



Artificial Intelligence for Trading Nanodegree Program Syllabus

Complete real-world projects designed by industry experts, covering topics from asset management to trading signal generation. Master AI algorithms for trading, and build your career-ready portfolio.

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*: 6 months

Frequency of Classes: The program is flexible, self-paced with suggested project deadlines

Textbooks required: None

Instructional Tools Available: Video lectures, mentor-led student community, forums, project reviews

*The length of this program is an estimation of total hours the average student may take to complete all required coursework, including lecture and project time. If you spend about 10 hours per week working through the program, you should finish within the time provided. Actual hours may vary.

Nanodegree Program Information

This nanodegree program is comprised of 8 courses and 8 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.

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:

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

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

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.

Lesson Content

- Lesson 1: Intro to Natural Language Processing
- Lesson 2: Text Processing
- Lesson 3: Feature Extraction
- Lesson 4: Financial Statements
- Lesson 5: Basic NLP Analysis

Project 6: Sentiment Analysis with Neural Networks

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.

Lesson Content

- Lesson 1: Introduction to Neural Networks
- Lesson 2: Training Neural Networks
- Lesson 3: Deep Learning with PyTorch
- Lesson 4: Recurrent Neural Networks
- Lesson 5: Embeddings & Word2Vec
- Lesson 6: Sentiment Prediction RNN

Project 7: Combining Signals for Enhanced Alpha

In this project, you'll combine signals on a random forest for enhanced alpha. While implementing this, you'll have to solve the problem of overlapping samples. For the dataset, we'll be using the end of day from Quotemedia and sector data from Sharadar.

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.

Lesson Content

- Lesson 1: Overview
- Lesson 2: Decision Trees
- Lesson 3: Model Testing and Evaluation
- Lesson 4: Random Forests
- Lesson 5: Feature Engineering
- Lesson 6: Overlapping Labels
- Lesson 7: Feature Importance

Project 8: Backtesting

In this project, you will build a fairly realistic backtester that uses the Barra data. The backtester will perform portfolio optimization that includes transaction costs, and you'll implement it with computational efficiency in mind, to allow for a reasonably fast backtest. You'll also use performance attribution to identify the major drivers of your portfolio's profit-and-loss (PnL). You will have the option to modify and customize the backtest as well.

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.

Lesson Content

- Lesson 1: Intro to Backtesting
- Lesson 2: Optimization with Transaction Costs
- Lesson 3: Attribution