AI for Trading Syllabus

Contact Info

While going through the program, if you have questions about anything, you can reach us at support@udacity.com. For help from Udacity Mentors and your peers visit the Udacity Classroom.

Nanodegree Program Info

Learn the basics of quantitative analysis, including data processing, trading signal generation, and portfolio management. Use Python to work with historical stock data, develop trading strategies, and construct a multi-factor model with optimization.

Required Software

- Python 3.6 or latest
- Anaconda 4.7 or latest
- GIT 2.23 or latest
- Jupyter notebook 6.0.1 or latest
- pip
- Pandas, Numpy
- AffdexMe

Version: 3.0.0

Length of Program: 163 Days*

* This is a self-paced program and the length is an estimation of total hours the average student may take to complete all required coursework, including lecture and project time. Actual hours may vary.

Part 1: Quantitative Trading

Learn the basics of quantitative analysis, including data processing, trading signal generation, and portfolio management. Use Python to work with historical stock data, develop trading strategies, and construct a multi-factor model with optimization.

Project: Trading with Momentum

Learn to implement a trading strategy on your own and test to see if it has the potential to be profitable.

Lesson	Summary
Welcome to the Nanodegree Program	Welcome to the exciting world of Quantitative Trading! Say hello to your instructors and get an overview of the program.
Knowledge, Community, and Careers	You are starting a challenging but rewarding journey! Take 5 minutes to read how to get help with projects and content.
Get Help with Your Account	What to do if you have questions about your account or general questions about the program.
Stock Prices	Learn about stocks and common terminology used when analyzing stocks.
Market Mechanics	Learn about how modern stock markets function, how trades are executed and prices are set. Study market behavior, and analyze price and volume data to identify potential trading signals.
Data Processing	Learn how to adjust market data for corporate actions, include fundamental information in your analysis and compute technical indicators.
Stock Returns	Learn how to calculate stock returns, and log returns in particular. Learn why log returns are used to analyze financial data.
Momentum Trading	Learn about alpha signals, and how they can be applied to a long/short trading strategy. Learn about momentum, a common alpha signal used in trading strategies.

Project: Breakout Strategy

Implement the breakout strategy, find and remove outliers, and test to see if it can be a profitable strategy.

Supporting Lessons

Lesson	Summary
Quant Workflow	Learn about the overall quant workflow, including alpha signal generation, alpha combination, portfolio optimization, and trading.
Outliers and Filtering	Learn the importance of outliers and how to detect them. Learn about methods designed to handle outliers.
Regression	Learn about regression, and related statistical tools that pre-process data before regression analysis. See how regression relates to trading and other more advanced methods.
Time Series Modeling	Learn about advanced methods for time series analysis, including ARMA, ARIMA, Kalman Filters, Particle Filters, and recurrent neural networks.
Volatility	Learn about stock volatility, and how the GARCH model analysis volatility. See how volatility is used in equity trading.
Pairs Trading and Mean Reversion	Learn about pairs trading, and study the tools used in identifying stock pairs and making trading decisions.

Project: Smart Beta and Portfolio Optimization

Build a smart beta portfolio against an index and optimize a portfolio using quadratic programming.

Supporting Lessons

Lesson	Summary
Stocks, Indices, Funds	Gain an overview of stocks, indices and funds. Also learn how to construct an index.
ETFs	Learn about Exchanged Traded Funds (ETFs) and how they are used by investors and fund managers.
Portfolio Risk and Return	Learn the fundamentals of portfolio theory, which are key to designing portfolios for mutual funds, hedge funds and ETFs.
Portfolio Optimization	Learn how to optimize portfolios to meet certain criteria and constraints. Get hands on experience in optimizing a portfolio with the cvxpy Python library.

Project: Multi-factor Model

Research and implement alpha factors, build a risk factor model. Use alpha factors and risk factors to optimize a portfolio.

Supporting Lessons

Lesson	Summary
Factors	In the next 7 lessons and project, learn about factor investing and alpha research. These lessons and the project were designed by Jonathan Larkin, equities trader and quant investor.
Factor Models and Types of Factors	Learn the theory of factor models, distinguish between alpha and risk factors, and get an overview of types of factors.
Risk Factor Models	Learn how to model portfolio risk using factors.
Time Series and Cross Sectional Risk Models	Learn about two important types of risk models: time series and cross-sectional risk models.
Risk Factor Models with PCA	Learn about Principle Component Analysis and how it's used to build risk factor models.
Alpha Factors	Learn about alpha generation and evaluation from a practitioner's perspective.
Alpha Factor Research Methods	Learn about alpha research from a practitioner's perspective.
Advanced Portfolio Optimization	Learn about portfolio optimization using alpha factors and risk factor models.

Part 2: AI Algorithms in Trading

Learn how to analyze alternative data and use machine learning to generate trading signals. Run a backtest to evaluate and combine top performing signals.

Project: NLP on Financial Statements

NLP Analysis on 10-k financial statements to generate an alpha factor.

Supporting Lessons

Lesson	Summary
Welcome To Term II	Welcome to Term 2! Say hello to your instructors and get an overview of the program.
Intro to Natural Language Processing	Learn how to build a Natural Language Processing pipeline.
Text Processing	Learn to prepare text obtained from different sources for further processing, by cleaning, normalizing and splitting it into individual words or tokens.
Feature Extraction	Transform text using methods like Bag-of-Words, TF-IDF, Word2Vec and GloVE to extract features that you can use in machine learning models.
Financial Statements	Learn how to scrape data from financial documents using Regular Expressions and BeautifulSoup
Basic NLP Analysis	Learn how to apply to NLP to financial statements

Project: Sentiment Analysis with Neural Networks

Build a deep learning model to classify the sentiment of messages.

Supporting Lessons

Lesson	Summary
Introduction to Neural Networks	In this lesson, Luis will teach you the foundations of deep learning and neural networks. You'll also implement gradient descent and backpropagation in python, right here in the classroom!
Training Neural Networks	Now that you know what neural networks are, in this lesson you will learn several techniques to improve their training.
Deep Learning with PyTorch	Learn how to use PyTorch for building deep learning models
Recurrent Neural Networks	Learn how to use recurrent neural networks to learn from sequential data such as text. Build a network that can generate realistic text one letter at a time.
Embeddings & Word2Vec	In this lesson, you'll learn about embeddings in neural networks by implementing the Word2Vec model.
Sentiment Prediction RNN	Implement a sentiment prediction RNN for predicting whether a movie review is positive or negative!

Project: Combining Signals for Enhanced Alpha

Build a random forest to generate better alpha.

Supporting Lessons

Lesson	Summary
Overview	Learn about machine learning from a bird's-eye-view.
Decision Trees	Decision trees are a structure for decision-making where each decision leads to a set of consequences or additional decisions.
Model Testing and Evaluation	Learn about metrics to evaluate models and about how to avoid over- and underfitting.
Random Forests	Learn about random forest models and how to use them to combine alpha factors.
Feature Engineering	Learn to engineer features such as market dispersion, market volatility, sector and date parts. Also learn to engineer targets (labels) that are robust to market changes over time.
Overlapping Labels	Learn about an issue with non-independent labels that comes up during alpha combination with machine learning models.
Feature Importance	Feature importance helps us decide how relevant each feature is to a machine learning model's predictions. Learn about two methods for calculating feature importance.

Project: Improve Your LinkedIn Profile

Find your next job or connect with industry peers on LinkedIn. Ensure your profile attracts relevant leads that will grow your professional network.

Project: Optimize Your GitHub Profile

Other professionals are collaborating on GitHub and growing their network. Submit your profile to ensure your profile is on par with leaders in your field.

Project: Backtesting

Build a backtester using Barra data.

Supporting Lessons

Lesson	Summary
Intro to Backtesting	Backtesting helps you determine whether or not your strategies can be generalizable to future unseen data.
Optimization with Transaction Costs	Learn about how to make the portfolio optimization in a backtest more realistic, and also more computationally efficient.
Attribution	Use performance attribution to determine how each factor contributed to the portfolio's results.

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Generated Fri May 15 21:38:51 PDT 2020