

CUNY School of Professional Studies

Syllabus

School of Professional Studies

DATA 609 - Mathematical Modeling Techniques for Data Analytics

Instructor Name: Dr. Harry Wang

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Degree Program: M.S. in Data Science

Credits: 3 graduate credits

Prerequisites: DATA 605; DATA 606

Type of Course: Elective Course

Description

Many problems in data mining and machine learning can be formulated as optimization problems. Therefore, optimization and algorithms are closely related to data mining and machine learning. In this course, students will learn mathematical and optimization algorithms for data mining and machine learning. Major data mining and machine learning algorithms will be studied from optimization perspective. These major algorithms include data fitting and regression, decision trees and random forest, logistic regression, clustering and classification, support vector machines, neural networks, and deep learning. In addition, students will be expected to explain their models, reports, and analyses in plain and easy-to-understand language.

Course Learning Outcomes:

By the end of the course, students should be able to:

- Understand major data mining and machine learning algorithms from optimization perspective
- Be able to formulate these optimization problems; understand and know solution algorithms.
- Learn how to use optimization tools.
- Program Learning Outcomes addressed by the course:
- Business Understanding. Apply frameworks and processes to build out data analytics solutions from understanding of business goals.
- Solid foundational data programming skills, using industry standard tools, essential algorithms, and design patterns for working with structured data, unstructured data and big data.
- Solid foundational math and statistics skills, with emphasis on linear algebra, probability, Bayesian statistics, and numerical methods.
- Data understanding. Collect, describe, model, explore and verify data.
- Data preparation. Selecting, cleaning, constructing, integrating, and formatting data.
- Optimization Modeling. Selecting optimization modeling techniques, generating test designs, building and assessing models.
- Model implementation and deployment.

- Presentation. Evaluating and communicating results.

How is this course relevant for IS professionals?

Math modeling and optimization technics are essential for data analytics problems. It is the foundation for some problems that we will come across in linear regression, machine learning, and data mining fields. With understanding of math modeling techniques, IS and Data Analytics professionals would be able to solve many more real problems more efficiently and effectively.

Grade Distribution

Quality of Performance	Letter Grade	Range %	GPA/ Quality Pts.
Excellent - work is of exceptional quality	A	93 - 100	4.0
	A-	90 - 92.9	3.7
Good - work is above average	B+	87 - 89.9	3.3
Satisfactory	B	83 - 86.9	3.0
Below Average	B-	80 - 82.9	2.7
Poor	C+	77 - 79.9	2.3
	C	70 - 76.9	2.0
Failure	F	< 70	0.0

Required Texts and Materials:

Introduction to Algorithms for Data Mining and Machine Learning, 1st Edition. Xin-She Yang. ISBN: 978-0-12-817216-2

Relevant Software, Hardware, or Other Tools:

Course will be using R for some of the computational homework and projects.

Please download and install R from here:

<http://cran.r-project.org/>

Use below two links as reference for your R programming

<https://www.edx.org/course/introduction-to-r-for-data-science-2>

<https://r4ds.had.co.nz/index.html>

You are encouraged to ask me questions on the “Ask Your Instructor” forum on the course discussion board where other students will be able to benefit from your inquiries

Course assignments	Percentage of Final Grade
Homework Assignments	80%
There will be 8 homework assignments used to re-enforce course concepts and provide implementation experience. Each assignment will be submitted at the end of the Module	
Participation	20%
Participation (communication and interaction with the instructor and with fellow students (through blackboard or email or in class questions))	
Total	100%

Projects & Schedule: Project due dates are listed in the class-by-class schedule below:

MD	Week of	Topics	Reading	HW	Due on
1	25-Aug	Introduction to Optimization in Data Mining and Machine Learning	Ch.1 L1 L2	#1	5-Sep
2	6-Sep	Mathematical Foundations	Ch.2 L1 L2	#2	19-Sep
3	20-Sep	Optimization Algorithms	Ch.3 L1 L2	#3	3-Oct
4	15-Mar	Data Fitting and Regression	Ch.4 L1 L2	#4	17- Oct
5	5-Apr	Logistic Regressions, PCA, LDA, and ICA	Ch.5 L1 L2 L3 L4	#5	31-Oct
6	19-Apr	Data Mining Techniques	Ch.6 L1 L2 L3 L4	#6	14-Nov
7	3-May	Support Vector Machine and Regressions	Ch.7 L1 Ch.8 L1 Section 8.1 8.2 8.3 8.4	#7	05- Dec
8	17-May	Neural Networks and Deep Learning	Ch.8 L2 L3	#8	12-Dec

Accessibility and Accommodations

The CUNY School of Professional Studies is committed to making higher education accessible to students with disabilities by removing architectural barriers and providing programs and support services necessary for them to benefit from the instruction and resources of the University. Early planning is essential for many of the resources and accommodations provided. For more information, please see:

[Disability Services on the CUNY SPS Website.](#)

Online Etiquette and Anti-Harassment Policy

The University strictly prohibits the use of University online resources or facilities, including Blackboard, for the purpose of harassment of any individual or for the posting of any material that is scandalous, libelous, offensive or otherwise against the University's policies. Please see: "[Netiquette in an Online Academic Setting: A Guide for CUNY School of Professional Studies Students.](#)"

Academic Integrity

Academic dishonesty is unacceptable and will not be tolerated. Cheating, forgery, plagiarism and collusion in dishonest acts undermine the educational mission of the City University of New York and the students' personal and intellectual growth. Please see:

[Academic Integrity on the CUNY SPS Website.](#)

Student Support Services

If you need any additional help, please visit [Student Support Services.](#)

IT Support

helpdesk@sps.cuny.edu