SYLLABUS

Introduction to Machine Learning Applications

79270 MGMT-6560-01 (3 credits) / 79115 MGMT-4966-01 (4 Credits)
Spring 2023, Tuesdays and Fridays 10 AM to 11:20 AM
Room Location: EATON 215
Websites: Piazza (https://piazza.com/rpi/spring2023/mgmt496601656001**)** and **LMS (For grades and submitting your work)**
Prerequisites or Other Requirements: Basics of object-oriented programming would be helpful.

Students may not receive credit for both the 4000 level and 6000 level versions of this course.

INSTRUCTOR

Instructor Name: Minor Gordon **Office Location:** PITTS 1126B
Tel. No.: 518-276-2812 **Email Address:** gordom6@rpi.edu
Office Hours: Tuesdays 12:30 PM – 2 PM via Webex (https://rensselaer.webex.com/rensselaer/j.php?MTID=mfcd9c495fb22b1067ec24e70bba17533)

COURSE DESCRIPTION

The widespread proliferation of IT-influenced economic activity leaves behind a rich trail of micro-level data, enabling organizations to use analytics and algorithmic modeling in both strategy and operations. This course provides a hands-on introduction to the concepts, methods, and processes for machine learning from data, the foundation of artificial intelligence. We will learn how to manipulate data, build machine learning models using data, and apply these models to business contexts.

COURSE GOALS/OBJECTIVES

The goal of this course will be to provide the technical foundation to enable students to become not just data scientists but also machine learning experts who can work with challenging datasets and confidently model them to perform prediction tasks.

STUDENT LEARNING OUTCOMES

For MGMT6560 through this course you are expected to:

(1) Demonstrate an understanding of analytics-based problem solving and analytics thinking in the context of machine learning models, deep learning, and big data.
(2) Be able to extract, match, transform, and clean data from a variety of sources.
(3) Develop machine learning predictions for business applications.
(4) Apply unbiased and robust frameworks to the creation of models.
(5) Translate research on state-of-the-art deep learning to business applications.

For MGMT4190, through this course you are expected to:

(1) Demonstrate an understanding of analytics-based problem solving and analytics thinking in the context of machine learning models, deep learning, and big data.
(2) Be able to extract, match, transform, and clean data from a variety of sources.
(3) Develop machine learning predictions for business applications.

COURSE REFERENCE MATERIALS

There is **no textbook** that adequately covers all of the conceptual and technical issues we will be covering in this course. However, there are a number of different Jupyter notebooks that will be shared by the instructor.

The following books are **optional** supplements to the primary course material:

Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems
Aurélien Géron
ISBN-10: 1098125975 • ISBN-13: 978-1098125974
3rd Edition
https://github.com/ageron/handson-ml3

Dive into Deep Learning
Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola
https://d2l.ai/d2l-en.pdf

COURSE ASSESSMENT MEASURES

Assignments

You will have assignments associated with many classes. Be sure to check piazza and submit assignments via blackboard (or LMS). Preparing the case questions in advance is expected to help you participate and contribute to class discussion. You can use Piazza

(link above) for discussions on course-related questions with the instructor, TA or your classmates.

Quizzes

I use quizzes to assess whether you are attending the lectures or not. There will be a few surprise quizzes through the semester to incentivize you to review the readings/concepts prior to class and arrive on time. The door will be locked at the start of class on a quiz day and you will receive a 0 if you arrive late.

Exams

There will be one midterm exam and one final exam. Students will be provided with further instructions on the specifics of these exams by the instructor.

Project

There will be an individual project to be completed as part of the class. The overall goal is to undergo all stages of the data understanding, data pre-processing, visualization, modelling, and evaluating the models you propose.

Research Translation Exercise

This will be an exercise where the 6000-level students were given a specific ML task and use in-class learnings to solve that task. More details will be announced later.

GRADING CRITERIA

All grading is out of 100%. The grading scale used for final course grades is: A (93-100); A- (86-92); B+ (82-85); B (78-81); B- (74-77); C+ (70-73); C (66-69); C- (60-65); F (below 60). There are no incomplete grades (I) in this class. Test grades and feedback will be given throughout the semester using the course management system (LMS).

MGMT6560 (3 Credits):

Component	Weight
Assignments	30%
Quizzes	10%
Research Translation Exercise	5%
Project*	15%
Exams	40%

MGMT4966 (4 Credits):

Component	Weight
Assignments	35%

Quizzes	10%
Project*	15%
Exams	40%

Students in MGMT6560 level cannot receive “D/D+/D-” grades.

*Project includes initial report, presentations at the end of the semester, and a final report – more details will be provided as the semester progresses.

Students should check LMS for grades on assignments/exams/project/quizzes. Students will also use LMS to submit their assignment/project/exam solutions. Piazza will be used as the main communication or discussion platform for this class (specific details will be provided by the instructor in the first lecture). Also, instructor will post different materials related to the class such as lecture notes, Jupyter notebooks (reference materials), solutions for tests, etc., on Piazza.

ATTENDANCE POLICY

Do not miss class hours! Understandably, there are circumstances (e.g., job interviews, family matters, extracurricular activity, etc.) that may cause you to miss class; nevertheless, excessive absences will reduce your class participation grade (quiz). Notify the instructor IN ADVANCE of any planned absences (especially students who participate in extracurricular activities as representatives of RPI.)

PLEASE DO NOT BE LATE TO CLASS. A maximum of 2 unexcused absences (assessed through quiz submissions) are allowed. Further absences will result in a 10% reduction of Homework/Lab grades.

In-class exercises are designed to be worked on during class time in a collaborative environment in which you each help one another. We have very different levels of technical expertise in the class, and it is important to work together on the exercises to help one another in a classroom environment. While you may be able to complete the work at home by yourself, in doing so you will be cheating your classmates of your expertise. I will consider helping behaviors during the class as part of the participation component of the class.

I expect each participant to attend class fully prepared, offer constructive criticism, provide goal-oriented analytic and synthetic insights, and encourage investigative dialectic. You earn your grade on participation through consistent, daily contribution. Merely "COMING TO CLASS” is necessary but not sufficient.

OTHER COURSE POLICIES

Students must follow all institute safety and health protocols at all times throughout the semester. There will be no exception to these requirements at any time.

Please reach out to the instructor in case you won't be able to submit an assignment. Assignments up to 24 hours late will have their grade reduced by 10%; assignments up to one week late will have their grade reduced by 70%. After one-week, late assignments will receive no credit (or 0 points). Please turn in your assignment early if there is any uncertainty about your ability to turn it in on time.

Office hours are online via Webex but in case you have to meet with me in-person, please reach out to the instructor who can accommodate the request on case-by-case basis.

ACADEMIC INTEGRITY

Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts that violate this trust undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities and The Graduate Student Supplement define various forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for a grade must represent the student's own work. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration.

Violations of academic integrity may also be reported to the appropriate Dean (Dean of Students for undergraduate students or the Dean of Graduate Education for graduate students, respectively).

In this course, the academic penalty for a first offense is a grade of zero on the assignment where a violation is detected, and the infraction will be reported to the Associate Dean for Academic Affairs. A second offense will result in failure of the course as noted in Lally's Three Strikes Policy.

If you have any question concerning this policy before submitting an assignment, please ask for clarification. In addition, you can visit the following site for more information on our Academic Integrity Policy: Students Rights, Responsibilities, and Judicial Affairs.

COVID-19 INFORMATION

Students must comply with all health and safety protocols specified by the Institute. This includes the information provided in the "January 2022 Return to Campus" memo issued on December 23rd by the President. Please pay special attention to the protocols listed under 'STUDENTS'. Please also follow protocols listed in Return-to-Campus plan available at the Rensselaer COVID-19 website. Appropriate action will be taken against those who do not comply fully with these protocols, and no exceptions will be made. Please also note that although all attempts will be made to follow the syllabus, class requirements and schedules may be changed in response to updates in Institute health and safety guidelines.

ACADEMIC ACCOMMODATIONS

Rensselaer Polytechnic Institute strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on a disability, please let me know immediately so that we can discuss your options.

To establish reasonable accommodations, please register with The Office of Disability Services for Students (mailto:dss@rpi.edu; 518-276-8197; 4226 Academy Hall). After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion."

COURSE CALENDAR

This is a tentative schedule and subject to change depending upon the progress of the class. Always check course website for the latest updates.

#	Day	Date	Topic	Deadlines
1	Tue	1/10	Course overview and introduction	
2	Fri	1/13	Python language	
3	Tue	1/17	Python data science libraries	
4	Fri	1/20	Python data science libraries; HW1	
5	Tue	1/24	Python data science libraries	
6	Fri	1/27	Python visualization libraries; HW2	HW1 due
7	Tue	1/31	Dimensionality reduction; model overview	
8	Fri	2/3	Model evaluation	HW2 due
9	Tue	2/7	Regression; HW3	
10	Fri	2/10	Exam review and in-class exercise	
11	Tue	2/14	**Exam-1**	**EXAM**; HW3
12	Fri	2/17	Decision trees; HW4	
	Tue	2/21	No class	
13	Fri	2/24	Ensemble modeling; k-NN; SVM; HW5	HW4 due
	Tue	2/28	No class (cancelled because of weather)	
14	Fri	3/3	Project description; start on project	HW5 due
	Tue	3/7	Spring Break; no class	
	Fri	3/10	Spring Break; no class	
16	Tue	3/14	Clustering	
17	Fri	3/17	Exam review and in-class exercise	Project Report-
18	Tue	3/21	**Exam-2**	**EXAM**
19	Fri	3/24	Text and Natural Language Processing; HW6	
20	Tue	3/28	Text and Natural Language Processing	
21	Fri	3/31	Image processing**; for 6000-level in-class RTE**	HW6 due
22	Tue	4/4	Neural networks; HW7	
23	Fri	4/7	Deep learning	
24	Tue	4/11	Exam review and in-class exercise	HW7 due
25	Fri	4/14	**Exam-3**	**EXAM**
26	Tue	4/18	Final presentations – Set 1	
27	Fri	4/21	Final presentations – Set 2	
28	Tue	4/25	Final presentations – Set 3	Project report