Informatique appliquée la finance I

ECTS : 3

Enseignant responsable : Louis BRIENS

Langue du cours : Français

Volume horaire : 18

Description du contenu de l'enseignement :

This course is designed to teach students the fundamentals of Python programming through practical applications in finance, statistics, and econometrics. It introduces key programming paradigms--imperative, functional, and, to a lesser extent, object-oriented programming--within an applied context. Each session blends theoretical concepts with hands-on exercises using real or simulated datasets. The course emphasizes reproducible and interpretable code, in line with industry best practices. Session Breakdown **Session 1 - Python Refresher and Programming Fundamentals**Core concepts: variables, data types, control structures, loops, functions Working with NumPy and Pandas Writing clean, modular, and readable code Simple financial/statistical computations Hands-on exercises to strengthen Python fluency Note: This session will be adapted depending on students' programming background and pace. **Session 2 - Optimization and Logistic Regression from Scratch** Introduction to gradient descent as a numerical optimization tool Application to logistic regression for binary classification Manual implementation of the algorithm: gradient, update rule, convergence Visualizing decision boundary and cost function Comparison with scikit-learn's LogisticRegression **Session 3 - Time Series and Regression Modeling** Visualization and decomposition of time series Stationarity, trend, and seasonality Univariate and multivariate regression ARIMA modeling for forecasting Introduction to GARCH-type volatility models **Session 4 - Systemic Risk Measures and Backtesting** Key systemic risk indicators: VaR, CoVaR, SRISK, MES Estimation methods using financial data Backtesting: Unconditional Coverage and Conditional Coverage tests Interpreting model adequacy and performance **Session 5 - CAPM Empirical Implementation Using CAC 40 Data** Log return computation with Pandas (weekly prices from 2011-2016) Construction of the ex-post market portfolio via minimum variance optimization Beta estimation through OLS regression Visualization: security market line, beta dispersion Pedagogical goal: hands-on CAPM estimation in Python **Session 6 - Index Construction and Computation** Overview of financial index structures and mechanics Loading and cleaning real market data Handling corporate actions and rebalancing Implementing index computation methods Constructing sectoral and composite indices Visualizing and analyzing index performance Note: Placed last to consolidate prior concepts and support the final project work.

Compétences à acquérir :

Fundamentals of Programming with Python. Application of Python in finance.

Pré-requis recommandés

A basic familiarity with Python is expected, though essential concepts will be reviewed in the first session.

Mode de contrôle des connaissances :

Final group project applying the methods covered in class to a real-world financial or econometric problem.

Coefficient : 1.00

Bibliographie, lectures recommandées :

Yves Hilpisch, « Python for Finance », 2019, Editions O'Reilly.