COLUMBIA | ENGINEERING
EXECUTIVE EDUCATION

APPLIED MACHINE LEARNING

OVERVIEW

“Over the past decades computers have broadly automated tasks that programmers could describe with clear rules and algorithms. Modern machine learning techniques now allow us to do the same for tasks where describing the precise rules is much harder.”

— Jeff Bezos
Founder, Amazon

Machine Learning has become an entrenched part of everyday life. The books we buy, the movies we watch, the sports we follow, the driving directions we get are driven by Machine Learning algorithms. It is one of the most exciting fields of computing today. And Machine Learning practitioners are in high demand, with a shortfall of 250,000 data scientists forecast.

At Columbia Engineering, we are fascinated by the possibilities of Machine Learning. We have created the Applied Machine Learning course, in partnership with Emeritus, to help students across the world apply Machine Learning to improve every aspect of human life.

Since this course requires an intermediate knowledge of Python, you will spend the first part of this course learning Python for Data Analytics taught by Emeritus. This will provide you with the comprehensive programming knowledge required to derive the maximum benefit from the Applied Machine Learning course.

ABOUT COLUMBIA ENGINEERING

Columbia Engineering (The Fu Foundation School of Engineering and Applied Science), is committed to pushing the frontiers of knowledge and shaping discoveries to meet the needs of society. These aspirations have been fundamental since its early origins in 1864 as a school devoted to metallurgy and mining.

Over the years, Columbia's faculty and students have made remarkable contributions that have spurred technological and social progress. Today, Columbia carries the tradition of innovation as engineering transforms nearly every aspect of life.

Faculty at Columbia Engineering have won 10 Nobel Prizes in physics, chemistry, medicine, and economics.

Transcending Disciplines, Educating Leaders, Transforming Lives

10

Nobel Prizes in physics, chemistry, medicine, and economics

PAST PARTICIPANTS

TOP COUNTRIES REPRESENTED

800+ participants from over 65 countries have benefitted from this course.

PAST PARTICIPANTS

INDUSTRIES

Past participants represent 25+ unique industry domains. Above 50% of the participants come from Banking and Financial Services, IT Products & Services and the Consulting Indsutry.

WORK EXPERIENCE

About 70% of the participants have more than 5 years' of work experience.

COURSE FACULTY

Dr. John Paisley

Columbia University
Associate Professor, Electrical Engineering
Affiliated Member, Data Sciences Institute

Dr. John Paisley received his PhD in Electrical and Computer Engineering from Duke University, and was a postdoctoral researcher at Princeton University and UC Berkeley prior to becoming a faculty member at Columbia.

Dr. John Paisley's research focuses on developing models for large-scale text and image processing applications. He is particularly interested in Bayesian models and posterior inference techniques that address the big data problem.

COURSE HIGHLIGHTS

Our approach to this course is to teach the underlying concepts and math of Machine Learning.

Going beyond the theory, our approach invites participants into a conversation, where learning is facilitated by live subject matter experts and enriched by practitioners in the field of machine learning. We expect learners would be required to put in 8-10 hours per week.

240+
Faculty Videos

45
Quizzes / Assignments

20+
Q&A Sessions with Course Leaders

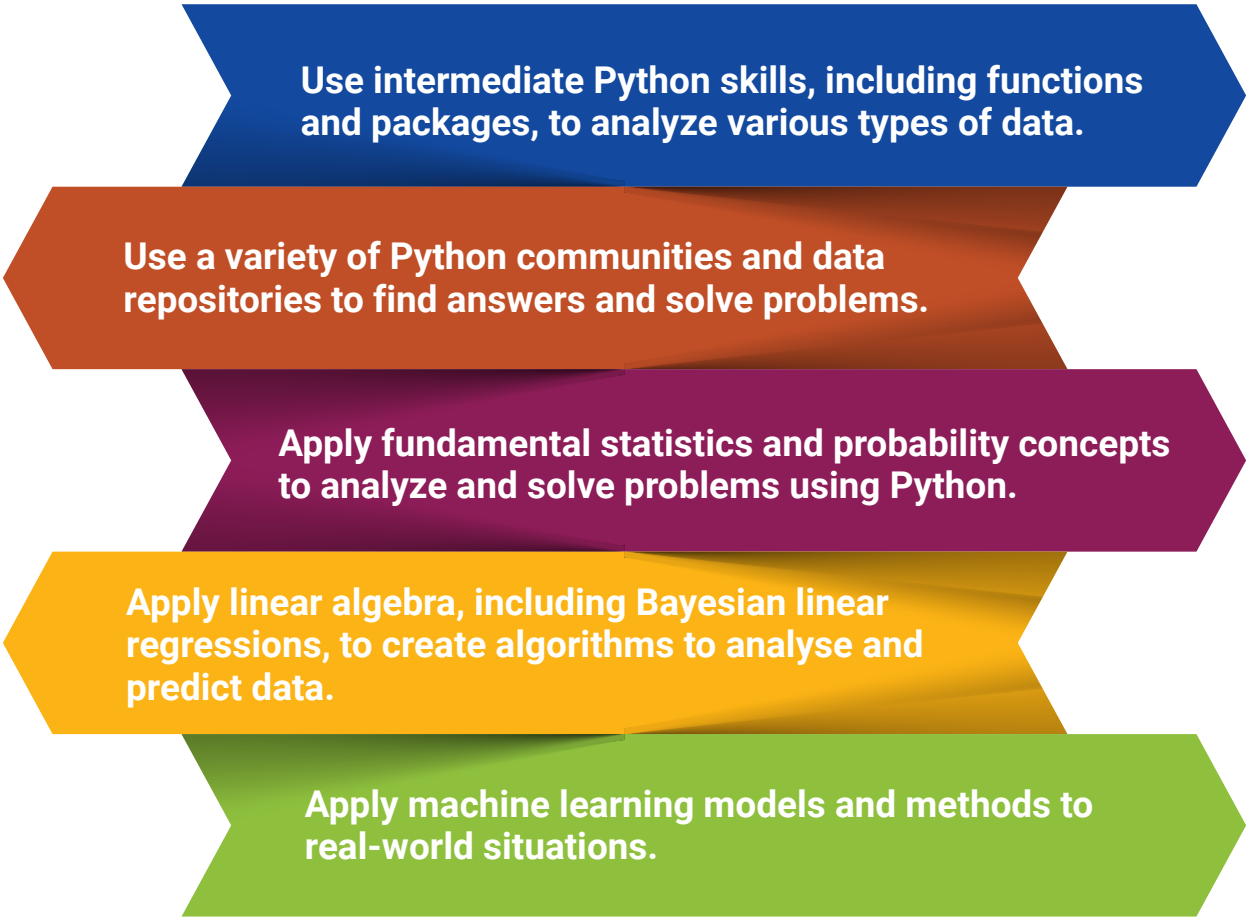
18
Moderated Discussion Boards

12
Application Projects

Live Online Teaching

KEY TAKEAWAYS

Master the models and methods of machine learning while acquiring the Python programming knowledge you need to find solutions to real-world data problems. Here are the key takeaways for this course:



SYLLABUS

Part 1: Python for Data Analytics (Video content and delivery by Emeritus)

Module 1

Introduction to Data Science

Module 2

Working with Data Types & Operators in Python

Module 3

Writing Functions in Python

Module 4

Popular Data Science Packages in Python

Module 5

Advanced Functions

Module 6

Data Manipulation and Analysis with Pandas

Module 7

Data Visualization with Matplotlib

Module 8

Random Variables & Statistical Inferences

Module 9

Statistical Distributions & Hypothesis Testing

Module 10

Data Cleaning

Module 11

Exploratory Data Analysis

Module 12

Getting Started with Linear Algebra for Machine Learning

SYLLABUS

Part 2: Applied Machine Learning (Video content from Columbia Engineering and delivery by Emeritus)

Supervised Learning

Module 1

Regression

Maximum Likelihood, Least Squares, Regularization

Module 2

Linear Regression

Module 3

Bayesian Methods

Bayes Rule, MAP Inference, Active Learning

Module 4

Foundational Classification Algorithms – Part 1

Nearest Neighbors, Perceptron, Logistic Regression

Module 5

Foundational Classification Algorithms – Part 2

Refinements to classification - kernel methods, Gaussian process

Module 6

Intermediate Classification Algorithms – Part 1

SVM, trees, forests, and boosting

Unsupervised Learning

Module 7

Intermediate Classification Algorithms – Part 2

Clustering methods - k-means clustering, e-m, Gaussian mixtures

Module 8

Clustering Methods

K-means clustering, e-m, Gaussian mixtures (cont.)

Module 9

Recommendation Systems – Part 1

Collaborative Filtering, Topic Modeling, PCA

Module 10

Recommendation Systems – Part 2

Sequential data models - Markov and hidden Markov models, Kalman filters

Module 11

Sequential Data Models

Markov and Hidden Markov Models, Kalman Filters

Module 12

Association Analysis Clustering Methods

Model comparisons, analysis considerations

APPLICATION PROJECTS

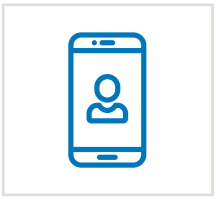
The course requires learners to work on application projects. These projects require learners to apply the Machine Learning concepts they have learned to datasets and derive inferences. These application projects are intentionally made to be challenging. We expect learners to spend substantial time and effort solving the application projects. At the end of the course, we expect learners to be able to apply Machine Learning to solve many of the business problems they face at their workplace.

Movie Recommendation Engine

You will build a movie recommendation engine by applying collaborative filtering and topic modelling techniques. You use a dataset which contains 20 million viewer ratings of 27,000 movies.

House Price Prediction

You will write code to predict house prices based on several parameters available in the Ames City dataset compiled by Dean De Cock using least squares linear regression and Bayesian linear regression.



Human Activity Recognition

You will predict the human activity (walking, sitting, standing) that corresponds to the accelerometer and gyroscope measurements by applying the nearest neighbours technique.

Credit Card Fraud Detection

You will detect potential frauds using credit card transaction data. You will apply the random forest method to identify fraudulent transactions.

Market Segmentation

You will create market segments using the US Census dataset and by applying the k-means clustering method.

THE LEARNING EXPERIENCE

The course is spread over 24 weeks and consists of Video Lectures, Assignments/Application Projects, Discussions.

Orientation
The first week is orientation week. During this week you will be introduced to the other participants in the class from across the world and you will learn how to use the learning management system and other learning tools provided.

Goal Setting
On other weeks, you have learning goals set for the week. The goals would including watching the video lectures and completing the assignments. All assignments have weekly deadlines.

Video Lectures
The recorded video lectures are by course faculty.

Live Webinars
Every few weeks, there are live webinars conducted by Emeritus Course Leaders. Course Leaders are highly-experienced industry practitioners who contextualize the video lectures and assist with questions you may have regarding your assignments. Live webinars are usually conducted between 1 pm and 3 pm UTC on Tuesdays or Wednesdays.

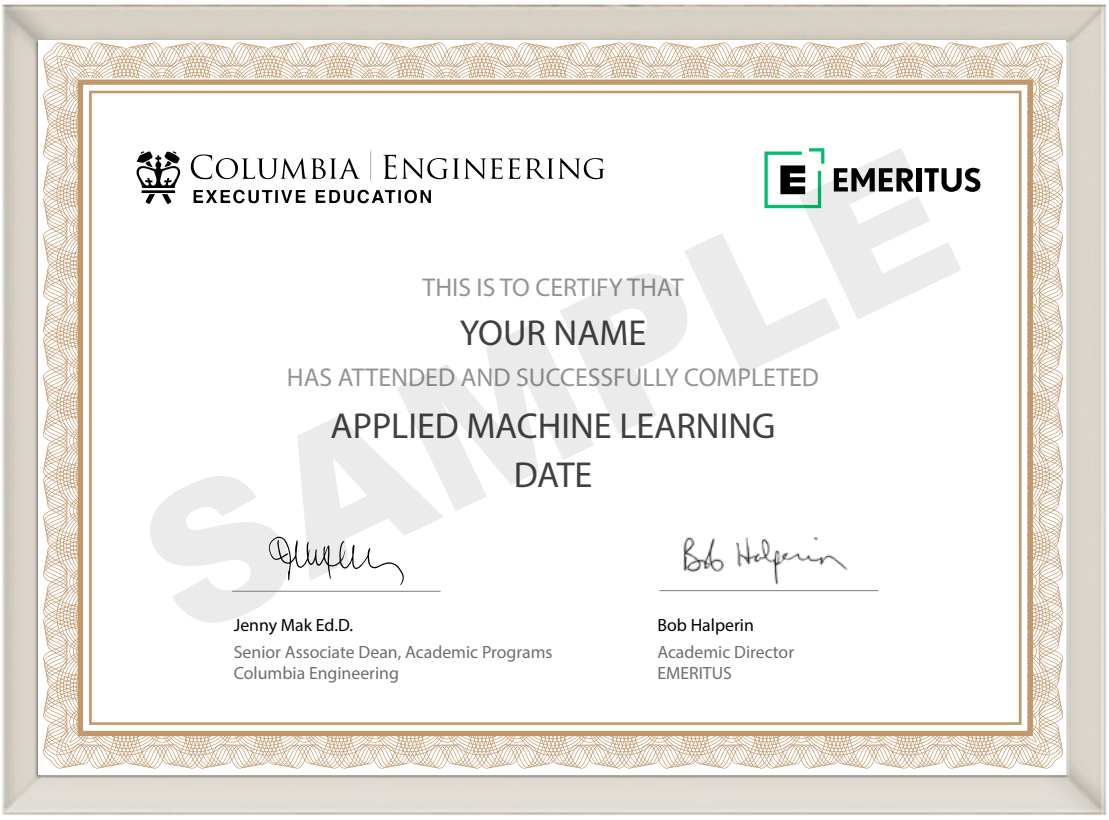
Q&A Sessions
In addition to the live webinars, the course leaders also conduct Q&A sessions every week or every alternate week to help participants clear up any ambiguities pertaining to the content.

Follow-Up
Emeritus Program Support Team follow up over email and phone calls with learners who are unable to submit their assignments on time.

Continuous Course Access
You will continue to have access to the course videos and learning material for up to 12 months from the course start date.

CERTIFICATE

Upon successful completion of the course, participants will receive a verified digital certificate from Emeritus in collaboration with Columbia Engineering Executive Education.



COURSE FEE AND DURATION

USD 2,350
5 Months, Online

Singapore residents who wish to enroll for this course will be charged GST.

PREREQUISITES

- **The course requires an undergraduate knowledge of statistics (descriptive statistics, regression, sampling distributions, hypothesis testing, interval estimation etc.), calculus (derivatives), linear algebra (vectors & matrix transformation) and probability (conditional probability/Bayes theorem).**

*__Assessment:__ Students will be given an assessment to test their math skills prior to commencement of the course. You can view sample questions by clicking here. To familiarize yourself with the topics of the assessment, refer to learning resources by clicking here.

ABOUT EMERITUS

Columbia Engineering Executive Education is collaborating with online education provider Emeritus to offer executive education courses through a dynamic, interactive, digital learning platform. These courses leverage Columbia Engineering Executive Education's thought leadership in Engineering practice developed over years of research, teaching and practice.

An Emeritus Certificate course created in collaboration with Columbia Engineering Executive Education is based on syllabus approved by Columbia Engineering Executive Education, and contains video content created and recorded by Columbia Engineering Executive Education faculty, combined with assessments, assignments, projects, cases, and exercises delivered by Emeritus. Upon successful completion of the course, learners will be awarded a certificate jointly by Emeritus and Columbia Engineering Executive Education.

- **Collaborative and engaging format**
- **Live online teaching, world-class faculty, hands-on project-based learning**
- **30,000 students from 120 countries have benefited**

www.emeritus.org

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Refer your colleague and receive a benefit

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Connect with a program advisor

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We attempt to respond to queries in 24 hours or less. However, over weekends and holidays, our responses may take up to 72 hours.

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