Technology & Visual Arts

# AIDI 1000- Artificial Intelligence Algorithms and Mathematics

# **Course Instructor:** Miss Garima Malik

**Email:** [Garima.Malik@GeorgianCollege.ca](mailto:Garima.Malik@GeorgianCollege.ca)

**Class Time and Location:** 11:00 – 3:00 PM – Monday, Online (Remote Delivery)

# **Office Hours:** Appointments should be requested by emails

**Course Description:**

This course aims to introduce certain mathematical methods and algorithmic principles behind Artificial Intelligence (AI) algorithms. The mathematical concepts are categorized into Linear Algebra, Optimization Methods, and Statistics & Probability. The applications of mathematical concepts are examined in Supervised, Unsupervised, and Reinforcement AI algorithms.

**Resources:** As this is a unique course, there is not a single textbook to cover all topics and meet the needs of course. Hence, the main resources are Lecture notes that are posted in the Blackboard system.

**Additional References:**

For Supervised and Unsupervised Learning:

# Introduction to Machine Learning, Fourth Edition, By Ethem Alpaydin

For Reinforcement Learning:

Richard S Sutton and Andrew G Barto. Reinforcement learning: An introduction. 2018.

# **Evaluation Criteria:**

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| --- | --- |
| Assignment 1 | 10% of the overall grade |
| Assignment 2 | 10% of the overall grade |
| Assignment 3 | 10% of the overall grade |
| Midterm | 30% of the overall grade |
| Final Exam | 40% of the overall grade |

# Schedule of Activities:

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| --- | --- | --- | --- | --- |
| **WEEK** | **Date** | **LESSON** | **Assignment /Exam** | **DUE** |
| 1 | 1/10 | Statistics and Probability part 1: Central tendencies, Random Variables, Sampling, PDF and CDF (discrete and continuous distributions) |  |  |
| 2 | 1/17 | Statistics and Probability part 2: Statistical Tests, Hypothesis Testing, parametric and non- parametric tests |  |  |
| 3 | 1/24 | Linear Algebra part 1: Matrices and related concepts, eigen values, eigen vectors, functions, differentiation, integration and convexity | Assignment – 1 Release | Mon 7th Feb 2022 |
| 4 | 1/31 | Optimization Techniques and Methods |  |  |
| 5 | 2/7 | Bayes theorem and its properties |  |  |
| 6 | 2/14 | Regression Methods: linear and multiple regression | Assignment - 2 Release | Mon 28th Feb 2022 |
| 7 | 2/21 | Family Day - Holiday - No Classes (Practice Questions for midterm) |  |  |
|  | 2/28 | Reading Week- No Classes |  |  |
| 8 | 3/7 | Midterm |  | Mon 7th March 2022 |
| 9 | 3/14 | Supervised Learning part 1: Linear Regression, K-Nearest Neighbor, Decision Trees, Random Forest |  |  |
| 10 | 3/21 | Supervised Learning part 2: Logistic Regression, Support Vector Machines, Naive Bayes | Assignment-3 Release | Mon 4th April 2022 |
| 11 | 3/28 | Unsupervised Learning part 1: Various types of Clustering such as k-means and Hierarchical |  |  |
| 12 | 4/4 | Unsupervised Learning part 2: Gaussian Mixture Models, Dimensionality Reduction Methods |  |  |
| 13 | 4/11 | Reinforcement learning: formulation of MDP, Dynamic Programming, bandit problems, case studies in RL. |  |  |
| 14 | 4/18 | Final Exam |  | Mon 18th April 2022 |

The sequence and content of this syllabus may change due to unanticipated opportunities or challenges, or to accommodate the learning styles of the students.