

Artificial Intelligence for Trading Nanodegree Program Syllabus



Master the Latest AI Applications in Quantitative Finance

Welcome to the Artificial Intelligence for Trading Nanodegree program!

Before You Start

Educational Objectives: In this program, you'll analyze real data and build financial models for trading. Whether you want to pursue a new job in finance, launch yourself on the path to a quant trading career, or master the latest AI applications in quantitative finance, this program offers you the opportunity to master valuable data and AI skills.

Prerequisite Knowledge: In order to succeed in this program, we recommend that you have some experience programming with Python, and be familiar with statistics, linear algebra, and calculus.

If you are new to Python, check out our free [Intro to Data Analysis](#) course. If you feel that you need to refresh your statistical and algebra knowledge, take a look at our free statistics course, [Intro to Statistics](#), and linear algebra course, [Linear algebra refresher](#).

Length of Program: The program is comprised of 2 terms, lasting 3 months each. We expect students to work 10 hours/week on average. Make sure to set aside adequate time on your calendar for focused work.

Instructional Tools Available: Video lectures, quizzes, Jupyter notebooks, personalized project reviews.

Nanodegree Program Information

Each term is comprised of 4 courses and 4 projects, which are described in detail below. Building a project is one of the best ways to demonstrate the skills you've learned, and each project will contribute to an impressive professional portfolio that shows potential employers your mastery of quantitative finance.

Length of Program (months): Two three-month terms, total of six months

Number of terms: Two

Estimated time/week: 10 hours/week

Number of Reviewed Projects: 8

Projects

Building a project is one of the best ways to both test the skills you've acquired and to demonstrate your newfound abilities to future employers. Throughout this Nanodegree program, you'll have the opportunity to master valuable skills by building the following projects:

Term 1: Quantitative Trading

- Project 1: Trading with Momentum
- Project 2: Breakout Strategy
- Project 3: Smart Beta and Portfolio Optimization
- Project 4: Multi-factor Model

Term 2: AI Algorithms for Trading

- Project 5: Sentiment Analysis using NLP
- Project 6: Deep Neural Network with News Data
- Project 7: Backtesting
- Project 8: Combine Signals for Enhanced Alpha

In the subsequent sections, you'll find a description of each project, along with the lesson content you'll learn along the way.

TERM 1: QUANTITATIVE TRADING

In the first term, you'll learn the basics of quantitative analysis, from data processing and trading signal generation to portfolio management. You will use Python to work with historical stock data, develop trading strategies, and construct a multi-factor model with optimization.

Project 1: Trading with Momentum

In this project, you will learn to implement a momentum trading strategy and test if it has the potential to be profitable. You will work with historical data of a given stock universe and generate a trading signal based on a momentum indicator. You will then compute the signal and produce projected returns. Finally, you will perform a statistical test to conclude if there is alpha in the signal.

Course: Basic Quantitative Trading

In this course, you will learn about market mechanics and how to generate signals with stocks. Your first project is to develop a momentum trading strategy.

Lesson content

- Lesson 1: Introduction
- Lesson 2: Stock Prices
- Lesson 3: Market Mechanics
- Lesson 4: Data Processing
- Lesson 5: Stock Returns
- Lesson 6: Momentum Trading

Project 2: Breakout Strategy

In this project, you will code and evaluate a breakout signal. You will run statistical tests to test for normality and to find alpha. You will also learn to find outliers and evaluate the effect that filtered outliers could have on your trading signal. You will run various scenarios of your model with or without the outliers and decide if the outliers should be kept or not.

Course: Advanced Quantitative Trading

In this course, you will get to know the workflow that a quant follows for signal generation, and also learn to apply advanced quantitative methods in trading.

Lesson content

- Lesson 1: Quant Workflow
- Lesson 2: Outliers and Filtering Signals
- Lesson 3: Regression
- Lesson 4: Time Series Modeling
- Lesson 5: Volatility
- Lesson 6: Pairs Trading and Mean Reversion

Project 3: Smart Beta and Portfolio Optimization

In this project, you will create two portfolios utilizing smart beta methodology and optimization. You will evaluate the performance of the portfolios by calculating tracking errors. You will also calculate the turnover of your portfolio and find the best timing to rebalance. You will come up with the portfolio weights by analyzing fundamental data, and by quadratic programming.

Course: ETFs, Indices, Stocks

In this course, you will learn about portfolio optimization, and financial securities formed by stocks such as market indices, vanilla ETFs, and Smart Beta ETFs.

Lesson content

- Lesson 1: Stocks, Indices and Funds
- Lesson 2: ETFs
- Lesson 3: Portfolio Risk and Return
- Lesson 4: Portfolio Optimization

Project 4: Multi-factor Model

In this project, you will research and generate multiple alpha factors. Then you will apply various techniques to evaluate the performance of your alpha factors and learn to pick the best ones for your portfolio. You will formulate an advanced portfolio optimization problem by working with constraints such as risk models, leverage, market neutrality and limits on factor exposures.

Course: Multi-factor Model

In this course, you will learn about alpha factors and risk factors, and construct a portfolio with advanced portfolio optimization techniques.

Lesson content

- Lesson 1: Factors Models of Returns
- Lesson 2: Risk Factor Models
- Lesson 3: Alpha Factors
- Lesson 4: Advanced Portfolio Optimization with Risk and Alpha Factors Models

TERM 2: AI ALGORITHMS FOR TRADING

In this term, you will work with alternative data and use machine learning to generate trading signals. You will run a backtest to evaluate your signals and use advanced techniques to combine the top performing signals.

Project 5: Sentiment Analysis using NLP

In this project, you will apply Natural Language Processing on corporate filings, such as 10Q and 10K statements, from cleaning data and text processing, to feature extraction and modeling. You will utilize bag-of-words and TF-IDF to generate company-specific sentiments. Based on the sentiments, you will decide which company to invest in, and the optimal time to buy or sell.

Course: Sentiment Analysis with Natural Language Processing

In this course, you will learn the fundamentals of text processing and use them to analyze corporate filings and generate sentiment-based trading signals.

Project 6: Deep Neural Networks with News Data

In this project, you will build deep neural networks to process and interpret news data. You will also play with different ways of embedding words into vectors. You will construct and train LSTM networks for sentiment classification. You will run backtests and apply the models to news data for signal generation.

Course Advanced Natural Language Processing with Deep Learning

In this course, you will get to know how deep learning is applied in quantitative analysis and get to use Recurrent Neural Networks (RNN) and Long Short-Term Memory Networks (LSTM) to generate trading signals.

Project 7: Backtesting

In this project, you will construct open-high-low-close (OHLC) data feed and a backtesting framework. You will learn about various visualization techniques for backtesting. You will construct trading strategies using various parameters such as trade days, take profit levels, stop loss levels, etc. You will then optimize the parameters and evaluate the performance by analyzing the results of your backtests.

Course: Simulating Trades with Historical Data

In this course, you will learn to refine trading signals by running a rigorous backtest. You will know how to keep track of your P&L while your algorithm buys and sells.

Project 8: Combine Signals for Enhanced Alpha

In this project, you will create a prediction model for S&P 500 and its constituent stocks by performing model selection for a large data set which includes market data, fundamental data and alternative data. You will validate your model to ensure there is no overfitting. You will rank and select stocks to construct a long/short portfolio based on the prediction results.

Course: Combining Multiple Signals

In this course, you will learn about advanced techniques to select and combine the factors that you've generated from both alternative data and market data.

Contact Info

While going through the program, if you have questions about anything, you can reach us at aitnd-support@udacity.com.