

Financial Analytics (Finlatics) using AI

The evolution of computing power along with large amounts of data that is being collected has transformed the world of finance. An example of this is algorithmic trading where an algorithm uses trading data to determine when you should buy or sell a stock in the market. It becomes more interesting when the income tax department assess a lot of data about individual taxpayers and determines that some of the citizens are not paying enough in taxes. The third example is based on the idea of who should be given a credit card. Most people who have high savings qualify for a credit card but what about those people who have low to medium savings. What about students at Ashoka?

Many of these decisions in finance, such as selling a stock, obtaining a credit card, and identifying defaulters, are based on technology, mathematical algorithms, and knowledge of finance. A person who masters these 3 fields can work for large companies, set-up their own start-up, trade in the markets, pursue a career in research, become a financial consultant and pursue many more opportunities than what is mentioned here.

The course starts with a brief understanding of markets and data that we can obtain for these markets. Then we look at how to use this data to decide if we should buy or sell a stock or bond. After having evaluated it heuristically we try to explore algorithms that can fit the behaviour of the data and perhaps indicate the buy and sell decision.

Similarly, we apply this broad principle of identifying the data, examining it and then determining which model should be fitted to different problems in finance including predicting stock price, detecting fraud, providing credit, pricing options, sizing of companies based on financial attributes.

Companies worldwide are looking for talented people who can understand different parts of finance and apply the right tools and techniques to analyze the products, customers and services. Our goal is to provide students an opportunity to learn these skills and see challenging careers in finance globally.

It is oriented towards undergraduates who may not necessarily have coding skills. The audience is expected to have the willingness to learn and explore. The focus will be to help students create a portfolio of projects where they can demonstrate the application of data analytics.

This course has 3 modules

Module 1: Mathematics for Finance – In this module the basic statistical and financial concepts will be taught. In this module the students will learn about optimization techniques, elementary calculus and statistics as applied to finance. These are required to understand how much risk you are taking and what should be the expected reward. After all finance works on the principle risk and reward.

Module 2: Technical Analysis – In this module you will learn how to use technical indicators in finance to identify opportunities to buy and sell stocks. Technical indicators are based on simple algebra and statistics. Students should be able to compute mean and variance in excel and eventually in Python. In this module you will learn about the various algorithms used by traders on Wall Street. Machine Learning algorithms will be fitted on the trading data

Module 3: ML applied to Finance – Financial decisions are often made based on predictions about the future. These predictions must be as accurate as possible. In this course the focus is on teaching the A.I. models that predict outcomes based on historical data. Here we will examine a broad of

issues including fraud detection, corporate bankruptcy, market sizing, credit rating models. You will use state-of-the-art A.I. algorithms and apply it on the finance datasets.

Evaluation Criteria

A mix of quizzes, homework assignments, projects and exams will be used to assess the learning outcome for this course. Each module will be assessed separately.

Mathematics for Finance (9 hours)

- Probability and Statistics
- Optimization Techniques
- Return measures
- Risk/Reward Ratio
- Regression Model

Learning Outcome

- Learn to compute statistical measures
- Use the statistical tools to solve business problems
- Understand the limitations of statistics

Evaluation*

- Assignment 20%
- Project 20%
- Exam 60%

Session 1-2: In the world we live, financial decisions are taken on limited information and often under great uncertainty. In this session we will start to explore how to deal with uncertainty by applying statistical measures.

Session 3-4: I have been wondering what stocks I should have in my portfolio. It has been a difficult decision to decide on the stocks. But how should I optimize the investments in each of my stocks. Should I invest 20% of my wealth in stock A and remaining in Stock B or is there a mathematical model that can help me get the proportions, right? Students will learn how to measure financial performance and optimize the reward to risk. You will construct your first financial portfolio and you will do it by yourself!

Session 5-6: An important tool that forms the basis of finance is regression. This will be used to model the expected return on equity which is the basis for computing the cost of capital. At what rate should you borrow so that you can maximize return? This is the most important question for a CFO and analytical techniques can help answer this question.

Technical Analysis (12 hours)

- Basics: Support, Resistance, Trend Line, Candlestick
- Algorithms: MACD, Bollinger Band, ADX, Renko, RSI, Fibonacci
- Performance Measures: Sortino, Teynor, Sharpe
- Trading Strategy and Backtesting

Learning Outcome

- Learn how to read trading data

- Understand the application of these models
- Establish a trading strategy

Evaluation

- Assignment 20%
- Project 60%
- Exam 20%

Sessions 7-8: In these sessions we will visit the various sources of trading data. You will learn how to extract the data and infer from the data. Concepts like support, resistance, candlestick, and trend lines will be explained using real data from the market. Your assignment will be to get the data of the stock you like and using the tools taught in the class, assess the performance of the stock.

Session 9-10: Now that you know how to read the trading data, we can apply algorithms like MACD, Bollinger Band, RSI etc. to determine if we should buy the stock or not. It will be interesting to see how algorithms can contradict each other leading to confusion. That is why you must do this course to clear your doubts.

Session 11-12: The story that began in the previous session continues because the number of algorithms is large and we should look at important dimensions such as volatility, volume of trade etc. This will impact the buy or sell decision. After all money does not grow on trees!

Session 13-14: Let us now evaluate the performance of your portfolios. We will look at performance measures used by traders worldwide to determine if you are beating the market or not. It could not get simpler than this!

ML Applied to Finance (18 hours)

- Discriminant Analysis
- Classification & Regression Trees
- Support Vector Machine
- Artificial Neural Network
- Deep Neural Network
- Long-short Term Memory

Learning Outcome

- Learn about the different types of datasets
- Apply Machine Learning algorithms to these datasets
- Predict financial behaviour

Evaluation

- Assignment 20%
- Project 60%
- Exam 20%

Session 15 to 16: In this session we will look at applying machine learning to credit card default data. If you are wondering how much of non-performing assets are created without proper due diligence, then you are in the right class! Also, it would be nice to know how you can assess the credit worthiness of a customer or a big company.

Session 17 to 18: In this session we will discuss about fraud and how it is committed. Which model should we use to detect it and what are the pros and cons. Let us figure it out.

Session 19 to 20: Companies do go bankrupt. Can we use machine learning to predict if a company is likely to go bankrupt? How did Altman do it? Let us look at some machine learning models which are the pillars of finance.

Session 21 to 22: Derivatives are used for hedging and speculating in the market. Can we determine what should be the price of a call option on Reliance stocks using machine learning techniques instead of the traditional Black-Scholes model. How do the two methods compare? Which is a better model to use?

Session 23 to 24: Deep Learning reminds one of Google Brain. You are now ready to enter the world of Artificial Intelligence. Welcome! You will learn how to make neural networks and predict the credit rating of bank customers. We will now compare how machine learning models have performed vis-à-vis deep learning models.

Session 25 to 26: Let us use Deep Learning techniques to predict the stock price of Google. The latest Long-short-term-memory models will be taught and by now you would be comfortable using deep neural networks. Perhaps the next big start-up idea will be born!