Data Science Bootcamp **Curriculum**

NYC Data Science Academy

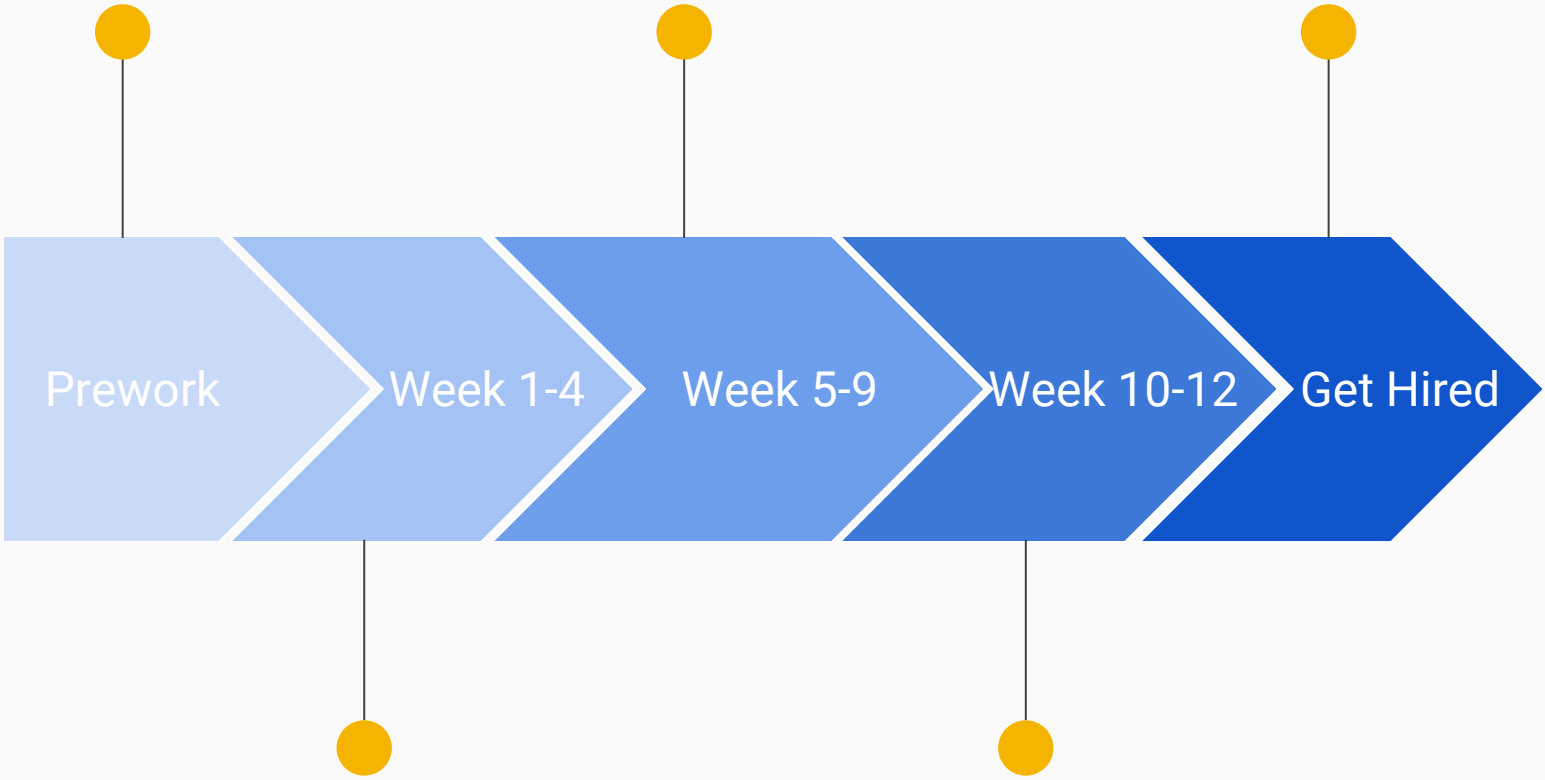
NYC DATA SCIENCE ACADEMY

100+ hours free, self-paced online course. Access to part-time in-person courses hosted at NYC campus

Machine Learning with R and Python
Foundations of statistics, regressions, classifications, model selections, unsupervised learning, time series analysis, NLP, deep learning, Tensorflow, etc.

Machine learning theory defense, Capstone project presentations.

Code reviews, resume workshop, mock interviews, career day



Data Analysis and Visualization
Linux system, Git, SQL
Data analysis and visualization with R and Python
R Shiny
Web scraping with Python

Big Data with Hadoop & Spark
Spark, Spark SQL, Spark MLlib, Hadoop and MapReduce, Hive, Pig

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Pre-work

Once students are enrolled in the bootcamp, they are granted access to our online, self-paced pre-work materials:

- 20-30 hours: Introductory Python (Optional)
- 35-45 hours: Data Analysis and Visualization with R
- 20-30 hours: Data Analysis and Visualization with Python

Students are also invited to join their cohort's Slack channel, where they meet their future classmates, instructors, and get support on pre-work assignments.

Enrolled bootcamp students can also choose to take part-time, beginner-level courses hosted at our NYC campus. 100% tuition credited to bootcamp.

Week 1

Data Science Toolkit – Linux, Git, Bash, and SQL

Data Science with R – Data Analytics – Part I

- Linux system
  - Operating Systems and Linux
  - File System and File Operations
  - Text-processing commands
  - Other useful commands
- Git
  - What is Version Control and Git?
  - Installing Git
  - Getting Started with Git
  - Git Tips
  - Undoing Changes
  - What is Github?
  - Working With Remotes
- SQL
  - Intro to SQL
  - Tables and schemas
  - SQL queries – SELECT
  - MySQL database management
  - Joins
- Programming foundation in R I
  - Introduction to R
  - Introduction to RStudio
  - R objects
  - Functional programming: apply
- Programming foundation in R II
  - More data types
  - Control statements
  - Functions
  - Data Transformations

Week 2

Data Science with R – Data Analytics – Part II

- Data manipulation with "dplyr"
  - Introduction to dplyr
  - Built-in functions

  - Join data sets
  - Groupwise operations
- Data Visualization with "ggplot2"
  - Why ggplot2?
  - The “Grammar of Graphics”
  - Constructing a ggplot2 plot
  - Scatterplots
  - Bar charts
  - Histograms
  - Visualizing big data
  - Saving Graphs
  - Customizing Graphics
- Lab: Data Visualization from Scratch
- Introduction to Shiny
  - Shiny introduction
  - Design the User-interface
  - Control widgets
  - Build reactive output
  - Use data table in Shiny Apps
  - Use R scripts, data and packages
  - UI and server for the App
  - Make Shiny perform quickly
  - Matrix-based visualizations
  - Use reactive expressions
  - Share and deploy Shiny apps
- Lab: Build a Shiny app from Scratch

Week 3

Data Science with R – Machine Learning – Part I

Data Science with Python - Data Analytics – Part I

- Foundations of Statistics
  - All About Your Data
  - Statistical Inference
  - Introduction to Machine Learning
  - Review
- Get Started with Python
  - Installing and using iPython
  - Simple values and expressions

- Lambda functions and named functions
- Lists
- Functional operators: map and filter

- Strings and Data Structures
  - String operations
  - File Input and Output
  - Searching in files
  - Data Structures
- Conditionals and Control Flows
  - Conditionals
  - For loops
  - List Comprehensions
  - While loops
  - Errors and Exceptions
- Project Day: Exploratory Visualization & Shiny

Project 1 Due: Exploratory Visualization & Shiny

Week 4

Data Science with Python – Data Analytics – Part II

- Advanced Topics
  - Multiple-list operations: map and zip
  - Functional operators: reduce
  - Object Oriented Programming
- Introduction to Web Scraping
  - Regular Expressions
  - Introduction to HTML
  - Basics of Beautifulsoup
  - Examples
- Introduction to Scrapy
  - An example
  - Getting Started
  - Items/spider/pipelines/settings.py
  - In Class Lab
- Introduction to Numpy
  - Ndarray
  - Subscripting and slicing
  - Operations
  - Matrix and linear algebra

- Random Sampling
- Introduction to Pandas
  - Data Structure
  - Data Manipulation
  - Handling missing data
  - Grouping and aggregation

Week 5

Data Science with Python - Data Analytics – Part III

Data Science with R - Machine Learning – Part I

- Matplotlib & Seaborn
  - In-class Lab
- Missingness & Imputation
  - Missing Data
  - Basic Methods of Imputation
  - K-Nearest Neighbors
  - Review
- Linear Regression I
  - Simple Linear Regression
  - Assumptions & Diagnostics
  - Transformations
  - The Coefficient of Determination R^2
- Project Day: Web Scraping

Project 2 Due: Web Scraping

Week 6

Data Science with R - Machine Learning – Part II

- Linear Regression II
  - Multiple Linear Regression
  - Assumptions & Diagnostics
  - Research Questions of Interest
  - Extending Model Flexibility
  - Review
- Generalized Linear Models
  - Logistic Regression
  - Maximum Likelihood Estimation
  - Model Interpretation
  - Assessing Model Fit

- Review
- The Curse of Dimensionality
  - Ridge Regression
  - Lasso Regression
  - Cross-Validation
  - Bias/Variance Tradeoff
- Tree Methods
  - Decision Trees
  - Bagging
  - Random Forest
  - Variable Importance

Week 7

Data Science with R - Machine Learning – Part III

Data Science with Python - Machine Learning – Part I

- Support Vector Machines
  - Maximal Margin Classifier
  - Support Vector Classifier
  - Support Vector Machines
  - Multi-Class SVMs
  - Review
- Association Rules & Naïve Bayes
  - Association Rule Mining
  - Naïve Bayes
  - Review
- Python - Linear Regression
  - What is Machine Learning
  - Introduction to Scikit-Learn
  - Simple Linear Regression
  - Multiple Linear Regression
  - Statsmodels
- Python - Classification Part I
  - Limitation of Linear Regression
  - Logistic Regression
  - Discriminant Analysis: Motivation
  - Discriminant Analysis: Models

- Naïve Bayes
- Python - Model Selection
  - Cross-Validation
  - Bootstrap
  - Feature Selection
  - Regularization
  - Grid Search

Week 8

Data Science with Python - Machine Learning – Part II

Data Science with R - Machine Learning – Part IV

- Python - Classification Part II
  - Support Vector Machines
  - Tree-Based Methods
- Principal Component Analysis
  - Taking a New Perspective
  - Dimension Reduction
  - Vectors of Highest Variance
  - The PCA Procedure
- Cluster Analysis
  - Intro to Cluster Analysis
  - K-Means Clustering
  - Hierarchical Clustering
  - Clustering Takeaways
  - Review
- Python - Unsupervised Learning
  - Intro to Unsupervised Learning
  - Principal Component Analysis
  - Clustering
- Project Day: Machine Learning

Project 3 Due: Machine Learning

Week 9

Data Science with R - Machine Learning (Continued)

Big Data

- Time Series Analysis
  - The Nature of Time Series Analysis
  - Learn from the Examples

- Decomposition of Time Series Data
- Examples of Stationary Non-White-Noise Time Series
- ARMA and ARIMA Models
- Assessing Model Fit

- Introduction to Spark
  - What is Apache Spark
  - Initializing Spark
  - RDDs, Transformations and Actions
  - Working with Key-Value Paris
  - Performance & Optimization
- Introduction to Spark SQL
  - Overview
  - Spark Session
  - Working with DataFrames
  - Using HiveQL in Spark SQL
- Spark Mllib
  - Spark Machine Learning Workflow
  - How ML Pipeline Works
  - ML Pipeline Example: Predicting Diamonds Price
  - Extracting, transforming and select features
  - Train Validation Splitting
  - Building the ML Pipeline with DecisionTreeRegressor
  - Model Evaluation
  - Model Tuning

Week 10

Big Data (Continued)

Advanced Machine Learning Topics

- Neural Network with Tensorflow
- Natural Language Processing with Deep Learning
- Hadoop and MapReduce:
  - What is Hadoop
  - HDFS
  - MapReduce
  - Combiner
  - Hadoop Monitoring Ports
- Apache Hive:

- Databases for Hadoop
- Hive
- Compiling HiveQL to MapReduce
- Technical aspects of Hive
- Extending Hive with TRANSFORM

- Apache Pig:
  - Pig Overview
  - An introductory example
  - Pig Latin Basics
  - Compiling Pig to MapReduce

Week 11

SQL, R, & Python Code Review

Machine Learning Theory Defense

- A/B Testing
- Machine Learning Theory Defense Practice
- Machine Learning Theory Defense
- Project Day - Capstone

Week 12

SQL, R, & Python Code Review

Machine Learning Theory Defense

Capstone Project Presentations

- SQL Code Review Session
- R Code Review Session
- Python Code Review Session
- Machine Learning Theory Defense

From the beginning of Bootcamp, you will work on hands-on projects. Now your Capstone Project lets you create your own data product that showcases your interests and talents. Students are free to use anything covered in class on this project.