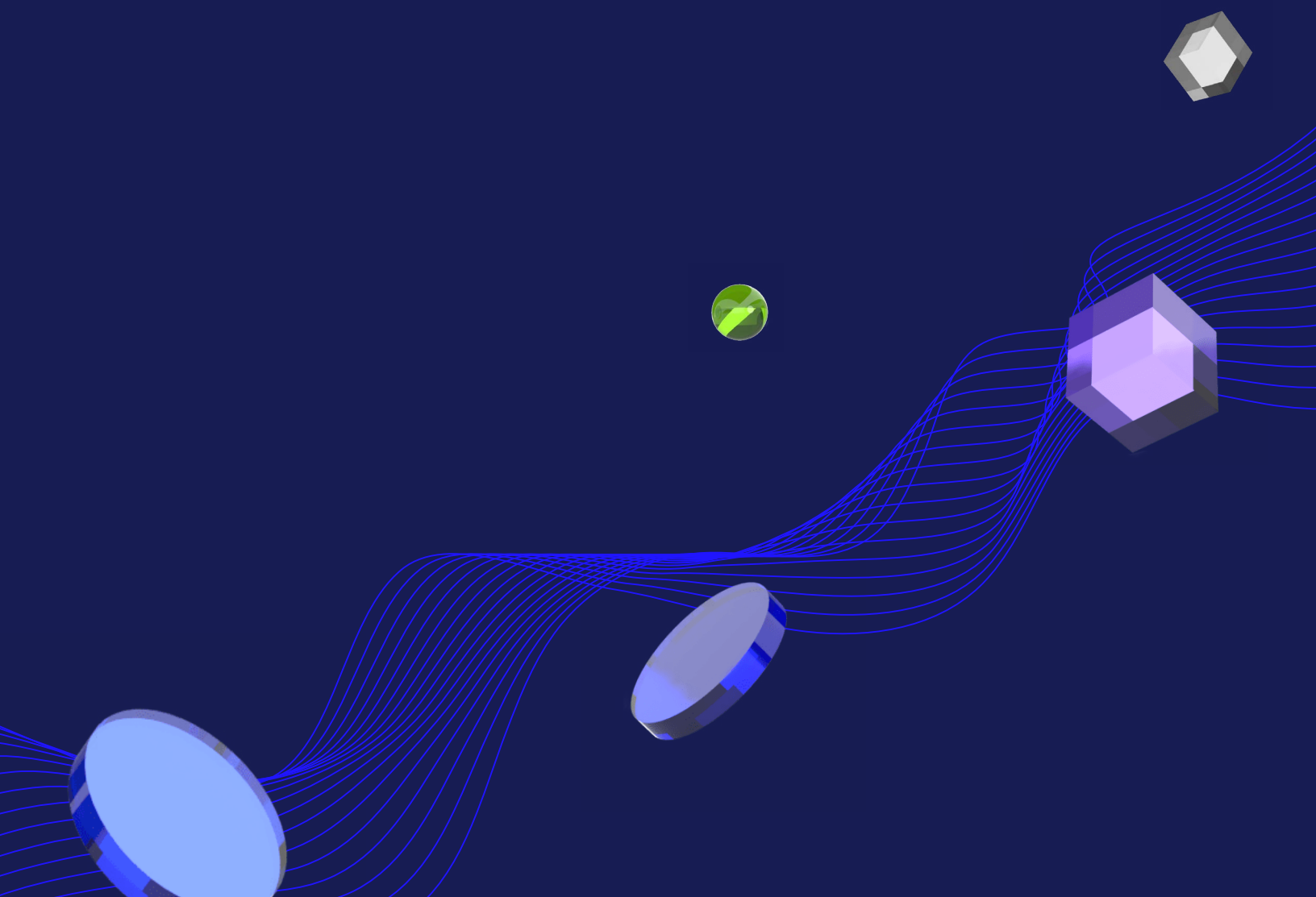
INDIVIDUAL LEARNERS

UDACITY

SCHOOL OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence for Trading

Nanodegree Program Syllabus



Overview

In this program, learners will analyze real data and build financial models for trading. Whether learners want to level up in finance, obtain new skills in quant trading, or learn the latest AI applications in quantitative finance, this program offers them the opportunity to gain mastery of valuable data and AI skills. Building a project is one of the best ways to demonstrate the skills students have learned learned, and each project will contribute to an impressive professional portfolio that will demonstrate learners newly acquired knowledge of quantitative finance.

Built in collaboration with:

WORLDQUANT

Program information

Estimated Time

6 months at 10hrs/week*

Skill Level

Intermediate

Prerequisites

A well-prepared learner should have experience programming with Python and familiarity with statistics, linear algebra, and calculus.

Required Hardware/Software

Learners need access to a computer running OS X or Windows; Python 3.7.

*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 5-10 hours per week working through the program, you should finish within the time provided. Actual hours may vary.

Course 1

Course 1: Basic Quantitative Trading

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

Course Project

Trading with Momentum

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

Lesson 1

Introduction

Lesson 2

Stock Prices

Lesson 3

Market Mechanics

Lesson 4

Data Processing

Lesson 5

Stock Returns

Lesson 6

Momentum Trading

Course 2

Advanced Quantitative Trading

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

Lesson 1

Quant Workflow

Lesson 2

Outliers & Filtering Signals

Lesson 3

Regression

Lesson 4

Time Series Modeling

Lesson 5

Volatility

Lesson 6

Pairs Trading & Mean Reversion

Course 3

Stocks, Indices & ETFs

In this course, students 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 & Portfolio Optimization

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

Lesson 1

Stocks, Indices & Funds

Lesson 2

ETFs

Lesson 3

Portfolio Risk & Return

Lesson 4

Portfolio Optimization

Course 4

Factor Investing & 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, learners will research and generate multiple alpha factors. Then they will apply various techniques to evaluate the performance of their alpha factors and learn to pick the best ones for their portfolio. Learners will formulate an advanced portfolio optimization problem by working with constraints such as risk models, leverage, market neutrality and limits on factor exposures.

Lesson 1

Factors Models of Returns

Lesson 2

Risk Factor Models

Lesson 3

Alpha Factors

Lesson 4

Advanced Portfolio Optimization with Risk & Alpha Factors Models

Course 5

Sentiment Analysis with Natural Language Processing

In this course, students 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, learners 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. Learners will utilize bag-of-words and TF-IDF to generate company-specific sentiments. Based on the sentiments, learners will decide which company to invest in and the optimal time to buy or sell.

Lesson 1

Intro to Natural Language Processing

Lesson 2

Text Processing

Lesson 3

Feature Extraction

Lesson 4

Financial Statements

Lesson 5

Basic NLP Analysis

Course 6

Advanced Natural Language Processing with Deep Learning

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

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

Course 7

Combining Multiple Signals

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

Course Project

Combining Signals for Enhanced Alpha

In this project, learners will combine signals on a random forest for enhanced alpha. While implementing this, learners will 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.

Lesson 1

Overview

Lesson 2

Decision Trees

Lesson 3

Model Testing & Evaluation

Lesson 4

Random Forests

Lesson 5

Feature Engineering

Lesson 6

Overlapping Labels

Lesson 7

Feature Importance

Course 8

Simulating Trades with Historical Data

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

Course Project

Backtesting

In this project, learners will combine signals on a random forest for enhanced alpha. While implementing this, learners will 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.

Lesson 1

Intro to Backtesting

Lesson 2

Optimization with Transaction Costs

Lesson 3

Attribution

Meet your instructors.

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.

Brok Bucholtz

Instructor

Brok has more than 5 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.

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.

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.

Arpan Chakraborty

Instructor

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

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.

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.

Juan Delgado

Instructor

Juan is a computational physicist with a master's 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.

Cezanne Camacho

Curriculum Lead

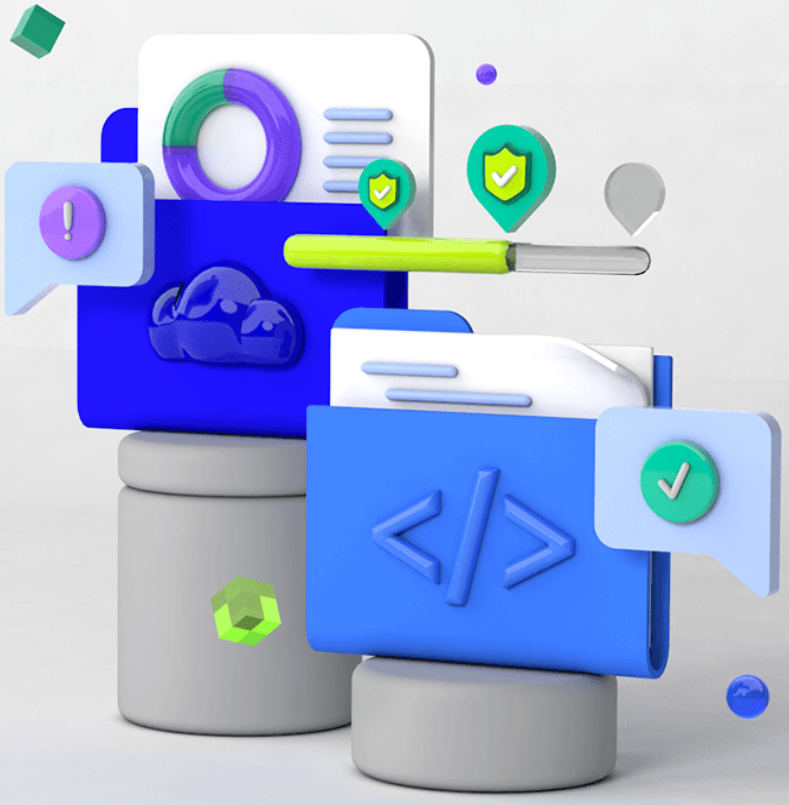
Cezanne is a machine learning educator with a master's in electrical engineering from Stanford University. As a former researcher in genomics and biomedical imaging, she's applied machine learning to medical diagnostic applications.

Mat Leonard

Instructor

Mat is a former physicist, research neuroscientist, and data scientist. He completed his PhD and postdoctoral fellowship at the University of California, Berkeley.

Udacity's learning experience



Hands-on Projects

Open-ended, experiential projects are designed to reflect actual workplace challenges. They aren't just multiple choice questions or step-by-step guides, but instead require critical thinking.

Quizzes

Auto-graded quizzes strengthen comprehension. Learners can return to lessons at any time during the course to refresh concepts.

Knowledge

Find answers to your questions with Knowledge, our proprietary wiki. Search questions asked by other students, connect with technical mentors, and discover how to solve the challenges that you encounter.

Custom Study Plans

Create a personalized study plan that fits your individual needs. Utilize this plan to keep track of movement toward your overall goal.

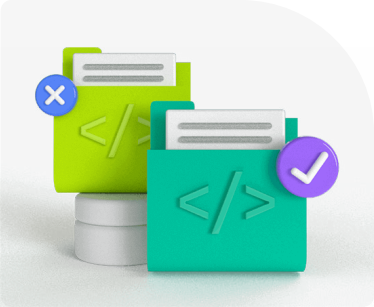
Workspaces

See your code in action. Check the output and quality of your code by running it on interactive workspaces that are integrated into the platform.

Progress Tracker

Take advantage of milestone reminders to stay on schedule and complete your program.

Our proven approach for building job-ready digital skills.



Experienced Project Reviewers

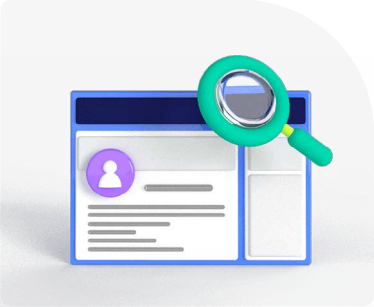
Verify skills mastery.

- Personalized project feedback and critique includes line-by-line code review from skilled practitioners with an average turnaround time of 1.1 hours.
- Project review cycle creates a feedback loop with multiple opportunities for improvement—until the concept is mastered.
- Project reviewers leverage industry best practices and provide pro tips.

Technical Mentor Support

24/7 support unblocks learning.

- Learning accelerates as skilled mentors identify areas of achievement and potential for growth.
- Unlimited access to mentors means help arrives when it's needed most.
- 2 hr or less average question response time assures that skills development stays on track.



Personal Career Services

Empower job-readiness.

- Access to a Github portfolio review that can give you an edge by highlighting your strengths, and demonstrating your value to employers.*
- Get help optimizing your LinkedIn and establishing your personal brand so your profile ranks higher in searches by recruiters and hiring managers.

Mentor Network

Highly vetted for effectiveness.

- Mentors must complete a 5-step hiring process to join Udacity's selective network.
- After passing an objective and situational assessment, mentors must demonstrate communication and behavioral fit for a mentorship role.
- Mentors work across more than 30 different industries and often complete a Nanodegree program themselves.

*Applies to select Nanodegree programs only.

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