Graduate Data Science Course Descriptions

DS-510. Introduction to Data Science. 3 Credits.

Data Science is a set of fundamental principles that guide the extraction of valuable information and knowledge from data. This course provides an overview and develops student's understanding of the data science and analytics landscape in the context of business examples and other emerging fields. It also provides students with an understanding of the most common methods used in data science. Topics covered include introduction to predictive modeling, data visualization, probability distributions, Bayes' theorem, statistical inference, clustering analysis, decision analytic thinking, data and business strategy, cloud storage and big data analytics.

DS-520. Data Analysis and Decision Modeling. 3 Credits.
This course will provide students with an understanding of common statistical techniques and methods used to analyze data in business. Topics covered include probability, sampling, estimation, hypothesis testing, linear regression, multivariate regression, logistic regression, analysis of variance, categorical data analysis, Bootstrap, permutation tests and nonparametric statistics. Students will learn to apply statistical techniques to the processing and interpretation of data from various industries and disciplines.

DS-530. Big Data and Data Management. 3 Credits.
This course explores foundational concepts of relational databases, data warehousing, distributed data management, structured and unstructured data, NoSQL data stores and graph databases. Various database concepts are discussed including Extract-Transform-Load, cloud-based online analytical processing (OLAP), data warehouse architecture, development and planning, physical database design, data pipelines, metadata, data provenance, trust and reuse. Students will develop practical experience using SQL.

DS-533. Enterprise Design Thinking. 3 Credits.
Students will learn a robust framework for applying design thinking techniques to key issues facing organizations across industries. Key skills developed include shared goal setting and decision-making, processes for continuous innovation, and the alignment of multi-disciplinary teams around the real needs and experiences of users and customers. Through instruction, experiential learning and an industry-recognized methodology, students will gain practice in the successful application of design thinking techniques to address common business problems.

DS-540. Statistical Programming. 3 Credits.
The course gives an introduction to SAS or R programming for statistical analyses and managing, analyzing and visualizing data. Topics include numeric and non-numeric values, arithmetic and assignment operations, arrays and data frames, special values, classes and coercion. Students will learn to write functions, read/write files, use exceptions, measure execution times, perform sampling and confidence analyses, plot a linear regression. Students will explore tools for statistical simulation, large data analysis and data visualization, including interactive 3D plots.

DS-542. Python in Data Science. 3 Credits.
The course gives an introduction to Python programming for statistical analyses and managing, analyzing and visualizing data. Topics include numeric and non-numeric values, arithmetic and assignment operations, arrays and data frames, special values, classes and coercion. Students will learn to write functions, read/write files, use exceptions, measure execution times, perform sampling and confidence analyses, plot a linear regression. Students will explore tools for statistical simulation, large data analysis and data visualization, including interactive 3D plots. Prerequisites: DS-510, DS-520.

DS-590. Data Structures and Algorithms I. 3 Credits.
This course explores essential topics for programmers and data scientists including the design of and implementation and analysis of efficient algorithms and their performance. Essential data structures are also reviewed, as well as searching and sorting algorithms.

DS-595. Applied Work Experience Cpt-Traditional. 1.00 Credit.

The Applied Work Experience/Curricular Practical Training course is an academic component that accompanies students' industry work experience and Curricular Practical Training. Students whose current work role has been approved by the Program Director as directly related to their program of study should register for this non-credit course each term during which they are working. Traditional Program students are eligible after their third trimester.

DS-596. Graduate Research Assistantship. 0 Credits.
Graduate Research Assistantship is a robust learning experience for pre-selected students, involving scholarly research under faculty supervision. These research projects involve the development of theoretical analyses and models, gathering and analysis of data, and special projects that require substantive research. The ultimate goals for this research is academic conference presentation, publication in peer-reviewed journals and research reports, and more broadly contributing to thought leadership of the Data Science Institute.

DS-597. Applied Research Experience. 0 Credits.
The Applied Research Experience is a learning experience that gives Data Science Institute students the opportunity to conduct real-world consulting and research projects with businesses and organizations, that build upon the science, theory, and application of data and analysis. This non-credit course fulfills the business experience requirement for the program for those students who do not have a current work role that fulfills the requirement.

DS-598. Applied Work Experience and Curricular Practical Training. 0 Credits.
The Applied Work Experience/Curricular Practical Training course is an academic component that accompanies students' industry work experience and Curricular Practical Training. Students whose current work role has been approved by the Program Director as directly related to their program of study should register for this non-credit course each term during which they are working.

DS-599. Research Practicum. 0 Credits.

The Research Practicum is a learning experience that gives the students the opportunity to conduct real-world consulting projects with businesses that build upon the science, research and application of data and analysis, extending to strategic planning and identifying relevent tactics to carry out strategies.

DS-600. Data Mining. 3 Credits.
Data mining refers to a set of techniques that have been designed to efficiently find important information or knowledge in large amounts of data. This course will provide students with understanding of the industry standard data mining methodologies, and with the ability of extracting information from a data set and transforming it into an understandable structure for further use. Topics covered include decision trees, classification, predictive modeling, association analysis, statistical modeling, Bayesian classification, anomaly detection and visualization. The course will be complemented with hands-on experience of using advanced data mining software to solve realistic problems based on real-world data. Prerequisites: DS-510, DS-520.

DS-605. Financial Computing and Analytics. 3 Credits.
This course covers the process of collecting data from a variety of sources and preparing it to allow organizations to make data-driven decisions. It builds upon the relationships within data collected electronically and applies quantitative techniques to create predictive spreadsheet models for financial decision making. Prerequisites: DS-510, DS-520.

DS-610. Big Data Analytics. 3 Credits.
Big Data (Structured, semi-structured, & unstructured) refers to large datasets that are challenging to store, search, share, visualize, and analyze. Gathering and analyzing these large data sets are quickly becoming a key basis of competition. This course explores several key technologies used in acquiring, organizing, storing, and analyzing big data. Topics covered include Hadoop, unstructured data concepts (key-value), Map Reduce technology, related tools that provide SQL-like access to unstructured data: Pig and Hive, NoSQL storage solutions like HBase, Cassandra, and Oracle NoSQL and analytics for big data. A part of the course is devoted to public Cloud as a resource for big data analytics. The objective of the course is for students to gain the ability to employ the latest tools, technologies and techniques required to analyze, debug, iterate and optimize the analysis to infer actionable insights from Big Data. Prerequisites: DS-510, DS-520, DS-530.

DS-620. Data Visualization. 3 Credits.
Visualization concerns the graphical depiction of data and information in order to communicate its contents and reveal patterns inherent in the data. It is sometimes referred to as visual data mining, or visual analytics. Data visualization has become a rapidly evolving science. This course explores the underlying theory and practical concepts in creating visual representations of large amounts of data. Topics covered include data representation, information visualization, real-time visualization, visualization toolkits including Tableau and their applications to diverse data rich contexts. At the end of the course, the student will be able to present meaningful information in the most compelling and consumable fashion. Prerequisites: DS-510, DS-520.

DS-621. Data Analytics With Qliksense. 3 Credits.
This course will focus on building dynamic dashboard and applications in order to understand and interpret the data. Course will also focus on visualization and business intelligence techniques to interpret the data as step towards Machine Learning. Prerequisites: DS-510 DS-520.

DS-630. Machine Learning. 3 Credits.
Machine learning is the field of study that gives computers the ability to learn from experience without being explicitly programmed. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. Topics include decision tree learning, parametric and non-parametric learning, Support Vector Machines, statistical learning methods, unsupervised learning, reinforcement learning and the Bootstrap method. Students will have an opportunity to experiment with machine learning techniques and apply them to solve a selected problem in the context of a term project. The course will also draw from numerous case studies and applications, so that students learn how to apply learning algorithms to build machine intelligence. Prerequisites: DS-510, DS-520, DS-530, DS-542.

DS-631. Deep Learning Algorithms. 3 Credits.
Machine learning is the science (and art) of programming computers so they learn from data. It is the field of study that gives computers the ability to learn from experience without being explicitly programmed. This course covers the theory and practical algorithms for neural networks and deep learning. Major topics neural networks, convolutional neural networks, recurrent neural networks, reinforcement learning, and implementation of deep learning in TensorFlow. Students will have an opportunity to experiment with advanced machine learning techniques (especially using Python) and apply them to solve selected problems in the context of a term project. Prerequisites: DS-630.

DS-640. Predictive Analytics and Financial Modeling. 3 Credits.
Predictive analytics is an area of data mining that deals with extracting information from data and using it to predict trends and behavior patterns. This course will provide predictive analytics foundational theory and methodologies as well as teach students how to build predictive models for practical financial and business applications and verify model effectiveness. Topics covered are linear modeling and regression, nonlinear modeling, time series analysis and forecasting, segmentation and tree models, support vector machine, clustering, neural networks and association rules. Prerequisites: DS-510, DS-520.

DS-642. Advanced Python in Data Science. 3 Credits.
This course explores essential advanced Python topics for programmers & data scientists including working with databases using Python, writing web services, exploring unit-testing frameworks, understanding multithreading concepts in Python, performing advanced statistical analysis using Python libraries and learning industry standards for writing and organizing large Python programs. Prerequisites: DS-510, DS-520, DS-542.

DS-650. Data Law Ethics and Business Intelligence. 3 Credits.
The increasing use of big data in our society raises legal and ethical questions. Business intelligence is the process of collecting and transforming raw data into meaningful and useful information for business purposes. This course explores the issues of privacy, data protection, non-discrimination, equality of opportunities and due process in the context of data-rich environments. It analyzes ethical and intellectual property issues related to data analytics and the use of business intelligence. Students will also learn the legal obligations in collecting, sharing and using data, as well as the impact of algorithmic profiling, industrial personalization and government. This course also provides an understanding of the important capabilities of business intelligence, the technologies that enable them and the management of business intelligence. Prerequisites: DS-510, DS-520.

DS-660. Business Analytics. 3 Credits.
Business analytics is the process of generating and delivering the information acquired that enables and supports an improved and timely decision process. The aim of this course is to provide the student with an understanding of a broad range of decision analysis techniques and tools and facilitate the application of these methodologies to analyze real-world business problems and arrive at a rational solution. Topics covered include foundations of business analytics, descriptive analytics, predictive analytics, prescriptive analytics, and the use of computer software for statistical applications. The course work will provide case studies in Business Analytics and present real applications of business analytics. Students will work in groups to develop analytic solutions to these problems. Prerequisites: DS-510, DS-520.

DS-665. Advanced Machine Learning. 3 Credits.
Machine learning is the science (and art) of programming computers so they learn from data. It is the field of study that gives computers the ability to learn from experience without being explicitly programmed. This course covers the theory and practical algorithms for neural networks and deep learning. Major topics neural networks, convolutional neural networks, recurrent neural networks, reinforcement learning, and implementation of deep learning in TensorFlow. Students will have an opportunity to experiment with advanced machine learning techniques (especially using Python) and apply them to solve selected problems in the context of a term project. Prerequisites: DS-510, DS-520 AND DS-630.

DS-670. Capstone: Big Data and Business Analytics. 3 Credits.
This course is structured as a capstone research practicum where students have an opportunity to apply the knowledge acquired in data science to interdisciplinary problems from a variety of industry sectors. Students work in teams to define and carry out an analytics project from data collection, processing and modeling to designing the best method for solving the problem. The problems and datasets used in this practicum will be selected from real world industry or government settings. At the end of the class students will write a report that presents their project, the approach and techniques used to design a solution, followed by results and conclusion. Students are encouraged to present their capstone research at conferences. Prerequisites: DS-620, DS-630; Course Type(s): Capstone.

DS-680. Marketing Analytics and Operation Research. 3 Credits.
Organizations need to interpret data about consumer choices, their browsing and buying patterns and to match supply with demand in various business settings. This course examines the best practices for using data to prescribe more effective business strategies. Topics covered include marketing resource allocation, metrics for measuring brand assets, customer lifetime value, and using data analytics to evaluate and optimize marketing campaigns. Students learn how data is used to describe, explain, and predict customer behavior, and meet customer needs. Students also learn to model future demand uncertainties, predict the outcomes of competing policy choices and take optimal operation decisions in high and low risk scenarios. Prerequisites: DS-510, DS-520.

DS-690. Data Science and Health. 3 Credits.
Students will be introduced to the types of data commonly used in public health, biomedical and clinical settings. Students will acquire the knowledge and skills to use these data for understanding and improving the quality of health outcomes. Through lectures and class data analysis projects, students will explore, analyze and create graphical visualization of data from a variety of healthcare sources. Students will also be exposed to selective topics on real time analytics, clinical informatics, and machine learning for biomedical applications. Prerequisites: DS-510, DS-520.

DS-700. Independent Study in Data Science. 3 Credits.
In this course, students will work with a faculty member to explore a topic in depth or conduct independent research. Requirements for completion include submission of a research report. Course Type(s): Independent Study.