Advanced Techniques in Applied Economics

2019-2020 Academic Year
Master of Research in Economics, Finance and Management

1. Description of the subject

- Advanced Topics in Applied Economics
- Total credits: 3 ECTS

Code: 32364
Workload: 75 hours
Term: 2nd

- Type of subject: Elective
- Department of Economics and Business
- Teaching team: Piotr Zwiernik

2. Teaching guide

Introduction

Modelling increasingly complex datasets in applied economics requires a broad range of tools from statistics and machine learning that go beyond the regression analysis. This course focuses on three important and closely related concepts: conditional independence, positive association, and causal inference. A convenient common framework to discuss these three concepts is that of probabilistic graphical models.

Graphical models play an important role in social sciences. They model interactions between agents in socio-economic networks but also give a way of representing complex probabilistic relations in large systems. The recent dynamic theoretical development of network modelling is largely driven by growing number of high-dimensional applications, like social media networks, and causality detection.

The aim of this course is to give a concise introduction to probabilistic graphical models, positive association, causal inference and their applications in economics and related fields. The course will be kept relatively high-level and will be based on work-out examples in R. Selected aspects of the theory will be presented mostly to reinforce some

of the concepts presented in the course "Advanced Topics in Data Science" and to improve overall statistical maturity of the students.

Teaching methodology

Each of the main concepts presented in the lecture will be illustrated with an applied problem. Worked out examples in R/Matlab will be provided.

Contents

The course is divided into five parts that roughly correspond to the five weeks of the course's duration.

1. Basic concepts:
   main concepts: conditional independence, factorization, graphs, undirected graphical models, Bayesian networks, Markov properties, latent variables.
2. Undirected graphical models:
   main concepts: log-linear models, Gaussian graphical models, maximum likelihood estimation, structure learning, partial correlation graphs, nonparametric graphical models.
3. Bayesian networks and causality:
   main concepts: Bayesian networks and causal models, learning a Bayesian network.
4. Causal inference:
   main concepts: causality, graphical models for causal reasoning, cause-effect models, multivariate causal models, causal inference in R.
5. Positive association:
   main concepts: latent graphical models, total positivity.

Assessment and Grading System

The final grade depends on the project submitted in the end of the course.

Literature

S. Højsgaard, D. Edwards, S. Lauritzen, Graphical models with R, Springer, 2012.

J. Peters, D. Janzing, and B. Schölkopf, Elements of Causal Inference, MIT Press, 2018. (available to download)