



Advanced Analytics @ MIT

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HISTORY

THE MIT OPERATIONS RESEARCH CENTER



- The Operations Research Center at MIT was established in **1953** by renowned physicist Philip M. Morse, a pioneer in the field of operations research (OR) in World War II and the first president of the Operations Research Society of America (ORSA)
- Philip M. Morse is considered to be the father of the field of Operations Research in the U.S.
- Today, the ORC is an interdisciplinary research center with over 50 distinguished faculty members from a diverse array of academic specialties across MIT



WHAT IS OPERATIONS RESEARCH?

Operations Research (OR) is the discipline of applying advanced analytical methods—such as **optimization, statistics, machine learning,** and **probability**—to make better decisions that impact society and the world positively.



SAMPLE RESEARCH TOPICS

Professor	Research Topic
Arnie Barnett	Collected and cleaned congressional votes data for 30 states and conducted hypothesis tests to identify gerrymandering
Dimitris Bertsimas	Building a predictive model to capture risk of developing infection in patients receiving chemotherapy
Dimitris Bertsimas	Minimization of hospital beds occupancy peak by leveraging past possible scenarios to take uncertainty into account within the optimization model
Dimitris Bertsimas	Optimization of the scheduling and routing of Boston School Buses
Dimitris Bertsimas	Predicting stroke for patients (acuity and location if applicable) using radiology reports.
Vivek Farias	Researching a new algorithm to control user social behavior on a running app, in order to maximize usage/running.
Stephen Graves	Munging and cleaning warehouse inventory data to estimate how long products stay in the warehouse and other associated statistics
Jonas Jonasson	Studying the impact of experience on operational efficiency and consistency. This is in the context of healthcare operations & the analysis uses a unique dataset of 10 years from the London Ambulance Services.
Georgia Perakis	<ol style="list-style-type: none">1. Improve sales forecasting and optimize shop floor display assortment using RFID data for Zara2. Conduct anomaly detection for display behavior by store managers
Nikos Trichakis	Optical Character Recognition (text in images) for commodity supply chain network in Indonesia
Karen Zheng	Predicting crop prices and optimizing network flow for rural farmers in India



Boston — Tuesday, July 25, 2017

“The **Boston Public Schools** is proud to announce that a team of analytics and optimization experts from the Massachusetts Institute of Technology has won the first-ever **BPS Transportation Challenge** by developing a computer-based model that more efficiently routes school buses, generating potentially **millions of dollars in cost savings** that will be put back into classrooms.”

<https://www.wsj.com/articles/how-do-you-fix-a-school-bus-problem-call-mit-1502456400>

“Our solution generates thousands of possible routes, and then picks from trillions of permutations the optimal bus route to connect schools throughout the day. Creating this many permutations by hand simply is not possible. Our algorithm creatively combines optimization theory, human intuition and the power of computing,”

-Professor Bertsimas of the Operations Research Center at MIT.

WORLD CLASS ANALYTICS FACULTY



**Arnold
Barnett**

George Eastman Professor of
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Sloan School of Management

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website

Probability modeling and statistics |
Transportation systems | Criminal behavior |
Health | Risk analysis and perception



**Erik
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Schussel Family Professor of
Management Science; Professor of
Information Technology; Director,
The MIT Center for Digital Business
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Information technology | Economics as it
relates to the organization of work,
productivity, and pricing | Digital information



**Dimitris
Bertsimas**

Boeing Professor of Operations
Research; Codirector, Operations
Research Center
Sloan School of Management

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Analytics | Discrete, convex and robust
optimization | Statistical learning under a
modern optimization lens | Personalized
medicine



**Georgia
Perakis**

William F. Pounds Professor of
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Predictive and prescriptive analytics |
Optimization | Pricing and revenue
management | Energy | Supply chains



**Y. Karen
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Behavioral operations | Environmentally and
socially responsible supply chains | Consumer
bounded rationality | Pricing management |
Risk management





CURRICULUM

AN ACCELERATED DOCTORAL-LEVEL 12-MONTH STEM CURRICULUM

Fall (Sep-Dec)

Jan IAP

Spring (Feb-May)

Summer Jun-Aug

Required Core: Analytics Capstone Project 24 units Jan-Aug

Required Core:

- 15.093: Optimization Methods (12)
- 15.095: Machine Learning (12)
- 15.681: From Analytics to Action (6)
- 15.071: Analytics Edge (12)
- 15.572: Analytics Lab (9)
- 15.003: Software Tools in R, Python, SQL and Julia (3)
- 15.286: Communicating with Data (3) – taught during IAP
- 15.TBD: Ethics and Data Privacy (3) – taught during IAP
- 15.089: Analytics Capstone Project (24)

Students must maintain a **minimum 4.5/5.0**
GPA in order to graduate

Spring Approved Electives (27-48 units):

- 6.883: Advanced Topics in Artificial Intelligence
 - 6.680: Statistical Learning Theory (taught in Fall)
 - HST.953 Collaborative Data Science in Medicine (taught in the Fall)
 - HST.956 Machine Learning in Healthcare
 - 15.399 Entrepreneurship Lab (taught in Fall)
 - 15.457: Advanced Analytics of Finance
 - 15.665: Power and Negotiation
 - 15.785: Digital Product Management
 - 15.764: Theory of Operations Management
 - 15.841: Marketing Analytics
 - 15.S04: Crypto Finance
 - 18.0651 Matrix Methods
- ... and more!*

Student
Graduate in
Late Aug



UNIQUE **CAPSTONE** MODEL

- The **Analytics Capstone Project** allows students to work in teams of 2 on **real-life data science** research problems with industry practitioners
- **7-month project** course with guaranteed full-time, **summer work experience** at a company location within the U.S. or abroad
- Students complete a written final report as well as presentation to the host company and MIT Sloan/ORC faculty for the Capstone Showcase in August
- Sample projects include:
 - **MBTA:** Multi-model optimization tool for the Boston paratransit service
 - **StubHub:** Creating a pricing prediction engine
 - **BCG Gamma:** Building a demand forecasting and supply chain model



Sample Capstone Companies



MASTER OF BUSINESS ANALYTICS CLASS OF 2020 PROFILE*

1010
Applications

62
Class Size

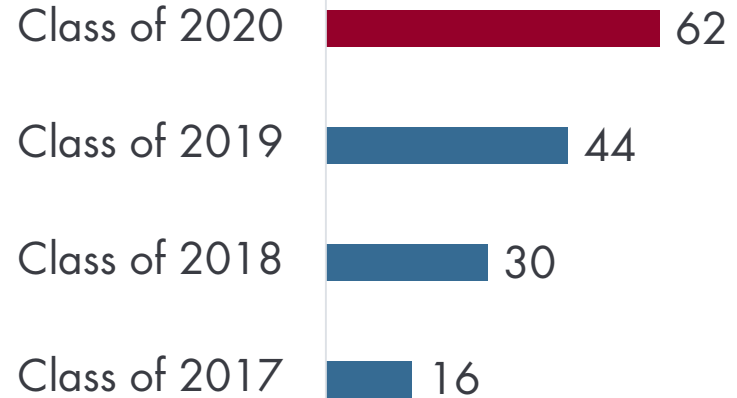
3.9
Mean GPA

168
Mean GRE Quant Score

73%
International

40%
Female

Steady Growth in Class Size

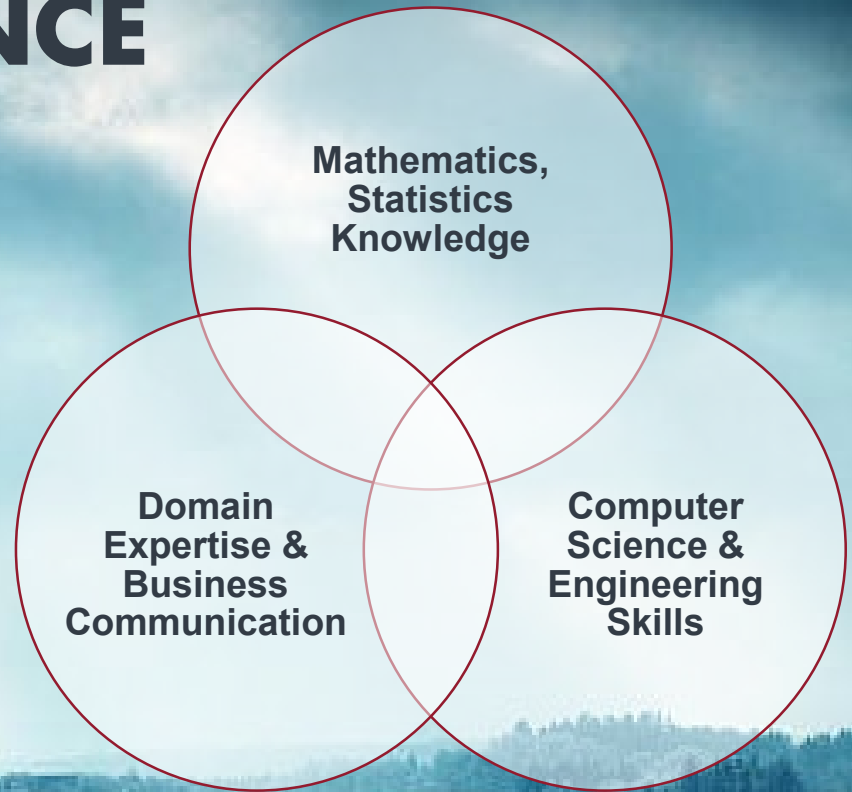


Program established in 2016

*Interim



THE DATA SCIENCE UNICORN





CAREERS

COMPREHENSIVE CAREER SERVICES

- Resume and Cover Letter Development
- LinkedIn Profile Development
- Networking Strategies
- Ongoing Industry Speaker Series
- 1-Week Immersion on the West Coast Data Science Trek
- Analytics Career Fair & Networking Events
- Career Research Resources
- Behavioral and Technical Mock Interviewing



MIT Analytics Speaker Series



General Electric



IBM Watson



McKinsey & Company



U.S. AIR FORCE



West Coast Data Science Trek

March 16-17, 2020



Amazon, Blue Origin, Boeing, Gates Foundation
Microsoft, Nordstrom, Starbucks, Zillow

March 18-20, 2020



Uber, Gap, Google, Facebook, Tesla, LinkedIn,
StubHub, Netflix, Walmart, Yelp

MIT ANALYTICS CAREER NIGHT

- Each year, the MBAn students organize a networking evening dedicated to exposing the MIT community to graduate opportunities in data science and business analytics
- Held each year during one night of the first week of Feb
- Companies from all sizes and industries come to the MIT Media lab to showcase their analytics excellence and recruit future talent

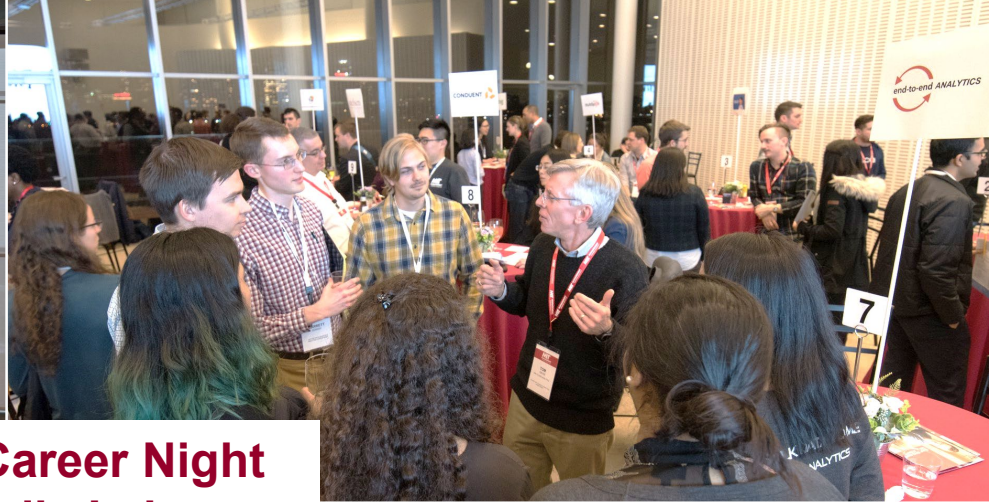
60+ Company Sponsors

600+ Graduate students from across the MIT from all different departments

800+ Attendees

Website: www.AnalyticsFair.mit.edu





**Analytics Career Night
MIT Media Lab
Feb 4, 2020**



WHERE OUR GRADUATES WORK



U.S. AIR FORCE



Interpretable AI

QUANTUMBLACK
A MCKINSEY COMPANY

McKinsey & Company



STITCH FIX



Sample Job Titles

- Data Scientist (*most common*)
- Research Scientist
- Analytics Associate
- Business Intelligence Engineer
- Machine Learning Scientist
- Data Science Consultant
- Operations Analyst
- Research Engineer
- Product Analyst
- Portfolio Manager

For more examples, visit:

www.AnalyticsFair.mit.edu/jobs



STRONG CAREER OUTCOMES

\$87,000–\$190,000

Range in Base Salary

\$110,000+

Average Base Salary

100%

Received an Offer Before Graduation

Refer to the [2018 MBAn Employment Report](#) for more details



OUR PORTFOLIO OF PROGRAMS

AREAS OF EXCELLENCE



MANAGEMENT

FINANCE

ANALYTICS

Entrepreneurship, Innovation & Technology

Average Age

GRADUATE

UNDERGRADUATE

	EMBA & SFMBA		
	MBA / LGO		
		MASTER OF FINANCE	MASTER OF BUSINESS ANALYTICS
	MAJOR & MINOR	MAJOR & MINOR	MAJOR & MINOR

40

⋮

27

⋮

23

⋮

20

Sloan Certificates: Open to all MIT students

★ Healthcare
★ Sustainability
★ Analytics

Contact:

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THANK YOU