



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 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.

IN COLLABORATION WITH

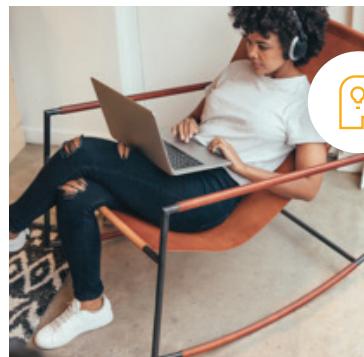
WORLDQUANT.



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

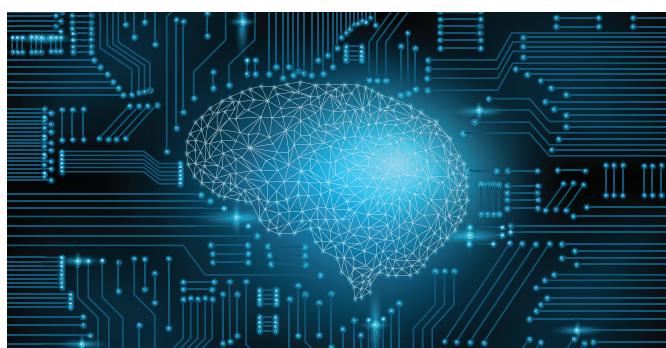
ETFs

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

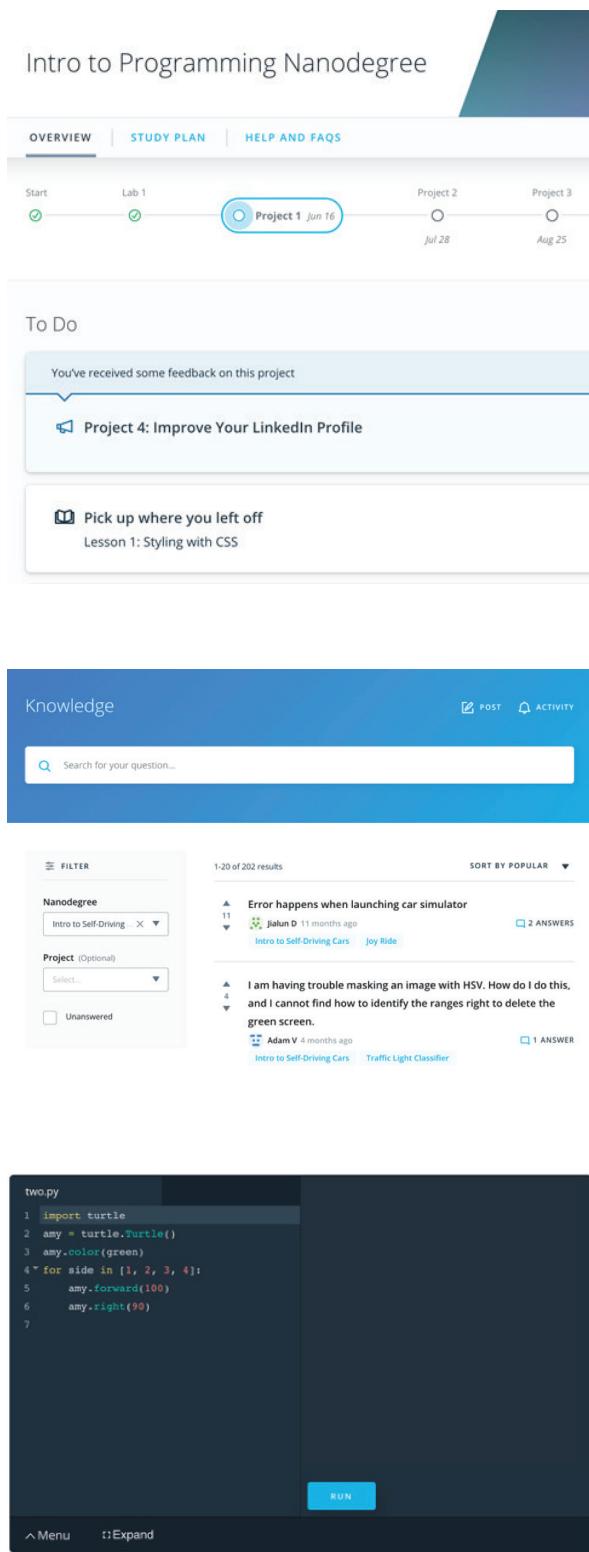
Optimization with Transaction Costs

LESSON THREE

Attribution



Our Classroom Experience



The screenshot shows the Udacity Classroom interface for the 'Intro to Programming Nanodegree'. It includes:

- OVERVIEW**: Shows a timeline from 'Start' to 'Aug 25' with milestones: Lab 1, Project 1 (Jun 16), Project 2 (Jul 28), and Project 3 (Aug 25).
- To Do**: A list of tasks including 'Project 4: Improve Your LinkedIn Profile'.
- Knowledge**: A search bar and a list of questions. One question is highlighted: "Error happens when launching car simulator" by 'Jialun D' (11 months ago) with 2 answers.
- Code Editor**: A workspace titled 'two.py' containing Python code for a turtle graphics program, with a 'RUN' button at the bottom.

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, connect with technical mentors, 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 fellow students in your Executive 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

Preschedule your study times and save them to your personal calendar to create a custom study plan. Program regular reminders to keep track of your progress toward your goals and completion of your program.

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 COACHING

- Personal assistance in your job search
- Monthly 1-on-1 calls
- Personalized feedback and career guidance
- Interview preparation
- Resume services
- 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

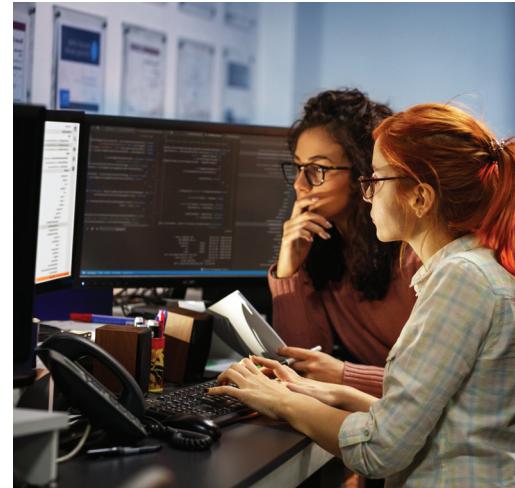
- Basic data structures
- Basic Numpy

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

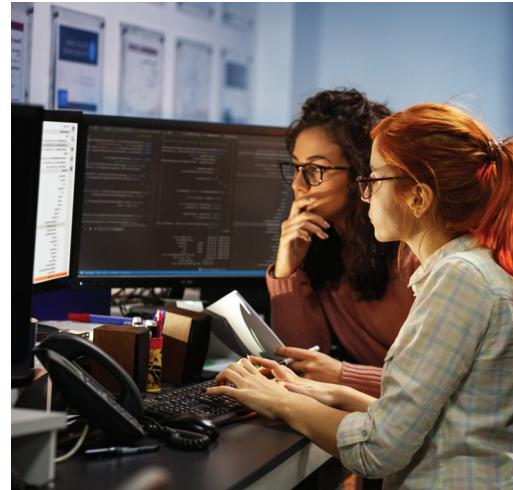
Each project will be reviewed by the Udacity reviewer network. Feedback will be provided and if you do not pass the project, you will be asked to resubmit the project until it passes.

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.

CAN I SWITCH MY START DATE? CAN I GET A REFUND?

Please see the Udacity Nanodegree program [FAQs](#) for policies on enrollment in our 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.