Carnegie Mellon
GRADUATE STUDY IN DATA SCIENCE
INTERDISCIPLINARY APPROACH TO DATA SCIENCE

OVERVIEW

The extraordinary spread of computers and online data is changing forever the way decisions are made in many fields, from medicine to marketing to scientific research. Dramatic growth in the scale and complexity of data that can be collected and analyzed is affecting all aspects of work and society including health care, business practices, public safety, scientific discoveries and public policy.

Understanding effective and ethical ways of using vast amounts of data is a significant challenge to science and to society as a whole, and developing scalable techniques for data analysis and decision making requires interdisciplinary research in many areas, including machine learning, algorithms, statistics, operations research, databases, complexity analysis, visualization, and privacy and security.

Carnegie Mellon University's programs in Data Science are designed to train students to become tomorrow's leaders in this rapidly growing area. Through a unique combination of interdisciplinary coursework and cutting-edge research, the programs will enable them to apply techniques and tools of data science to applications drawing on appropriate and relevant concepts and models from the engineering, natural or social sciences. Graduates will be uniquely positioned to pioneer new developments in this field, and to be leaders in industry, the public sector, and academia.

Carnegie Mellon’s educational and research activities in data science span a wide number of disciplines and departments. One reflection of this breadth is the number of different master’s-level data science programs, which vary as to the incoming students’ background, the focus of study, the intended outcomes, and detailed logistics. This document provides a brief summary of the different programs, along with links to their individual home pages, and is intended to help prospective students understand CMU’s varied offerings in data science.
ADMISSIONS

Admission to graduate programs is handled by the individual academic departments, and requirements and deadlines vary from department to department. For detailed information on the individual programs, refer to the contact information provided in the margin of each page.

FUNDING

Policies on financial assistance and funding of students in Master's programs are made at the department level. For information about funding, please feel free to contact the departments in whose programs you are interested.

DATA SCIENCE MASTERS PROGRAMS

Information System Management

Information System Management with Business Intelligence and Data Analytics Concentration

Public Policy and Management, Policy Analytics Track

Educational Technology and Applied Learning Science

Computational Data Science

Intelligent Information Systems

Language Technologies

Machine Learning

Statistical Practice

Business Analytics Track
MASTER’S of INFORMATION SYSTEM MANAGEMENT (MISM) with BUSINESS INTELLIGENCE and DATA ANALYTICS (BIDA) CONCENTRATION

Summary Information

- Incoming students typically hold a technical degree (engineering, computer science) and have 1-3 years work experience.
- Completing the program requires 3 semesters.
- Graduates typically work in financial service firms, consulting companies, technology companies and start-up organizations.

More Information

MISM Program see: 

BIDA Track see: 

DESCRIPTION

The Master of Information Systems Management (MISM) degree prepares the next generation of technology managers to lead enterprises in innovative ways. Unlike other programs, the MISM program was developed from the ground up as a blended business-technology program, which teaches the planning, management, technical and communication skills necessary to lead organizations in today’s complex, digital world. MISM graduates have a ten-year track record of receiving highly competitive employment offers from financial service firms, consulting companies, technology companies and start-up organizations.

CURRICULUM

Within the MISM program, graduates of the Business Intelligence and Data Analytics (BIDA) concentration will be trained in business process analysis and optimization, and will be skilled in data warehousing and management and predictive modeling, GIS mapping, analytical reporting, segmentation analysis, and data visualization. Experiential learning is an important component of the program and students in the MISM-BIDA program acquire the skills to integrate cutting-edge information and analytic technology practices with applied business methods. They also have the opportunity to take a cohesive blend of data analytics, management, and IT courses. All students complete a semester long capstone project which enables them to work on real life problems with real clients in key sectors of the economy. Students are required to perform a summer internship, and will complete the program in sixteen months, graduating in December.
H. John Heinz III College
SCHOOL OF INFORMATION SYSTEMS AND MANAGEMENT &
SCHOOL OF PUBLIC POLICY AND MANAGEMENT

MASTER OF SCIENCE in PUBLIC POLICY
and MANAGEMENT, POLICY ANALYTICS
TRACK

Summary Information

- Incoming students tend to have an undergraduate degree in business, science, technology, engineering, or mathematics; have high quantitative and analytical test scores; have relevant internship and/or full-time work experience; and have strong “soft skills” in communications and teamwork.

- Completing the program requires 2 years.

- Graduates work in federal government agencies, state and city governments; large consulting firms; and think tanks.

More Information


- Contact David Eber, Director of Admissions and Financial Aid: deber@andrew.cmu.edu (412) 268-3347

DESCRIPTION

There is enormous demand for master’s graduates with data analytics skills who are passionate about solving societal problems in the public, private and non-profit sectors. Carnegie Mellon’s Heinz College offers a unique Policy Analytics track in its two-year Master of Science in Public Policy and Management (MSPPM) degree program to help meet this demand. The MSPPM program ranks in the top 10 overall, and is first in information technology (out of 250 public policy master’s programs in the country).

One factor that distinguishes policy analytics from data analytics in the private sector is the complexity of decision-making in public organizations. Unlike private companies, public sector decision-making involves a democratic, deliberative, political system with multiple stakeholders and no single-dimension bottom line. Thus, our policy analytics curriculum includes rich decision frameworks, policy models, and methods—in addition to a full set of data science courses—preparing future leaders in the public sector to meet these challenges.

CURRICULUM

Students in the two-year Policy Analytics Track take core courses comprising half of the curriculum in statistics, economics, operations research and management science, database management, R programming, policy and politics, organizational design, financial analysis, and a capstone project course. For the other half of the curriculum students take courses in machine learning/data mining, statistical modeling, information systems, and decision modeling. Students also do a summer internship. All students complete a semester long systems project where they get the opportunity to work on real problems and societal scale data with clients in the public and societal sectors.
PROFESSIONAL MASTER’S in EDUCATIONAL TECHNOLOGY and APPLIED LEARNING SCIENCE

Summary Information

- Incoming students generally hold undergraduate degrees in backgrounds in psychology, education, computer science, design, information technology, or business.

- Completing the program requires 3 semesters over one 12 month period.

- Graduates are prepared to take key positions in corporations, universities and schools as designers, developers, and evaluators of educational technologies as well as learning engineers, curriculum developers, learning technology policy-makers, and even chief learning officers.

More Information

- [http://metals.cs.cmu.edu](http://metals.cs.cmu.edu)

DESCRIPTION

This one-year interdisciplinary professional masters, jointly taught by the Human Computer Interaction Institute and the Psychology Department, trains students to design, develop and evaluate evidenced-based programs for guiding human learning in settings that range from schools to homes, workplaces to museums, and online to offline learning environments. Graduates will challenge the future of learning by re-examining the goals of education and assessment.

CURRICULUM

During their first and second semesters, students acquire core knowledge and skills in learning principles, technology design, and implementation, as well as choosing from a range of electives. During their second and third semesters the students participate in a substantial industry capstone project with an external client.

Students take seven core courses and five electives. Core courses include E-Learning Principles, Methods, Interaction Design Fundamentals, and Programming Usable Interfaces. The choice of electives is large, and we encourage students to take electives from various departments within the university. This freedom allows students to tailor the program to their particular area of interest.
MASTER’S in
COMPUTATIONAL DATA SCIENCE

Summary Information

• Incoming students generally hold undergraduate degrees in computer science, or else have degrees in a closely related field and substantial background in computer science.

• Completing the program typically requires 3 semesters.

• Graduates most often work in software engineering positions at technical corporations.

More Information

• http://mcds.cs.cmu.edu/

DESCRIPTION

The MCDS program focuses on the technologies used to construct very large information systems, such as databases, cloud computing, information retrieval and web search, machine learning, and software engineering. The program consists of a mixture of projects, research, internships, and courses, primarily from the Computer Science Department, Machine Learning Department, and Language Technologies Institute. The Analytics track of the MCDS program focuses on machine learning, software engineering, and information retrieval. The Systems track focuses on operating systems, databases, cloud computing, and distributed storage systems.

CURRICULUM

Students must take five core courses as well as three electives. MCDS students also spend a full semester on a capstone project (42 units, equivalent to 3.5 normal 12-unit courses) and attend the Data Science Seminar.

The core courses for the analytics track are Intelligent Information Systems; the Intelligent Information Systems Project; Machine Learning; Machine Learning from Large Datasets; Search Engines; and Scalable Analytics. The core courses for the systems track include Operating Systems Implementation, Database Applications, Parallel Computer Architecture and Programming, Distributed Systems, Big Data Systems Studio, Advanced Storage Systems, Cloud Computing and Advanced Cloud Computing, Advanced Topics in Database Systems, and Multimedia Databases.
MASTER’S in INTELLIGENT INFORMATION SYSTEMS

Summary Information

- Incoming students generally hold undergraduate degrees in computer science, or else have degrees in a closely related field and substantial background in computer science.

- Typically requires 16 months, including fall semester, spring semester, and one summer.

- Graduates of this newly-created program are likely to work in software engineering positions at technical corporations.

More Information

http://miis.lti.cs.cmu.edu/about/miis/degree.shtml

DESCRIPTION

The Master of Science in Intelligent Information Systems (MIIS) degree provides advanced study and practical experience in areas of Computer Science focused on the processing and analysis of unstructured and semi-structured information, for example, text, image, video, speech, and audio information. It is a practice-oriented professional degree designed for students who want to rapidly master advanced content-analysis, mining, and intelligent information technologies prior to beginning or resuming leadership careers in industry and government.

Just over half of the curriculum consists of graduate courses. The remainder provides direct, hands-on, project-oriented experience working closely with CMU faculty to build systems and solve problems using state-of-the-art algorithms, techniques, tools, and datasets.

CURRICULUM

The Intelligent Information Systems (IIS) degree offers students the flexibility to create their own course of study in consultation with their advisor. Students must take at least 84 units (typically 7 courses) of qualifying and elective courses that satisfy human language, machine learning, and language technology applications breadth requirements.

Students gain practical experience by doing software development projects with their advisors and classmates. Students must do 24 units (2 course-equivalents) of directed study projects with their advisor, and a 42-unit capstone group project.
**Summary Information**

- Incoming students generally hold undergraduate degrees in computer science, or else have degrees in a closely related field and substantial background in computer science.

- Completing the program requires 2 years.

- Graduates most often work in software engineering positions at technical corporations such as Google, Microsoft, and Twitter. Many students also go on to continue on to Ph.D. programs at CMU and other top schools.

**More Information**

[http://www.lti.cs.cmu.edu/education/msprogram.shtml](http://www.lti.cs.cmu.edu/education/msprogram.shtml)

**DESCRIPTION**

The Language Technologies Institute is a leader in the areas of speech processing, language processing, information retrieval, machine translation, machine learning, and computational biology. The Master’s in Language Technology (MLT) program focuses on these areas, and consists of courses, directed research and project work.

The MLT program is a research-oriented degree. Most MLT students are affiliated with an advisor’s research project, in which they gain hands-on experience with advanced research and state-of-the-art software. Many MLT students are also funded through the department by research grants. Many continue on to Ph.D. programs at CMU or other top universities. The MLT program is also appropriate for students who want to gain experience for industrial jobs in speech processing, information retrieval, language processing, machine translation, and computational biology.

When MLT graduates are admitted to the LTI PhD program, most of their MLT courses and hands-on work are credited towards the Ph.D.

**CURRICULUM**

Students must take (register for and pass) ten courses at a senior or graduate level. Of these, six courses must be LTI courses and two other courses must be SCS courses. Students may optionally submit a Master’s thesis. The LTI courses must include Software Engineering for Information Systems and Algorithms for Natural Language Processing; a lab course or a project-oriented Master’s thesis; and one “Task Orientation Focus” course, which covers a research area central to LTI.
MASTER'S in MACHINE LEARNING

Summary Information

- Incoming students typically hold undergraduate degrees in computer science or statistics, or a closely related field.
- Completing the program requires 3 semesters.
- Graduates of this newly-instituted program are likely to work in research or software engineering positions at technical corporations, or else go on to further their education in graduate school.

More Information

http://www.ml.cmu.edu/prospective-students/ms-in-machine-learning.html

DESCRIPTION

The Masters in Machine Learning is part of CMU's Machine Learning Department. Machine learning is dedicated to furthering the scientific understanding of automated learning, and to producing the next generation of algorithms, theory and methods for data analysis and decision making.

The MS program in Machine Learning offers students with a Bachelor's degree the opportunity to improve their training with advanced study in Machine Learning. Incoming students should have good analytic skills and a strong aptitude for mathematics, statistics, and programming. An undergraduate degree in computer science is not required. The program consists primarily of coursework, with a limited research component.

CURRICULUM

The Masters in Machine Learning requires five core machine learning courses, and three electives. Specifically, all students take Machine Learning (10-701), Statistical Machine Learning (10-702), and Intermediate Statistics (10-705), and also take two of the following five courses: Multimedia Databases (15-826), Algorithms (15-750) or Algorithms in the Real World (15-853), Optimization (10-725), or Graphical Models (10-708).

Students are also required to complete a Data Analysis Project (which may be part of an 12 unit Directed Research course). The Data Analysis Project will be concluded by a written report (in lieu of a Masters Thesis) and a presentation in the Machine Learning Journal Club.
MASTER’S in STATISTICAL PRACTICE

Summary Information

- Incoming students must have coursework in calculus-based mathematical statistics, regression analysis (or econometrics), and matrix algebra. Programming experience is also highly recommended.

- Completing the program requires 2 semesters, including a capstone consulting experience.

- Graduates have found jobs in business and scientific consulting, banking and finance, market research and in the actuarial sciences. Some also go on to do additional graduate study in statistics or other quantitative fields.

More Information

http://www.stat.cmu.edu/academics/graduate/the-masters-in-statistical-practice-program

DESCRIPTION

The Master’s in Statistical Practice (MSP) is an intensive, two-semester professional master’s degree program that emphasizes statistical practice, methods, data analysis and practical workplace skills. Students become proficient in R, SAS and SQL and develop consulting skills through interacting with clients, learning how to bring statistical thinking to the framing of real consulting problems. The MSP is for students who are interested in professional careers in business, industry, government, consulting or scientific research.

CURRICULUM

Approximately two-thirds of the courses emphasize data analysis and methods, including applied linear and multi-level models; supervised data analysis; model diagnostics and sensitivity analyses; applied multivariate analysis; data mining; experimental design and time series, and data visualization. In each semester students are enrolled in the Perspectives in Data Science (I & II) core course which includes topics such as statistical computing, oral and written communication, client and group management skills, and resume, job search, and interview preparation. In the Spring semester, students working in teams of two or three, participate in a capstone client initiated consulting project. Successful completion of the degree will be grade based; there is no master’s thesis requirement or qualifying exams.
MASTER of BUSINESS ADMINISTRATION
BUSINESS ANALYTICS

Summary Information

- Incoming students have diverse backgrounds from all disciplines including business, humanities, science, technology, and engineering. Admission to the program is highly competitive and based upon standardized test scores, academic record, and work experience.

- Completing the program requires 2 years.

- Graduates typically work for major consulting; information technology firms; or in the analytical marketing and financial data analysis sector.

More Information


Contact MBA Admissions at mba-admissions@andrew.cmu.edu
(412) 268-2273

DESCRIPTION

The technological advances of the last decades have impacted the business world in fundamental ways. Massive amounts of data are being gathered and stored, from individual medical records, to every single truck movement via GPS for large logistics providers. Moreover, ever faster computers and optimization methods have become available to transform this data into information for better decision-making. All of this makes it now possible to apply advanced analytical methods to business problems that were impossible 10 or 15 years ago – ranging from detailed supply chain optimization to healthcare applications and the service industry.

The over-arching methodology that refers to the skills and technologies to explore past business performance to make better decisions is called business analytics. BA uses data, statistical and quantitative analysis, and predictive modeling. The Business Analytics Track of Tepper’s MBA Program is appropriate for those interested in transforming large amounts of data into better decisions, and especially for those with a strong interest in analytical approaches to management, as shown by aptitude in courses such as Optimization, Probability and Statistics, and Statistical Decision Making.

CURRICULUM

Students take four core courses for the analytics track: Application of Operations Research, Data Mining, Strategic IT, and the Business Analytics Project, and five electives. In addition, they complete other the requirements for the MBA program, including courses in probability and statistics, managerial economics, accounting, optimization, marketing, finance, and decision-making, and workshops to develop leadership and communication skills.