UDACITY

NANODEGREE PROGRAM SYLLABUS

Artificial Intelligence for Trading

Overview

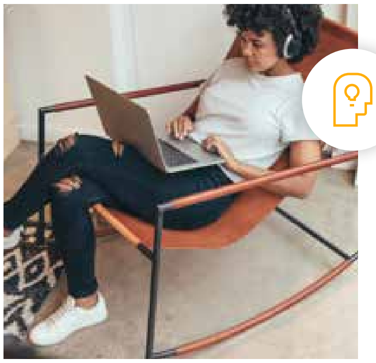
In this program, you'll analyze real data and build financial models for trading. Whether you want to pursue a new job in finance, launch yourself on the path to a quant trading career, or master the latest AI applications in quantitative finance, this program offers you the opportunity to master valuable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

IN COLLABORATION WITH

WORLDQUANT

Estimated Time:
6 Months at
10hrs/week

Prerequisites:
Python &
Mathematics



Flexible Learning:
Self-paced, so you can learn on the schedule that works best for you

Need Help?
udacity.com/advisor
Discuss this program with an enrollment advisor.

Course 1: 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.

Course Project : 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.

	LEARNING OUTCOMES
LESSON ONE	Introduction
LESSON TWO	Stock Prices
LESSON THREE	Market Mechanics
LESSON FOUR	Data Processing
LESSON FIVE	Stock Returns
LESSON SIX	Momentum Trading

Course 2: 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.

Course Project:
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.

	LEARNING OUTCOMES
LESSON ONE	Quant Workflow
LESSON TWO	Outliers and Filtering Signals
LESSON THREE	Regression
LESSON FOUR	Time Series Modeling
LESSON FIVE	Volatility
LESSON SIX	Pairs Trading and Mean Reversion

Course 3: Stocks, Indices, and ETFs

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.

Course Project:
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.

	LEARNING OUTCOMES
LESSON ONE	**Stocks, Indices and Funds**
LESSON TWO	**ETFs**
LESSON THREE	**Portfolio Risk and Return**
LESSON FOUR	**Portfolio Optimization**

Course 4: Factor Investing and Alpha Research

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

Course Project:
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

	LEARNING OUTCOMES
LESSON ONE	**Factors Models of Returns**
LESSON TWO	**Risk Factor Models**
LESSON THREE	**Alpha Factors**
LESSON FOUR	**Advanced Portfolio Optimization with Risk and Alpha Factors Models**

Course 5: 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.

Course Project:
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.

	LEARNING OUTCOMES
LESSON ONE	**Intro to Natural Language Processing**
LESSON TWO	**Text Processing**
LESSON THREE	**Feature Extraction**
LESSON FOUR	**Financial Statements**
LESSON FIVE	**Basic NLP Analysis**

Course 6: 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

Course Project:
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.

	LEARNING OUTCOMES
LESSON ONE	Introduction to Neural Networks
LESSON TWO	Training Neural Networks
LESSON THREE	Deep Learning with PyTorch
LESSON FOUR	Recurrent Neural Networks
LESSON FIVE	Embeddings & Word2Vec
LESSON SIX	Sentiment Prediction RNN

Course 7: 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.

Course Project:
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.

	LEARNING OUTCOMES
LESSON ONE	Overview
LESSON TWO	Decision Trees
LESSON THREE	Model Testing and Evaluation
LESSON FOUR	Random Forests
LESSON FIVE	Feature Engineering
LESSON SIX	Overlapping Labels
LESSON SEVEN	Feature Importance

Course 8: Simulating Trades with Historical Data

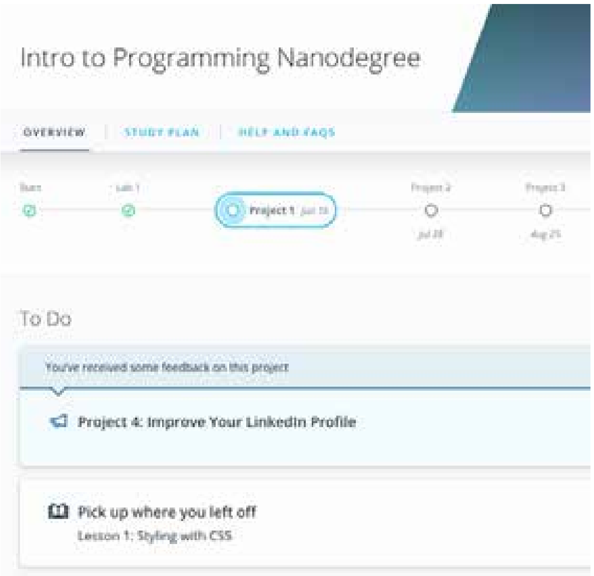
In this project, you will build a fairly realistic backtester that uses the Barra data. The backtester will perform portfolio optimization that includes transaction costs, and you'll implement it with computational efficiency in mind, to allow for a reasonably fast backtest. You'll also use performance 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.

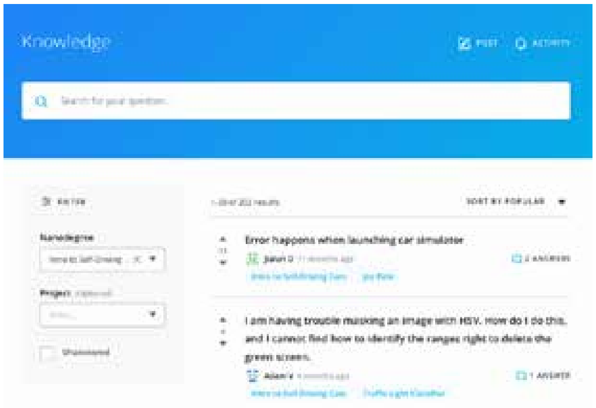
Course Project:
Backtesting

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.

	LEARNING OUTCOMES
LESSON ONE	**Intro to Backtesting**
LESSON TWO	**Optimization with Transaction Costs**
LESSON THREE	**Attribution**

Our Classroom Experience





REAL-WORLD PROJECTS
Build your skills through industry-relevant projects. Get personalized feedback from our network of 900+ project reviewers. Our simple interface makes it easy to submit your projects as often as you need and receive unlimited feedback on your work.

KNOWLEDGE
Find answers to your questions with Knowledge, our proprietary wiki. Search questions asked by other students and discover in real-time how to solve the challenges that you encounter.

STUDENT HUB
Leverage the power of community through a simple, yet powerful chat interface built within the classroom. Use Student Hub to connect with your technical mentor and fellow students in your Nanodegree program.

WORKSPACES
See your code in action. Check the output and quality of your code by running them on workspaces that are a part of our classroom.

QUIZZES
Check your understanding of concepts learned in the program by answering simple and auto-graded quizzes. Easily go back to the lessons to brush up on concepts anytime you get an answer wrong.

CUSTOM STUDY PLANS
Work with a mentor to create a custom study plan to suit your personal needs. Use this plan to keep track of your progress toward your goal.

PROGRESS TRACKER
Stay on track to complete your Nanodegree program with useful milestone reminders.

Learn with the Best

Cindy Lin

CURRICULUM LEAD

Cindy is a quantitative analyst with experience working for financial institutions such as Bank of America Merrill Lynch, Morgan Stanley, and Ping An Securities. She has an MS in Computational Finance from Carnegie Mellon University.

Arpan Chakraborty

INSTRUCTOR

Arpan is a computer scientist with a PhD from North Carolina State University. He teaches at Georgia Tech (within the Masters in Computer Science program), and is a coauthor of the book Practical Graph Mining with R.

Elizabeth Otto Hamel

INSTRUCTOR

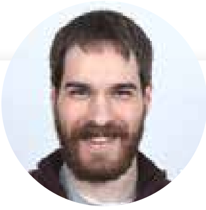
Elizabeth received her PhD in Applied Physics from Stanford University, where she used optical and analytical techniques to study activity patterns of large ensembles of neurons. She formerly taught data science at The Data Incubator.

Eddy Shyu

INSTRUCTOR

Eddy has worked at BlackRock, Thomson Reuters, and Morgan Stanley, and has an MS in Financial Engineering from HEC Lausanne. Eddy taught data analytics at UC Berkeley and contributed to Udacity's Self-Driving Car program.

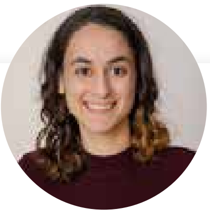
Learn with the Best



Brok Bucholtz

INSTRUCTOR

Brok has a background of over five years of software engineering experience from companies like Optimal Blue. Brok has built Udacity projects for the Self Driving Car, Deep Learning, and AI Nanodegree programs.



Parnian Barekatain

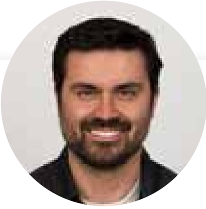
INSTRUCTOR

Parnian is a self-taught AI programmer and researcher. Previously, she interned at OpenAI on multi-agent Reinforcement Learning and organized the first OpenAI hackathon. She also runs a ShannonLabs fellowship to support the next generation of independent researchers.

Juan Delgado

CONTENT DEVELOPER

Juan is a computational physicist with a Masters in Astronomy. He is finishing his PhD in Biophysics. He previously worked at NASA developing space instruments and writing software to analyze large amounts of scientific data using machine learning techniques.



Luis Serrano

INSTRUCTOR

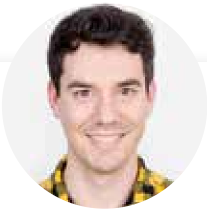
Luis was formerly a Machine Learning Engineer at Google. He holds a PhD in mathematics from the University of Michigan, and a Postdoctoral Fellowship at the University of Quebec at Montreal.

Learn with the Best

Cezanne Camacho

COURSE DEVELOPER

Cezanne is an expert in computer vision with an M.S. in Electrical Engineering from Stanford University. Inspired by anyone with the drive and imagination to learn something new, she aims to create more inclusive and effective STEM education.



Mat Leonard

INSTRUCTOR

Mat is a former physicist, research neuroscientist, and data scientist. He did his PhD and Postdoctoral Fellowship at the University of California, Berkeley.

All Our Nanodegree Programs Include:

EXPERIENCED PROJECT REVIEWERS

REVIEWER SERVICES

- Personalized feedback & line by line code reviews
- 1600+ Reviewers with a 4.85/5 average rating
- 3 hour average project review turnaround time
- Unlimited submissions and feedback loops
- Practical tips and industry best practices
- Additional suggested resources to improve

TECHNICAL MENTOR SUPPORT

MENTORSHIP SERVICES

- Questions answered quickly by our team of technical mentors
- 1000+ Mentors with a 4.7/5 average rating
- Support for all your technical questions

PERSONAL CAREER SERVICES

CAREER SUPPORT

- Resume support
- Github portfolio review
- LinkedIn profile optimization

Frequently Asked Questions

PROGRAM OVERVIEW

WHY SHOULD I ENROLL?

Demand for quantitative talent is growing at incredible rates. Data-driven traders are now responsible for more than 30% of all US stock trades by investors (or about $1 trillion USD worth of investments, up from 14% in 2013). This scenario represents incredible opportunity for individuals eager to apply cutting-edge technologies to trading and finance.

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 trading and quantitative finance, this program will give you the opportunity to build an impressive portfolio of real-world projects. You will build financial models on real data, and work on your own trading strategies using natural language processing, recurrent neural networks, and random forests. You'll also enjoy direct access to leading experts in the field, and get personalized project and career support.

To create the curriculum for this program, we collaborated with WorldQuant, a global quantitative asset management firm, as well as top industry professionals with prior experience at JPMorgan, Morgan Stanley, Millennium Management, and more. If your goal is to learn from the leaders in the field, and to master the most valuable and in-demand skills, this program is an ideal choice for you.

WHAT JOBS WILL THIS PROGRAM PREPARE ME FOR?

Graduates of this program will have the quantitative skills needed to be extremely valuable across many functions, and in many roles at hedge funds, investment banks, and FinTech startups.

Specific roles include:

- Quantitative analyst
- Quantitative researcher
- Investment analyst
- Data intelligence analyst
- Risk analyst
- Desk quant
- Desk strategist
- Financial engineer
- Financial data scientist

HOW DO I KNOW IF THIS PROGRAM IS RIGHT FOR ME?

If you're a programmer, data analyst or someone with a strong quantitative background, this program offers you the ideal path to pursue a quant trading

FAQs Continued

career and prepares you to seek out data science jobs across the financial ecosystem.

ENROLLMENT AND ADMISSION

DO I NEED TO APPLY? WHAT ARE THE ADMISSION CRITERIA?
No. This Nanodegree program accepts all applicants regardless of experience and specific background.

WHAT ARE THE PREREQUISITES FOR ENROLLMENT?
The Artificial Intelligence for Trading Nanodegree program is designed for students with intermediate experience programming with Python and familiarity with statistics, linear algebra and calculus. In order to successfully complete this program, you should meet the following prerequisites:

Python programming
- Basic data structures
- Basic Numpy

Statistics
- Mean, median, mode
- Variance, standard deviation
- Random variables, independence
- Distributions, normal distribution
- T-test, p-value, statistical significance

Calculus and linear algebra
- Integrals and derivatives
- Linear combination, independence
- Matrix operations
- Eigenvectors, eigenvalues

IF I DO NOT MEET THE REQUIREMENTS TO ENROLL, WHAT SHOULD I DO?
We have a number of short free courses that can help you prepare, including:
- Intro to Data Analysis
- Intro to Statistics
- Linear Algebra

TUITION AND TERM OF PROGRAM

HOW IS THIS NANODEGREE PROGRAM STRUCTURED?
The Artificial Intelligence for Trading Nanodegree program is comprised of content and curriculum to support eight (8) projects. We estimate that students can complete the program in six (6) months working 10 hours per week.

FAQs Continued

Each project will be reviewed by the Udacity reviewer network. Feedback will be provided and if you do not pass the project, you will be asked to resubmit the project until it passes.project until it passes.

HOW LONG IS THIS NANODEGREE PROGRAM?
Access to this Nanodegree program runs for the length of time specified in the payment card above. If you do not graduate within that time period, you will continue learning with month to month payments. See the **Terms of Use** and **FAQs** for other policies regarding the terms of access to our Nanodegree programs.

SOFTWARE AND HARDWARE

WHAT SOFTWARE AND VERSIONS WILL I NEED IN THIS PROGRAM?
To successfully complete this Nanodegree program, you'll need to be able to download and run Python 3.7.