DOUGLAS COLLEGE
COMMERCE AND BUSINESS ADMINISTRATION

CSIS 3290 - FUNDAMENTALS OF MACHINE LEARNING IN DATA SCIENCE (3 Credits)

Section 001

SEMESTER:	Winter 2024	**INSTRUCTOR:**	Asif Ahmed Neloy
COURSE TIME:	W 12:30 pm – 3:20 pm	**ROOM:**	N4308
EMAIL:	neloya@douglascollege.ca	**CREDIT:**	3.0
OFFICE HOURS:	M 12:00 pm – 2:00 pm R 12:00 pm – 2:00 pm	**LOCATION:**	N4304

**All times shown are in Pacific Standard Time (PST)*

PREREQUISITES:

Min grade C in CSIS 1190 OR currently active in:

- PBD Computer and Information Systems
- PDD Data Analytics
- PDD Information and Communication Technology

COURSE SPECIFIC TECHNICAL REQUIREMENTS

- Anaconda (with Jupyter and all needed libraries), matplotlib (and seaborn) Python 3.X.X
- GitHub.
- Docker.

COURSE DESCRIPTION

In this course, students will learn to apply machine learning concepts to analyze data and make predictions. Students will learn how to collect and wrangle data, to explore data using statistics and visualizations, to transform data for further modeling, to model data using machine learning algorithms to predict data patterns, and to evaluate these model-based predictions. Students will be expected to have prior experience with the fundamentals of programming.

COURSE CONTENT

1. Programming language review for data analytics
    - Basic syntax, variables, control flow, loops, install and import libraries for data processing such as SciPy, NumPy, Pandas, Sci-Kit Learn, TensorFlow or other similar libraries and packages.
2. Data And Features: using libraries such as NumPy and Pandas
    - Represent data using lists, arrays for structured data.
    - Work with data frames using packages such as Pandas to represent diverse data.
    - Use Control Flow for filtering data and performing filtered computations.
    - Manipulate Data using functions and packages to process the data and perform computations.
    - Understand, determine, and represent Features.
    - Perform Data Wrangling
3. Exploring Data: - using libraries such as Matplotlib
    - Visualize Data by creating plots using tools such as Matplotlib.
    - Perform high dimensionality visualizations.
4. Transforming Data: using libraries such as Sci-Kit learn
    - Create Data Transformers and apply dimensionality reducing techniques as PCA.
5. Data Modeling: using libraries such as Keras, TensorFlow and scikit-learn.
    - Use machine learning techniques such as clustering, supervised learning, K-nearest neighbours, Regression to model the data.
6. Evaluating Data: Evaluate modeled data using evaluation techniques.
    - Create and apply confusion matrices.
    - Perform cross-validation using scoring metrics.
    - Implement and apply power tuning and pipelining to evaluate the data.

LEARNING OUTCOMES

At the end of this course, the successful student will be able to:

- Use appropriate tools and libraries needed for data science.
- Explain the concepts of data processing and feature engineering.
- Conduct data wrangling for further machine learning processing.
- Apply statistics and visualization techniques for data exploration.
- Employ suitable structures to transform data for modeling.
- Utilize various machine learning models and algorithms for different applications.
- Compare different models using appropriate evaluation metrics and strategies.

TEXTBOOKS

Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition. (ISBN-10: 1492032646).

METHODS OF INSTRUCTION:

Lecture, seminar, and hands-on exercises in the lab.

ASSESSMENT GUIDELINE:

A final course grade will be determined based on the following instruments and their corresponding weighted percentages:

Labs	5%
Assignments (2) and Project (1)	25% (10%+15%)
Midterm Exam (1)	30%
Final Exam (1)	40%
TOTAL	**100%**

IMPORTANT NOTE:

1. If a student completed less than 70% of the total evaluations available for this course or missed more than 30% of the classes where the Instructor's Course Outline specifies that attendance is a course requirement, the student will be assigned a UN as the final grade. Students will receive a UN as the final course grade for missing the FINAL examination.
2. In order to pass the course, students must, in addition to receiving an overall course grade of 50%, also achieve a grade of at least 50% on the combined weighted examination components (including quizzes, tests, and exams).
3. Students are required to produce ID cards during examinations.
4. *If you miss more than 30% of the scheduled classes, you will* receive UN Grade for your course grade.

Hardware/Software Requirements

Please check **Hardware and Software supplies** on the first page for hardware/software requirements. Students must troubleshoot their own software installation or operation. Regardless of the operating system installed, the instructor cannot and will not be held responsible for any misfunctions of student computers. In order to maintain overall standards, unless agreed in advance by the instructor, the student may not use non approved hardware/software. Using non approved hardware/software may put the student in a difficult situation to complete the course assessments.

Use of Cell/Mobile phones during the Class (lectures, labs, seminars, presentations)

Unless the class is on break or explicitly allowed by the instructor, cell/mobile devices are not allowed to be used during class. Cell/mobile devices will be muted and stowed away. Laptops and tablets may be used with the sole purpose of taking notes or reading the textbook. Audio or video recording or taking of photos of the class proceedings, participants or material is prohibited unless permission is obtained from the instructor in advance.

Student Conduct during the Class (lectures, labs, seminars, presentations in class and online)

Any student who displays disruptive or dangerous behavior will be asked by the instructor to leave the classroom. Reprimands will be exercised according to official college policy. College policies are available at **http://www.douglascollege.ca/about-douglas/governance/policies**.

Timeliness

Students are expected to be in class at the start of class. If a student must be late, contact the instructor with an explanation prior to the late class. It is the instructor's discretion to allow the student to join late the class. If allowed by instructor, the late student should enter from and sit

in the back of the classroom so as to not disrupt class activities. Arriving on time is a matter of respect for the instructor and fellow students. After due warning, students who are repeatedly late and disruptive for class may be prohibited from entering the classroom. College policies are available at **http://www.douglascollege.ca/about-douglas/governance/policies**.

Electronic Communication between Instructor and Students

The main method of electronic communication is Blackboard and Douglas College email system. It is the students' responsibility to ensure that they have access to Blackboard and Douglas College email system, and they check regularly for any new postings. All academic related communication through emails must originate or destined from/to a valid **@student.douglascollege.ca** email address. Emails originated from a different email address will be disregarded as there is no method to recover complete history of communication from other email service providers. Please include the following information in the email for efficient communication: course and section number, name, and student number.

Academic Integrity

The College values academic integrity**.**

Plagiarism is presenting or submitting as one's own work, research, words, ideas, artistic imagery, arguments, calculations, illustrations or diagrams of another person or persons without explicit or accurate citation or credit; this includes submission of purchased material as well as material in which the student has permitted someone else (a fellow student, tutor, mentor or teaching assistant, friend, etc.) to contribute unacknowledged. People include past and current students. Unless explicitly awarded by the instructor, in a written document or communication, the right to submit common/teamwork by two or more students, the submission/presentation is considered plagiarism. The use and/or reference of any/all websites (e.g., coursehero.com or similar) which host copies of Douglas College course work assessments such as but not limited to quizzes, assignments, midterms, labs, exams, practical work, etc., constitutes plagiarism.

Self-plagiarism is submitting one's own work for credit in more than one course without the permission of the instructors, or re-submitting work, in whole or in part, for which credit has already been granted.

Cheating is the possession or provision of unauthorized aids, assistance, or materials in the preparation of assignments, during examinations or in the completion of practical work (in clinical, practicum or lab settings). See the Academic Integrity policy for other definitions of academic dishonesty. Academic dishonesty will be treated as a serious offence. Discipline can range from a zero grade on the exam or assignment in which the offence occurred to suspension or expulsion from the College. Douglas College condemns cheating or attempted cheating within its community. Regarding the details of the policy on Academic Dishonesty, please visit- **https://www.douglascollege.ca/sites/default/files/docs/Academic%20Integrity%20%28Violation%20of%29%20Standard%20Operating%20Procedure%20%28SOP%29.pdf**

Missed tests or examinations.

Tests (quizzes, Midterm) and final examinations will be offered only during the scheduled date and time of sitting. Exceptions may be considered in cases of extraordinary circumstances. It is the responsibility of the student to inform the College and the instructor at the earliest reasonable opportunity if he/she intends to miss a test or examination. Otherwise, the student will receive a **ZERO** Mark for any missed Quizzes and will receive a **UN** as the final course grade for missing the **FINAL** examination.

ASSIGNMENTS

Assignment Submission

Assignments submitted by Blackboard must be submitted before the deadline. Unless otherwise communicated by the instructor, Blackboard will not accept late assignments. The assignment MUST be in the format specified by the instructor (please refer to the work submission guideline document). If the assignment or assignment file name is not in the correct format or it is submitted without a valid student full name or student ID will receive a **ZERO** mark. It is the student's responsibility to ensure that the submitted file is the correct file and it can be opened by the instructor. Any file submitted that is incorrect or can not be opened by the instructor will receive a **ZERO** mark.

Late Assignment

Unless otherwise communicated/agreed by/with the instructor, late assignments will NOT be graded and receive an automatic **ZERO** MARK and will count towards a UN mark requirement.

Assignment Work

Unless otherwise communicated in the Course Outline or by the instructor, all assignments are considered INDIVIDUAL work. Submitting assignments by two or more students that contains substantially common work is considered plagiarism. Not using quotations and references is also considered plagiarism. See the academic integrity guideline above.

Extra Copies of Assignment

Students are advised to keep extra copies (i.e. photocopies or file backups) of their assignments in case of any possible misplacement or digital data loss.

QUIZZES/TESTS

Unless otherwise stipulated in the course outline or by the instructor, quizzes/tests, midterms, labs, etc. will take place at the beginning of the class at scheduled date and time. There is no additional time awarded in case the student is late. The student will only make use of the time between his/her arrival and the scheduled end. Failure to attend quiz/test will cause the student to receive a **ZERO** MARK and will count towards a UN mark requirement. See "Missed Tests or Examinations"

Bonus Marks

The instructor could offer Bonus Marks (fractions or full points or percentages). These marks are

over and above the original 100% marks allocated to the course. Bonus marks will not be awarded to the detriment of the 100% marks covered by the CG and/or CO. These Bonus Marks could be offered for either team or individual work. Before the activity for which bonus marks would be awarded, the instructor will explain the conditions under which the student can achieve the bonus marks. The students have the right to not participate in any or all bonus mark activities. The students have to actively accept or reject participating in the Bonus Mark event or activity by communicating with the instructor in advance of the event or before a specified deadline that was marked to award Bonus Marks. A submission of the result of the activity will be considered active acceptance.

Material used in Exam (Midterm or Final)

Any material such as printed documents, scratch papers, notes, any other papers used during the examination, CDs, USB flash drives will be returned to the instructor at the end of the exam before leaving the exam room. In addition, for exams that make use of computers, it is strictly forbidden to take photographs, make copies or to duplicate the material from the exam by emailing or posting it to websites. Without the instructor's explicit permission, the action to remove or make duplicate copies will cause the exam to be scored at **ZERO** marks and the behavior will be reported to the CBA management.

CHANGES TO THE COURSE OUTLINE AND SCHEDULE

The course outline and/or schedule are subject to change (Consistent with College Policy and with notice to the students).

The Final Examination period is *starting day to final day*. Please check the examination schedule as soon as it becomes available for potential scheduling conflicts.

GRADING POLICY:

Grade	Numerical Value	Achievement Level
A+	4.33	90% to 100%
A	4.00	85% to 89%
A-	3.67	80% to 84%
B+	3.33	77% to 79%
B	3.00	73% to 76%
B-	2.67	70% to 72%
C+	2.33	65% to 69%
C	2.00	60% to 64%
C-	1.67	55% to 59%
D	1.00	50% to 54%
F	0.00	49% and below

Grade	Numerical Value	Achievement Level
UN	0.00`	Students completed less than 70% of the total evaluation of the course or missed more than 30% of the class where the instructor's Course Outline specifies that attendance is a course requirement.
W	N/A	Does not include GPA calculation

REGULATIONS FOR STUDENTS:

LATE ASSIGNMENTS: Late assignments/labs will not be graded and receive an automatic zero mark except for extraordinary circumstances or prior arrangements with the instructor. Students are encouraged to keep extra copies (i.e., photocopies or file backups) of their assignments in case of data loss in the digital world.

CLASSROOM CIVILITY AND SHARED RESPONSIBILITY:

STUDENT CONDUCT: Any student who displays disruptive or dangerous behavior will be asked to leave the classroom/lab by the instructor. Such behavior will be classified as misconduct. Reprimands and appeals will be exercised according to the Douglas College Student Conduct policy.

TIMELINESS: *S*tudents are expected to be in class at the start of class. Any late student should enter the session and try to not interrupt the flow of class activity as per Douglas College Student Conduct policy.

CLASS CANCELLATION: If a class is cancelled due to unforeseen circumstances, a notification will be made through Blackboard to every student enrolled in the course. It is the responsibility of students to be proactive and to check their announcements and/or e-mail before coming to class. Every effort will be made to ensure that the notification is made as soon as possible.

ILLNESS AND OTHER UNAVOIDABLE CIRCUMSTANCES: Except in extraordinary circumstances, quizzes, tests, exam and assignment deadlines must be adhered too. If unable to attend or submit, advance notice must be provided via email at your earliest opportunity. On the email include

- Course and section number (e.g., CSIS1190-006)
- Your name and student number (e.g., Student Number 212121212)
- Late assignment or missed quiz (e.g., Missed Term Test #1)
- Brief comment (e.g., Explanation of reasoning)

Without documentation such as a doctor's letter, the instructor will discuss the most appropriate course of action that will lead to fair evaluation of your overall learning in the course. Students must use their Douglas College email account to communicate with the instructor and communication must be in English.

PREPARATION, ATTENDANCE AND PARTICIPATION: Attendance will be taken on a regular basis. The method of delivery includes classroom discussion and lab exercises; and students need to be present to participate and to learn.

STUDENT EFFORT: In addition to the scheduled times for classes and labs, students are expected to spend at least 4 hours a week on this course. If you are consistently spending more time than this, consider speaking with your instructor or reaching out to the Accessibility Centre for assistance.

This following schedule is tentative and subject to change, as per the College policy.
Please do not make any travel arrangements during the final examination period – final exam scheduling is beyond the instructor's control. Please see the Registrar's office immediately with any conflict(s).

WEEK #	DATES	WEEKLY TOPICS AND ACTIVITIES	NOTES
Week 01	2024-01-03	Course Overview, Machine Learning Overview, Introduction to Python	
Week 02	2024-01-10	Managing Data with Python, Data Cleansing	
Week 03	**2024-01-17**	No Class, Campus Closed	
Week 04	**2024-01-24**	Data Exploration and Supervised Learning – Classification	**Lab 1**
Week 05	**2024-01-31**	**Supervised Learning – Regression**	**Lab 2**
Week 06	**2024-02-07**	Supervised Learning – SVM, KNN, Decision Trees	**Lab 3**
Week 07	**2024-02-14**	Supervised Learning – SVM, KNN, Decision Trees (Cont.)	**Mid-Term, Assignment 1 deadline**
Week 08	**2024-02-21**	**Study break, no class**	
Week 09	**2024-02-28**	**Dimensionality Reduction**	**Lab 4**
Week 10	**2024-03-06**	Unsupervised Learning	**Lab 5**
Week 11	**2024-03-13**	Unsupervised Learning – Clustering	**Lab 6**
Week 12	**2024-03-20**	**Neural Network and Deep Learning**	**Lab 7**
Week 13	2024-03-27	Deep Learning	**Lab 8**
Week 14	2024-04-03	Deep Learning	**Lab 9**
Week 16	2024-04-10	Review	**Assignment 2 deadline**
Week 15	2024-04-17	Project Presentation	
Week 17	**2024-04-20**	**FINAL EXAMINATION PERIOD**	

LINKS TO IMPORTANT INFORMATION AVAILABLE ON COLLEGE WEBSITE:

1. *Minimum technical requirements for taking courses online at Douglas College*
2. *Technical support information for students on the College website*
3. *Academic Integrity Policy (*Douglas College Educational Policy)

   Plagiarism and Cheating:

   The use and/or reference of any/all websites (e.g. coursehero.com or similar) which host copies of Douglas College course work assessments such as but not limited to Quizzes, assignments, midterms, labs, exams, practical work, etc. constitutes plagiarism**.**
4. *Course transferability*
5. COVID-19 safety and guidance
6. *Dates and Deadlines*
7. *Bookstore*
8. *Accessibility Services* – Carrie Keen for CBA Students
9. *Library*