DATA SCIENCE: BRIDGING PRINCIPLES AND PRACTICE

Develop your data literacy to make more confident decisions in your organization.

Berkeley Executive Education | Berkeley Haas
Fear of disruption. It’s a common feeling across today’s business landscape: fear that a smarter, more agile company will leverage data in ways that compel competitive advantage. To combat this fear, many thought leaders, including those at UC Berkeley Executive Education, believe that every company should begin to think of itself as a data company – for it’s that competency that can truly lead to performance gains.

Investment in big data and related technologies is at an all-time high, yet according to research by New Vantage Partners, only 48 percent of the companies say they are competing on data and analytics; only 31 percent have created a data-driven organization and only 28 percent have forged a data culture. The challenge in realizing the potential of big data lies not in the technology itself, but rather in transforming people, culture, and processes.

In this program, prepare to get dirty in the data. UC Berkeley Executive Education’s Data Science: Bridging Principles and Practice gives working professionals a foundational understanding of what data science and analytics is all about, and many of the most common techniques used to manipulate and analyze data. At the end of this program, you will be able to work effectively with data science and analytics teams to drive business decisions and successful outcomes for your organization.

"We won't dance around the math. If you want to delve deeper than a trend line in a Google Analytics report, this data science program will help you develop real data literacy."

- Steve Tadelis, James J. and Marianne B. Lowrey Chair in Business, Haas School of Business
WHO IS THIS PROGRAM FOR?

This program is for individual contributors and mid-level to senior managers coming from either the private or public sectors seeking a truly rigorous, hands-on experience with modern data analysis methods.

Representative roles and industries that can benefit include:

- Managers who manage or will manage data science teams or vendors
- Performance marketing professionals
- Product engineers, product managers, and R&D managers
- Business/technology strategists and consultants
- Human resources professionals
- Technology-driven industries where data analysis is critical including retail, information technology, ecommerce, financial services, fintech, manufacturing and healthcare.

PREPARING FOR DATA SCIENCE LITERACY

While there are no formal prerequisites such as coding knowledge, having an aptitude for quantitative concepts is important. As pre-term work and in week 1, there will be a review of basic mathematical and statistical concepts such as mean, standard deviation, graphs, histograms and linear and logarithmic functions. In addition, there will be a weekly 'prep session' to introduce key concepts from the next module that participants may want a refresher on. To gain true literacy in data science, be prepared to get dirty in the data and embrace some math and stats. We’ll fully support you along the way.

KEY TAKEAWAYS:

Adopt a data-driven mindset
- Learn to ask the right questions of the data
- Common techniques for turning data into business insights
- Knowing which method to use to answer specific business questions

Learn to communicate and interpret data
- Effective methods for data presentation
- The language used to communicate with data scientists
- Interpret data more effectively by understanding the most common techniques

Create a data-driven culture
- Use technology and process to drive a cultural shift where data is leveraged for strategy, decision making and execution
- Learn the capabilities that make for successful data science teams
Participant Profile

You’ll be in good company on your data science journey. Past participants come from a wide range of industries, job functions, and management levels.

Work Experience

- 1-5 yrs: 9%
- 6-10 yrs: 12%
- 11-15 yrs: 28%
- 16-20 yrs: 24%
- >26 yrs: 12%
- 12-25 yrs: 11%
- 26-30 yrs: 9%
- >30 yrs: 6%

Representative Companies

Participants include representatives from companies such as:

- Adobe Inc.
- Amazon
- Apple Inc.
- Bank of America
- Bayer
- Cisco Systems
- DBS Bank
- Dow Jones
- Euromonitor International
- ExxonMobil
- Microsoft Corporation
- Oracle Corporation
- Procter & Gamble
- Saatchi & Saatchi
- Visa Inc.
- Wells Fargo & Company

Participant Titles Include:

Participants include representatives from companies such as:

- CEOs & Managing Directors
- CIOs
- Director Global Data Warehouse and Enterprise Applications
- Director, Enterprise Architecture
- Director, Predictive Analytics
- Chief Data Officer
- Vice President of Digital Strategy and Immersion
- Head of Machine Learning and AI
- Senior Manager, Strategic Analytics
- Senior Manager, Business Development
- Data Analyst
- Consultant Digital Strategy Marketing
“The Jupyter Notebook assignments and the weekly office hours were the best part of the program for me.”
- Bita Luliano, Talent Management Analyst

“I enjoyed the combination of videos, hands-on exercises and Jupyter Notebook exercises in the program.”
- Michael Wolff, Executive Director, Digital Platforms & Products

“This program gave me the required insight into the world of data science, the different languages, models, algorithms as well as the value and pros/cons of using these.”
- Saloni Sonawala, Application Scientist

“Working with Jupyter Notebook, having access to a good online platform with a focus on real life cases and learning facilitators added a lot of value in my learning journey throughout this program.”
- Dmitry Karablinov, Business Development Manager
During this ten-week online journey, you’ll connect directly with UC Berkeley Executive Education’s faculty, industry leaders and peers from every corner of the globe. Taking a rigorous, hands-on approach, you’ll analyze data sets using Jupyter Notebook, an interactive open-source platform we will use for computational analysis. While the curriculum is pre-determined, this is an agile learning experience and there may be dynamic opportunities that present themselves based on real-world happenings.

- Interviews with industry experts who are driven by data, from leading companies including Google, the Oakland A’s, Uber and more
- Live webinars with UC Berkeley Executive Education faculty including Q&A
- Application exercises using Python in Jupyter Notebook to visualize and analyze data (graded as complete or incomplete)
- Live weekly 'prep sessions' to introduce any technical concepts for next module, weekly office hours and live assignment reviews
- Two week-long learning labs to focus on hands-on assignments and dig deeper into the data
- Moderated discussion boards

Our Approach to Data Science and Analytics

The basic approach to data science and analytics has four steps. First, the **motivation**: clearly state the question you want to answer. Second, the **method**: this describes the data you’ll use and the analytics approach needed. Third, the **mechanics**: you and other team members will roll up your sleeves and get the work done. Finally, the **message**: summarizes your results and answers the initial question in a clear and concise way that can be understood by a broad range of business leaders in your organization.
Company Examples:

UC Berkeley Executive Education's faculty have strong relationships with industry, including many of the top tech firms in and around Silicon Valley. Content from the program is either inspired by or directly derived from research and applications from companies that include:

- **Rocket Fuel Ad Campaign**: Rocket Fuel is a digital advertising company that optimizes digital marketing through big data and machine learning. You’ll use Python to organize and visualize data from an ad campaign, then conduct an A/B test to determine whether the ad campaign was successful or not.

- **Capital Bikeshare**: Capital Bikeshare is a bike-sharing company that is interested in predicting how many riders they can expect to have on a given day. You’ll use Python to generate and analyze summary statistics, then create regression models to try to predict the number of riders on a given day.

- **Employee Attrition at IBM**: You’ll work with a fictional data set created by IBM to try to predict whether or not an employee will leave their job. In the Jupyter Notebook, you’ll use Scikit-Learn — a free, open-source software for machine learning in Python — to create, train and evaluate their machine learning model.
Industry Examples:

We exist in the analytics economy, where every organization can benefit from improving its data literacy skills. Examples come from a broad range of industries, including:

- Fintech/Financial Svs.
- Healthcare
- Information Technology
- Manufacturing
- Retail

Note: All product and company names are trademarks™ or registered® trademarks of their respective holders. Use of them does not imply any affiliation with or endorsement by them.
MODULE 1

Probabilistic Decision Making

We’ll introduce the foundational concepts behind data science and analytics before exploring the fundamentals of data.

- Identify the difference between categorical and numerical data
- Explore the basic ways in which data reveal information
- Explore the association between categorical variables and numerical variables
- Healthcare example: HMO Membership and doctor visits using aggregated data
- Introduction to Jupyter Notebook, Python and Panda

MODULE 2

Creating Sample Data

Learn the definitions of key survey terms as well as methods by which sampling is used to analyze the pros and cons of business decisions through the exploration of sampling, type I and type II errors and control limits.

- Learn to define types of data samples, sampling variation, and quality
- Identify and define foundational concepts for sampling
- Identify and mitigate bias in sampling data
- Examples to illustrate joint, marginal and conditional probability: Comcast, Google and Nextag

MODULE 3

Testing Hypothesis

Making data-driven business decisions relies on well-articulated hypotheses that lend themselves to statistical tests. We’ll cover the foundations of this approach including statistical comparisons, confidence intervals and margins of error.

- Identify the basic tenets of experimentation
- Identify and discriminate between 1-sided and 2-sided statistical tests
- Complete problem sets using the 4M model (Motivation, Method, Mechanics, Message)
- Example: 24 Hour Fitness tests a new proprietary diet—testing between control and treatment groups.

MODULE 4

Extrapolating Information from Sample Data

We’ll explore the most common linear and curved patterns and understand different ways to fit data to linear models. A central application will be to understand market demand, price setting and elasticities.

- Identify conditions for using and interpreting linear and curved patterns
- Examine curved (non-linear) patterns as applied to vehicle weight and fuel efficiency
- Complete problem sets using the 4M model for Credit Cards and Crime and Housing Prices in Philadelphia.
MODULE 5

Basic Regression Models

Simple regression analyses are at the heart of more elaborate data-driven business decision making. We’ll focus on understanding the ways in which these models are used, the assumptions that make their use valid and how to leverage these models to make better business decisions.

- Define and apply the simple regression model and identify conditions for using the simple regression model
- Apply and interpret prediction intervals
- Identify three major problems affecting regression models: changing variation in data, outliers and dependence among observations
- Retail example: use regression modeling to determine the location of a franchise outlet

MODULE 6

Advanced Regression Models

Build on the basics to define the multiple regression model and explore different use cases.

- Discriminate between marginal and partial slopes
- Articulate inference in the multiple regression model
- Summarize the process of fitting and building a multiple regression model
- Financial example: build a multiple regression model that aims to explain the returns on Sony’s stock
- Human resources example: analyze salary data using MRM to identify gender imbalances

MODULE 7

Forecasting Machine Learning

We’ll demystify machine learning by learning the fundamentals and studying different applications.

- Discriminate between supervised, semi-supervised and unsupervised learning
- Examine machine learning approaches including the “bag of words” method for supervised learning
- Practice forecasting using time series regressions
- Cybersecurity example: machine learning for Spam Detection

MODULE 8

Building Effective Data Science Teams

With the fundamentals and some of the most common tools under our belt, we’ll wrap up with a deep dive into the suite of competencies that define effective data science teams and how to build a data-driven culture in your organization. Common pitfalls will be stressed, and strategies to work effectively with data scientists will be laid out.

- Review requirements for building effective data science teams
- Continue exploration of building a data-driven culture
- Advertising example: Rocket Fuel: conversion rates, benefit, ROI, opportunity cost and A/B test

Note: In order to help you explore some of the hands-on techniques that lead directly to making better data-driven decisions, there will be two week-long learning labs as an opportunity to dig deeper into the data. This makes for a 10-week long program in total.
Prior to starting his position at Berkeley Haas, Steve was an assistant professor at Stanford University for eight years.

Steve also held positions as a senior director and distinguished economist at eBay Research Labs (2011–13) and vice president of economics and market design at Amazon (2016–17) where he applied economic research tools to a variety of product and business applications, working with technologists, machine learning scientists and business leaders. He continues to advise Amazon part-time as an Amazon economist fellow.

Steve’s current areas of research are ecommerce, industrial organization, procurement contracting, consumer behavior and applied game theory.

Select honors include:

- Honorable Mention, Cheit Teaching Award, Full-Time MBA Program, 2010–11
- Montias prize – best article published in the Journal of Comparative Economics in 2010–11
- Barbara and Gerson Bakar Faculty Fellow, UC Berkeley, Haas School of Business, 2008–15
- Phi Beta Kappa Undergraduate Teaching Award, Stanford University, 2005
- Department of Economics Advising Award, Stanford University, 2002
Shachar is the former department chair and faculty director of the Experimental Social Science Laboratory (Xlab). His research in behavioral and experimental economics provides novel tools for understanding individual preferences and attitudes towards risk and time, which inform nearly all aspects of decision making.

His academic experience includes visiting professorship positions at Stanford University, Princeton University, University of Oxford, University of Cambridge, the European University Institute and the Norwegian School of Economics, among others. Shachar is a co-founder chief scientist at Capital Preferences, a company revolutionizing enterprise investment advice, lending, insurance and talent market solutions.

**Select honors include:**

- The Earl F. Cheit Award for Excellence in Teaching, UC Berkeley, Haas School of Business, 2012
- Alfred P. Sloan Research Fellowship, 2009
- Distinguished Teaching Award, UC Berkeley, Division of Social Sciences, 2006–07
- Outstanding Advising Award, UC Berkeley, Department of Economics, Graduate Economics Association, 2006–07
Upon successful completion of the program, UC Berkeley Executive Education grants a verified digital certificate of completion to participants. This program is graded as a pass or fail; participants must receive 80 percent to pass and obtain the certificate of completion.

Note: After successful completion of the program, your verified digital certificate will be emailed to you in the name you used when registering for the program. All certificate images are for illustrative purposes only and may be subject to change at the discretion of UC Berkeley Executive Education.

This program counts toward a Certificate of Business Excellence

CURRICULUM DAYS
Two Days

PILLAR(S)
Strategy & Management

A UC Berkeley Certificate of Business Excellence gives individuals the opportunity to create a personal plan of study structured by our four academic pillars. Participants will earn a mark of distinction with certification from a world-class university, and enjoy the flexibility of completing the program in up to three years.

LEARN MORE
STARTS ON
July 30, 2020

ENDS ON
October 14, 2020

DURATION
10 weeks
6–8 hours per week*

PROGRAM FEES
$2,850

*Time required to complete the modules, assignments and attend live support sessions will vary depending on your technical abilities and background. This is an estimate of the average time required to complete the program successfully.

ABOUT EMERITUS

UC Berkeley Executive Education is collaborating with online education provider EMERITUS to offer a portfolio of high-impact online programs. These programs leverage UC Berkeley Executive Education’s thought leadership in management practice developed over years of research, teaching, and application. By working with EMERITUS, we are able to broaden access beyond our on-campus offerings in a collaborative and engaging format that stays true to the quality of The University of California, Berkeley. EMERITUS’s approach to learning is based on a cohort-based design to maximize peer-to-peer sharing and includes live teaching with world-class faculty and hands-on project-based learning. In the last year, more than 30,000 students from over 150 countries have benefited professionally from EMERITUS’s courses.
Our programs are designed to meet the needs of individual learning styles, while also leveraging the power of peer learning. This is achieved through a user-friendly learning platform that enables participants to easily navigate the program content to achieve learning objectives.

**KEEPING IT REAL**

Our pedagogical approach is designed to bring concepts to life, including:

- Byte-sized learning techniques
- Real world application
- Peer learning discussions
- Live, interactive teaching

**KEEPING IT CONVENIENT**

Access to program content is flexible and available through multiple devices, allowing working professionals to easily manage schedules and learn remotely—anytime, anywhere. Participants enrolled in the program obtain access to learning materials in a modular approach, with new content released weekly. Program modules include a variety of teaching instruments, such as:
• Video lectures
• Discussions
• Class materials: articles, cases
• Quizzes
• Surveys
• Assignments

To further personalize the program modules, live teaching sessions are scheduled during the program, often with Q&A. For participants who are unable to attend these live sessions, a recording is made available so nothing is missed. Our industry-leading learning platform allows participants to create a profile, connect and collaborate with peers, and interact with academic/industry experts such as program leaders and teaching assistants. Assignments are often linked to participants' real-world situations, making concepts inherently practical.

KEEPING IT INTERESTING

Our globally connected classrooms enable participants to seamlessly interact with their peers to complete group assignments and stay on track toward program completion—with culturally enriching encounters along the way.

PROGRAM REQUIREMENTS

To access our programs, participants will need the following:

• Valid email address
• Computing device connected to the internet: PC/laptop, tablet, or smartphone
• Class materials: articles, cases
• The latest version of their preferred browser to access our learning platform

• Microsoft Office and PDF viewer to access content such as documents, spreadsheets, presentations, PDF files, and transcripts

OTHER REQUIREMENTS

Programs may necessitate the usage of various software, tools, and applications. Participants will be informed about these additional requirements at the registration stage or when the program begins. Our program advisors are also available to respond to any questions about these requirements.
CONNECT WITH A PROGRAM ADVISOR

Email: berkeley@emeritus.org
Phone: +1 510-822-8883