Ryerson University Graduate Studies

Curriculum

Data Science and Analytics

Degree Requirements: Master of Science

	Major Research Paper (MRP)	(Milestone)
DS8012	Research Skills	Pass/Fail
DS8005	Soft Skills, Communication and Ethics	Pass/Fail
DS8001	Design of Algorithms and Programming for Massive Data	1
DS8002	Machine Learning	1
DS8003	Management of Big Data and Big Data Tools	1
DS8004	Data Mining and Prescriptive Analytics	1
	Two Elective credits	2

Electives

Course code	Course title	Credits
BP8113	Advanced Imaging	1
CP8202	Advanced Software Engineering	1
CP8203	Advanced Database Systems	1
CP8206	Soft Computing and Machine Intel	1
CP8304	Distributed Systems	1
CP8305	Knowledge Discovery	1
CP8311	Genetic Programming	1
CP8314	Advanced Artificial Intelligence	1
DS8006	Social Media Analytics	1
DS8007	Advanced Data Visualization	1
DS8008	NLP (Text Mining)	1
DS8009	Special Topics in Data Science and Analytics	1
DS8010	Interactive Learning in Decision Process	1
DS8011	Bayesian Statistics and Machine Learning	1

DS8013	Deep Learning	1
DS8014	Graph Mining	1
DS8015	Machine Learning non Data Science Student	1
EF8903	Applied Econometrics	1
EF8913	Empirical Topics in International Finance	1
EF8914	Financial Econometrics	1
EF8933	Empirical Topics Int'l Trade	1
EF8937	Labour Economics	1
EF8944	Panel Data and NL Model Analysis	1
EF8945	Nonparametric Data Analysis	1
ME8118	Info Sys Analysis & Design	1
ME8127	Optimization Models	1
ME8140	Simulation Theory/Methodology	1
MT8310	Special Topics Info Sys Mgmt	1
SA8901	Geospatial Data Analytics	1
SA8911	Geodemographics	1

Course listing

Major Research Project
The student is required to conduct an applied advanced research project. The project will be carried out under the guidance of a supervisor. On completion of the project, the results are submitted in a technical report format to an examining committee and the student will make an oral presentation of the report to the committee for assessment and grading of the report. The student is expected to provide evidence of competence in the carrying out of a technical project and present a sound understanding of the material associated with the research project. This is a "Milestone." Pass/Fail

DS8001- Design of Algorithms and Programming for Massive Data
NP-completeness, approximation algorithms and parallel algorithms. Study of algorithmic techniques and To introduce students to the theory and design of algorithms to acquire and process large dimensional data. Advanced data structures, graph algorithms, and algebraic algorithms. Complexity analysis, complexity classes, and modeling frameworks that facilitate the analysis of massively large amounts of data. Introduction to information retrieval, streaming algorithms and analysis of web searches and crawls. 1 Credit

DS8002 – Machine Learning

Overview of artificial learning systems. Supervised and unsupervised learning. Statistical models. Decision trees. Clustering. Feature extraction. Artificial neural networks. Reinforcement learning. Applications to pattern recognition and data mining. 1 Credit

DS8003 – Management of Big Data and Big Data Tools
The course will discuss data management techniques for storing and analyzing very large amounts of data. The emphasis will be on columnar databases and on Map Reduce as a tool for creating parallel algorithms that can process very large amounts of data. Big Data applications, Columnar stores, distributed databases, Hadoop, Locality Sensitive Hashing (LSH), Dimensionality reduction, Data streams, unstructured data processing, NoSQL, and NewSQL 1 Credit

DS8004 Data Mining and Prescriptive Analytics
The course teaches to use data to recommend optimum course of action to achieve the optimum outcome and to formulate new products and services in a data driven manner. The course will cover all these issues and will illustrate the whole process by examples. Special emphasis will be given to data mining and computational techniques as well as optimization and stochastic optimization techniques. Prerequisite: DS8002 1 Credit

DS8005 Soft Skills, Communication and Ethics
The course will focus on communicating and presenting data analytics and modeling results. It aims at building the competency in story telling from numbers. The course also covers ethical and social impacts of data science, analytics and AI. Prerequisite: DS8012 Pass/Fail

DS8006 Social Media Analytics
The course will cover fundamental concepts and tools in Social Network Analysis by showing how AI, math, and statistical methods are used to study them. The topics include: weblog analysis, centrality in social networks, influence, sentiment analysis and opinion mining, information cascades, multimedia analysis, reasoning and prediction with social media and modeling behaviour. The lab component of the class will use R or Python to develop and analyze network models. Prerequisite: DS8002 1 Credit

DS8007 Advanced Data Visualization
Overview of data visualization. Basic visualization design and evaluation principles. Learn to acquire, parse, and analyze large datasets. Techniques for visualizing multivariate, temporal, text-based, geospatial, hierarchical, and network/ graph data using tools such as ggplot2, R, D3, etc. 1 credit

DS8008 NLP (Text Mining)
The course covers important topics in text mining including: basic natural language processing techniques, document representation, text categorization and clustering, document summarization, sentiment analysis, social network and social media analysis, probabilistic topic models and text visualization. Prerequisites: DS8002 and DS8003 1 credit.

DS8009 Special Topics in Data Science and Analytics
This course consists of lectures, seminars and readings covering the latest advances and research in data science and analytics. The course description will be announced prior to scheduling of the course. 1 credit.

DS8010 Interactive Learning in Decision Process
This course focuses on topics related to reinforcement learning. The course will cover making multiple-stage decisions under uncertainty, heuristic search in planning, Markov decision processes, dynamic programming, temporal-difference learning including Q-learning, Monte Carlo reinforcement learning methods, function approximation methods, and the integration of learning and planning. Other topics can be included as well. Prerequisites: DS 8002 1 Credit

DS8011 Bayesian Statistics and Machine Learning

This course will cover modern machine learning techniques from a Bayesian probabilistic perspective. Bayesian probability allows us to model and reason about all types of uncertainty. The result is a powerful, consistent framework for approaching many problems that arise in machine learning, including parameter estimation, model comparison, and decision making. We will begin with a high-level introduction to Bayesian inference, then proceed to cover more-advanced topics. Prerequisites: DS 8002 1 Credit

DS8012 Research Skills
This course will be an introduction to research preparation, experimental design, methods of data collection, exploratory data analysis, and understanding threats to validity of results with aim to prepare student for MRP work. Pass/Fail

DS8013 Deep Learning
The course aims to present the mathematical, statistical and computational challenges of building stable representations for highdimensional data, such as images, text and data. The topics include: Convolutional neural networks. Autoencoders, their sparse, denoising variants, and their training. Regularization methods for preventing overfitting. Stacked autoencoders and end-to-end
networks. Recurrent and recursive networks. Multimodal approaches. Deep architectures for vision, speech, natural language processing, and reinforcement learning. Prerequisite: DS8002. 1 Credit

DS8014 Graph Mining
The course aims to present the mathematical, statistical and computational challenges of building stable representations for highdimensional data, such as images, text and data. The topics include: Convolutional neural networks. Autoencoders, their sparse, denoising variants, and their training. Regularization methods for preventing overfitting. Stacked autoencoders and end-to-end networks. Recurrent and recursive networks. Multimodal approaches. Deep architectures for vision, speech, natural language processing, and reinforcement learning. Prerequisite: DS8002

DS8015 Machine Learning non Data Science Student
This course will introduce students to the theory and design of machine learning algorithms using Python. The course will cover Python Fundamentals, Data Structures, Functions and Functional Programming, Python Libraries, Exploratory Data Analysis, Statistical Inference, Introduction to Machine Learning, Unsupervised Learning, Supervised Learning: Regression, Supervised Learning: Classification, Dimensionality Reduction. 1 credit

For course descriptions of non DS courses, go to the Program offering the course. BP – Biomedical Physics CP – Computer Science EF – Economics ME – Mechanical and Industrial Engineering MT – Master of Science in Management SA – Spatial Analysis