FINANCIAL ECONOMETRICS – FIN 407

Main goals: This course aims to give a general introduction to the application of machine learning techniques to finance. These techniques have become extremely popular due to the increase in available data sources and in computing power. The information contained in these data is relevant to many areas of finance, but traditional financial econometrics methods have difficulties tackling the "big data" challenge. This course will review these traditional techniques to emphasize their limitations, and will detail how machine learning methods can be used to overcome these limitations.

Evaluation: The evaluation will be based on three elements:

1) One exam
2) Project: Students will be asked to choose among a list of projects (with the possibility to design their own project). They will work in small groups. They will write a report with their findings and will present them in one of the two last classes.

The course will be evaluated as follows: 1/3 of the grade on the exam, 1/3 on the project report and 1/3 on the project presentation.

Outline of the course

Chapter 1 (weeks 1 and 2): Introduction to financial markets and financial time series
  • Introduction to financial markets
  • Some probabilistic tools to analyze financial time series
  • Stylized facts of asset returns
  • Introduction to option pricing

Chapter 2 (week 3): Introduction to machine learning in finance
  • Goals of machine learning
  • Applications of machine learning
  • Timeline of machine learning
  • Main types of algorithms
  • Natural Language Processing

Chapter 3 (weeks 4 and 5): Supervised learning
  • Regression
  • Classification

Chapter 4 (weeks 6 and 7): Time series models
- ARMA processes
- Vector autoregressive processes
- Heteroskedastic volatility models

Chapter 5 (week 8): Feedforward neural networks

Chapter 6 (week 9): State space models
- Kalman filter
- Extended and unscented filter
- Particle filter

Chapter 7 (weeks 10 and 11): Unsupervised learning
- Clustering
- Factor analysis

Chapter 8 (week 12, if time allows): Advanced Neural Networks
- Recurrent Neural Networks
- Convolutional Neural Networks

Project presentations (weeks 13 and 14)