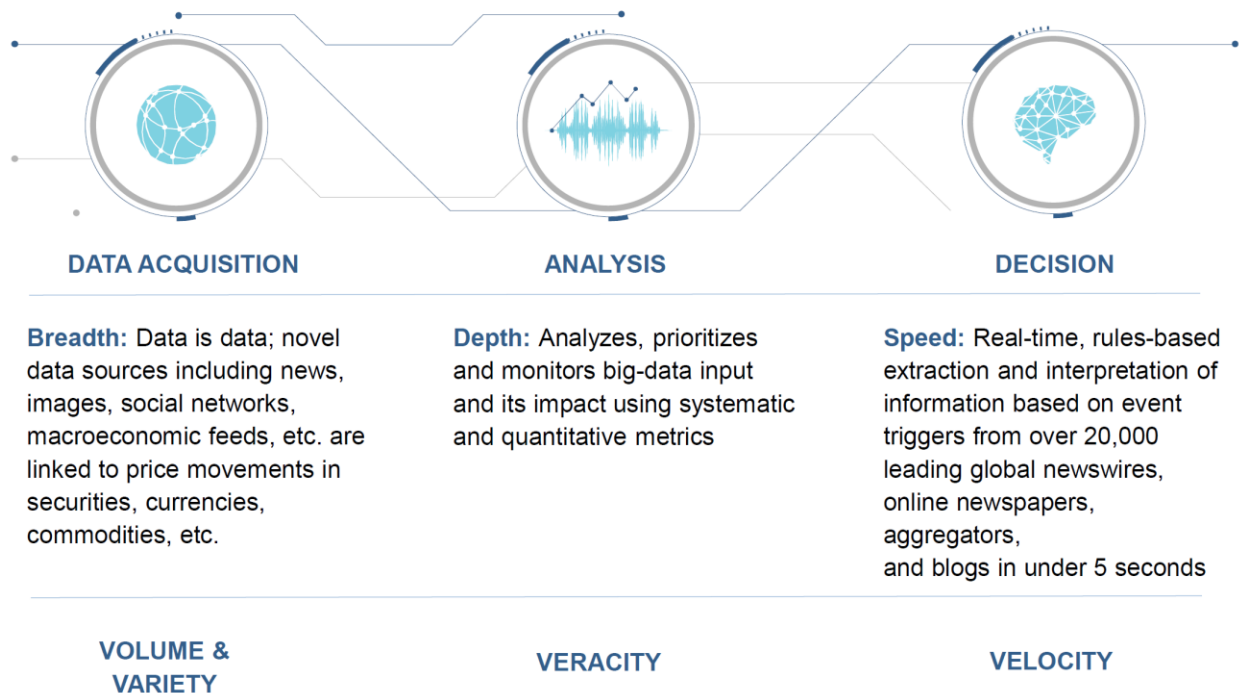


Big Data in Finance : A practical view - Syllabus

Motivation

Finance is one of the areas in which big data is more useful and yet one of the most difficult ones, financial times series are indeed a challenging modeling problem. In this course you will learn how to implement big data in financial services. The promise of new data (structured or unstructured), Analysis: traditional and machine learning models and speed implementation are key success factors. Challenges are important: non-stationarity, the curse of dimensionality, over-fitting and estimation. We will learn how to address these issues.



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Description

The vast proliferation of data and increasing technological complexities continue to transform the way industries operate and compete. Over the last two years, 90 percent of the data in the world has been created as a result of the creation of 2.5 quintillion bytes of data on a daily basis. Commonly referred to as big data, this rapid growth and storage creates opportunities for collection, processing and analysis of structured and unstructured data.

Financial services, in particular, have widely adopted big data analytics to inform better investment decisions with consistent returns. In conjunction with big data, algorithmic trading uses vast historical data with complex mathematical models to maximize portfolio returns. The continued adoption of big data will inevitably transform the landscape of financial services. However, along with its apparent benefits, significant challenges remain in regards to big data's ability to capture the mounting volume of data.



The increasing volume of market data poses a big challenge for financial institutions. Along with vast historical data, banking and capital markets need to actively manage ticker data. Likewise, investment banks and asset management firms use voluminous data to make sound investment decisions. Insurance and retirement firms can access past policy and claims information for active risk management.

The course will be a mix of Theory and practice with real big data cases in finance. We will invite guest lecturers mostly for real Big Data Finance Applications. We will give MATLAB, R or Python examples.

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Course content

Theory

1. Introduction: What Is Big Data in Finance?
2. Software and Tools: Hadoop ,SPARK and Google cloud
3. Highlighted Data Providers
4. Structured and Unstructured Data. Providing Structure to Unstructured Data
5. Modern Data Analysis : Classical Econometrics and Portfolio Management
6. Modern Data Analysis: Learning and Data Mining. Machine Learning. Supervised, Unsupervised, Reinforced and Deep Learning.
 - a. Supervised Learning Regressions
 - i. Penalized Regression Techniques: Lasso, Ridge, and Elastic Net
 - ii. Non-Parametric Regression: Loess and K-Nearest Neighbor
 - iii. Neural Networks
 - iv. Extreme Gradient Boosting
 - b. Supervised Learning Classification
 - i. Logistic Regression
 - ii. Support Vector Machines
 - iii. Decision Trees and Random Forests
 - iv. Hidden Markov Model
 - c. Unsupervised learning
 - i. Clustering and Factor Analysis
 - ii. Hierarchical clustering
 - d. Deep and Reinforcement Learning
 - i. Multi-Layer Perceptron
 - ii. Time-Series Analysis: Long Short-Term Memory
 - iii. Convolutional Neural Networks
 - iv. Restricted Boltzmann Machines
 - e. Reinforcement Learning
7. Modern Data Analysis : Estimation and Robustness and Optimization Techniques

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8. Sentiment Analysis : Extracting Meaning from Data
9. High Frequency Trading
10. Big Data and Fintech companies

Practice - Big data in Finance applications

1. Predictive Analytics / Trading
2. Sentiment Analysis
3. Financial Fraud and Know your Customer
4. Credit Ratings

Course Grading

- Homework : 20%
- Project : 40%
- Final Exam : 20%
- Mid Term Exam 20%

Instructor : Miquel Noguer i Alonso PhD

Miquel Noguer i Alonso is a financial markets practitioner with more than 20 years of experience in asset management, he is currently working for UBS AG (Switzerland) as Executive Director. He worked as a CFO and CIO for a European bank from 2000 to 2006. He started his career at KPMG.

He is Adjunct Assistant Professor at Columbia University teaching Asset Allocation, Big Data in Finance, Fintech for the Master in Financial Engineering program and Hedge Fund Professor at ESADE. He received an MBA and a Degree in business administration and economics in ESADE in 1993. In 2010 he earned a PhD in quantitative finance with a Summa Cum Laude distinction (UNED - Madrid Spain). He also holds the Certified European Financial Analyst diploma (2000).

His research interests range from asset allocation, big data to algorithmic trading and fintech. His academic collaborations include a visiting scholarship in Columbia University in 2013 in the Finance and Economics Department, in Fribourg University in 2010 in the mathematics department, and giving presentations in Indiana University, ESADE, London Business School and several industry seminars.

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Miquel will be talking about Big Data in Finance in the Quant Summit USA this summer and giving a 1-day workshop on Machine Learning in Finance.

Prerequisites : Course is self-contained.

Lecture guest speakers : UBS, Google and MAN AHL speakers

Textbook

No textbook but recommended reading:

- Doing Data Science, O'Reilly Media
- Python for Data Analysis, O'Reilly Media
- The elements of statistical learning :data mining, inference, and prediction Trevor Hastie, Robert Tibshirani, Jerome Friedman. Springer 2009
- Neural networks in finance : gaining predictive edge in the market Paul McNelis. Elsevier. 2005
- Machine Learning: A Probabilistic Perspective, Kevin P Murhpy.
- Deep Learning (Adaptive Computation and Machine Learning series) Hardcover – November 18, 2016 by Ian Goodfellow, Yoshua Bengio, Aaron Courville. The MIT Press (November 18, 2016)