Georgia Tech Relevant Coursework and Descriptions

CSE 6040 Computing for Data Analytics: This course is your hands-on introduction to basic programming techniques relevant to data analysis and machine learning. Beyond programming languages and best practices, you'll learn elementary data processing algorithms, numerical linear algebra, and numerical optimization. You will build the basic components of a data analysis pipeline: collection, preprocessing, storage, analysis, and visualization. You will program in some subset of Python, R, MATLAB, and SQL, at the faculty's discretion. This course aims to fill in gaps in your programming background, in preparation for other programming-intensive courses in the OMS Analytics program. If you come to the program with a significant programming background already, you may be eligible for exemption from this course.

CSE 6242 Data and Visual Analytics: This course will introduce you to broad classes of techniques and tools for analyzing and visualizing data at scale. It emphasizes how to complement computation and visualization to perform effective analysis. We will cover methods from each side, and hybrid ones that combine the best of both worlds. Students will work in small teams to complete a project exploring novel approaches for interactive data & visual analytics.

CS 6400 Database Systems Concepts & Design: This course presents an example of applying a database application development methodology to a major real-world project. All the database concepts, techniques, and tools that are needed to develop a database application from scratch are introduced along the way when they are needed. In parallel - slightly delayed - learners in the course will apply the database application development methodology, techniques, and tools to their own major class team project. Students will also learn the Extended Entity Relationship Model, the Relational Model, Relational algebra, calculus and SQL, database normalization, efficiency, and indexing. Finally, techniques and tools for metadata management and archival will be presented.

CS 6601 Artificial Intelligence: This course is a survey of the field of Artificial Intelligence and will often be taken as the first graduate course in the area. It is designed to be challenging and involves significant independent work, readings, and assignments. The course covers most of the required textbook Artificial Intelligence A Modern Approach 3rd edition, which is a keystone of Georgia Tech's Intelligent Systems PhD qualifier exam.

CS/ISYE 6740 Machine Learning: Machine Learning is the area of Artificial Intelligence that is concerned with computational artifacts that modify and improve their performance through experience. The area is concerned with

issues both theoretical and practical. This class takes care to present algorithms and approaches in such a way that grounds them in larger systems. We will cover a variety of topics, including statistical supervised and unsupervised learning methods, randomized search algorithms, Bayesian learning methods, and reinforcement learning. The course also covers theoretical concepts such as inductive bias, the PAC and Mistake-bound learning frameworks, minimum description length principle, and Ockham's Razor. In order to ground these methods, the course includes some programming and involvement in a number of projects.

CS 7642 Reinforcement Learning: Through a combination of classic papers and more recent work, the course explores automated decision making from a computational perspective. It examines efficient algorithms, where they exist, for single-agent and multi-agent planning as well as approaches to learning near-optimal decisions from experience. Topics include Markov decision processes, stochastic and repeated games, partially observable Markov decision processes, and reinforcement learning. Of particular interest will be issues of generalization, exploration, and representation. Students will replicate a result in a published paper in the area.

CS 7643 Deep Learning: Deep learning is a sub-field of machine learning that focuses on learning complex, hierarchical feature representations from raw data. The dominant method for achieving this, artificial neural networks, has revolutionized the processing of data (e.g. images, videos, text, and audio) as well as decision-making tasks (e.g. game-playing). Its success has enabled a tremendous amount of practical commercial applications and has had significant impact on society. In this course, students will learn the fundamental principles, underlying mathematics, and implementation details of deep learning. This includes the concepts and methods used to optimize these highly parameterized models (gradient descent and backpropagation, and more generally computation graphs), the modules that make them up (linear, convolution, and pooling layers, activation functions, etc.), and common neural network architectures (convolutional neural networks, recurrent neural networks, etc.). Applications ranging from computer vision to natural language processing, and decision-making (reinforcement learning) will be demonstrated. Through in-depth programming assignments, students will learn how to implement these fundamental building blocks as well as how to put them together using a popular deep learning library, PyTorch. In the final project, students will apply what they have learned to real-world scenarios by exploring these concepts with a problem that they are passionate about.

CS 7646 Machine Learning for Trading: This course introduces students to the real-world challenges of implementing machine learning based trading strategies including the algorithmic steps from information gathering to market orders. The focus is on how to apply probabilistic machine learning approaches to trading decisions. We consider statistical approaches like linear regression, Q-Learning, KNN, and regression trees and how to apply them to actual stock trading situations.

CSE 7648 Computational Analytics Practicum: Every MSA student is required to take the Applied Analytics Practicum course (CSE/ISYE/MGT 6748) before graduating. This six-credit course gives all of our students an opportunity to do an important applied analytics/data-science project with a company or organization that really cares about the results. Most of our students use an analytics/data-science internship as their project for the course. US citizens and Permanent Residents may also use a full-time permanent analytics/data-science job for the course. Also, companies bring projects to us for our students to work on in teams each semester. One way or another, before graduating every MSA student gets experience working with a company/organization applying the analytics skills they've gained through the MSA curriculum to a real-world data science problem. The Applied Analytics Practicum course also includes lessons on issues of professional analytics practice from experts in things like ethics, leadership, change management, etc., and of course there are faculty, Tas and alumni mentors available to answer students' questions through the course of their projects.

ISYE 6501 Introduction to Analytics Modeling: Analytical models are key to understanding data, generating predictions, and making business decisions. Without models, it's nearly impossible to gain insights from data. In modeling, it's essential to understand how to choose the right data sets, algorithms, techniques, and formats to solve a particular business problem. In this course, you'll gain an intuitive understanding of fundamental models and methods of analytics and practice how to implement them using common industry tools like R. You'll learn about analytics modeling and how to choose the right approach from among the wide range of options in your toolbox. You will learn how to use statistical models and machine learning as well as models for: Classification, clustering, change detection, data smoothing, validation, prediction, optimization, experimentation, and decision making.

ISYE 6644 Simulation & Modeling for Science and Engineering: This course covers modeling of discrete-event dynamic systems and introduces simulation-based methods for using these models to solve engineering design and analysis problems. Learn how to develop simulation models and conduct simulation studies. Become familiar with the organization of simulation languages. In particular, we will do a great deal of modeling with Arena, a comprehensive simulation package with animation capabilities. Review statistical aspects including input analysis, random variate generation, output analysis, and variance reduction techniques.

ISYE 8803 Topics in High Dimensional Data Analysis: This course focuses on analysis of high-dimensional structured data including profiles, images, and other types of functional data using statistical machine learning.
A variety of topics such as functional data analysis, image processing, multilinear algebra and tensor analysis, and regularization in high-dimensional regression and its applications including low rank and sparse

learning is covered. Optimization methods commonly used
in statistical modeling and machine learning and their computational aspects are also discussed.

MGT 6203 Data Analytics in Business: Teaches the scientific process of transforming data into insights for making better business decisions. It covers the methodologies, algorithms, and challenges related to analyzing business data.