineering from PUC-Rio (Brazil). Before his current appointment, he has worked as a visiting researcher at the Centre of Advanced Process Decision-making (CAPD) at Carnegie Mellon University (USA), as a Postdoctoral Research Fellow in the Mathematical Sciences Department at RMIT University (Australia), and as an Assistant Professor in the Industrial Engineering Department at PUC-Rio. His main research interests are practical and computational challenges of applying optimization under uncertainty for solving production planning and supply chain management problems.

Course Description

In this course, you will learn about mathematical programming methods for modelling and solving optimisation problems under uncertainty. This is critical for the use of mathematical programming approaches in real settings, where the uncertainty related to the input data must be taken into account. You will learn about the two main paradigms for uncertainty consideration: stochastic programming and robust optimisation. Our focus will be primarily practical, meaning that we will learn about good modelling practice and uncertainty representation.

Learning Outcomes

Upon completing this course, the student should:

- understand how optimisation models can be enhanced to consider uncertainty in the input data;
- understand the main techniques for modelling and solving optimisation problems under uncertainty in practice;
- know how to use optimisation software for implementing and solving stochastic programming and robust optimisation problems.

Teaching methods

This course uses a combination of lectures, tutorials and seminars. The lectures are targeted to introduce the basic concepts related to stochastic programming and robust optimisation. To complement the lectures, tutorial sessions will also take place. These will consist of exercises that are aimed at clarifying the content discussed in the lectures and discussing computational aspects and practical applications.

The course will be taught by a composition of the following methods:

- lectures;
- tutorial sessions;
- guided self-study;
- seminar presentations;
- project work and feedback.

The course is implemented in person. Participation and discussions are part of the learning and thus required.

The course will be taught in Portuguese

Course Material

Main study material: lecture slides, selected research papers, and tutorial notebooks.

Course Schedule

A tentative schedule for the course is given. The content of each class may be adapted according to the pace of the classes and the number of students.

Session	Content
1	Two- and multi-stage stochastic optimisation
2	Scenario generation and sample average approximation
3	Chance constraints and risk measures
4	Static and adaptive robust optimisation

Table 1: Course schedule. Each session is 2h teaching + 2h exercises