

SYLLABUS

QM411E_0101_26

Introduction to AI and Machine Learning

ACADEMIC AREA :	OPERATIONS AND ANALYTICS
PROGRAMME :	MASTER DAIS / PGE / UGTC LEVEL 4 PGE
PERIOD :	SPRING
COORDINATOR :	Karim ZKIK
INSTRUCTOR(S) :	Karim ZKIK
CONTACT HOURS :	24.0 hours
STUDY TIME :	null hours (Class preparation, homework and assessments)
CREDITS :	4.0 ECTS
AOL :	NO

PRE-REQUISITE MODULES :

- Basic programming knowledge (Python recommended)
- Introduction to Statistics and Linear Algebra (preferred)

MODULE DESCRIPTION :

This course provides an introduction to the fundamental concepts, techniques, and applications of Artificial Intelligence (AI) and Machine Learning (ML). Students will explore both theoretical foundations and practical applications of AI/ML in diverse fields, learning to develop, train, and evaluate machine learning models. This module emphasizes real-world problem-solving, encouraging students to critically analyze AI and ML technologies and understand their limitations and ethical implications.

CONTRIBUTION TO PROGRAMME LEARNING OBJECTIVES :

- Demonstrate advanced technological literacy to Connect physical and digital spaces #ConnectSpaces
- Integrate disciplines and deep knowledge to Create innovative solutions #CreateSolutions

MODULE INTENDED LEARNING OUTCOMES (ILOs) :

After successfully completing this module, the students should be able to: 1. Understand the key concepts, techniques, and applications of AI and Machine Learning. 2. Develop and implement basic machine learning algorithms, including supervised, unsupervised, and reinforcement learning techniques. 3. Analyze and evaluate the performance of machine learning models and choose appropriate metrics for different problem types. 4. Interpret and critique current research in AI and Machine Learning, identifying trends and potential areas for innovation.

TOPICS COVERED :

- Introduction to Artificial Intelligence and Machine Learning - Data Preprocessing and Exploratory Data Analysis (EDA) - Supervised Learning Techniques - Unsupervised Learning Techniques - Neural Networks and Deep Learning

RESEARCH-LED TEACHING :

Throughout the course, students will engage with recent research papers in AI and ML, exposing them to the latest developments and open challenges in the field. Key AI and ML research areas, such as neural networks, natural language processing, and reinforcement learning, will be highlighted through case studies, and discussions on innovative AI/ML applications.

CSR AND SUSTAINABLE DEVELOPMENT GOALS :**CSR NB HOURS :****SUSTAINABLE DEVELOPMENT GOALS COVERED :**

- 09 - Industry, innovation and infrastructure

TEACHING METHODS :

The topics will be covered mainly through lectures, examples, case studies and hands-on exercises.

METHODS OF ASSESSMENT :

Continuous/Final	Group/Individual	Assessment	Weight	Duration	ILOs assessed
Continuous	Group	Written assessment at home	40%		All
Final	Individual	Final written exam	60%	2 Heures	All

Assessment 1 details:

In the final session (Session #8), students will present the results of their project, focusing on a major use case they have investigated.

More details will be provided in the first session of the course

Assessment 2 details:

The final individual written exam will take place in the exam week and cover all topics taught over all sessions. It will be a paper exam.

More details will be provided in the first session of the course.

ACADEMIC INTEGRITY :

Academic misconduct encompasses various behaviors or actions that violate the principles of academic integrity, fairness, and honesty, thereby undermining the credibility of academic work, assessments, or research. Examples of academic misconduct include:

- Cheating
- Plagiarism
- Fabrication
- Gaining an unfair advantage
- Assisting others in committing academic misconduct, such as by utilizing generative AI
- Falsification of records or official documents
- Unauthorized access to restricted information or data
- Unauthorized or unethical use of generative AIS

Academic misconduct is a serious offense and can result in consequences such as module failure, research project failure, or even expulsion from the school. To prevent unintentional academic misconduct, it is essential to consult with your instructor to understand the specific rules and instructions pertaining to the use of AI in learning and assessment.

For more comprehensive information on academic integrity rules, principles, and disciplinary procedures, please refer to the Academic Integrity section of the Student Handbook.

BIBLIOGRAPHY :

- Rebal, G., Ravi, A., & Churiwala, S. (2019). An introduction to machine learning. Springer. Ebook[<https://urls.fr/fBoR9X>]
- Neapolitan, R. E., & Jiang, X. (2018). Artificial intelligence: With an introduction to machine learning. CRC press. Ebook [https://urls.fr/TNqZKg]

Additional Reading

- Mueller, J. P., & Massaron, L. (2021). Machine learning for dummies. John Wiley & Sons.
- Stamp, M. (2022). Introduction to machine learning with applications in information security. Chapman and Hall/CRC.

MODULE PLAN SESSIONS :

Plan Session 01 :

Introduction to Artificial Intelligence and Machine Learning

- History and Evolution of AI and ML
- Key AI Concepts: Narrow vs. General AI, Ethics, and Societal Impact
- Machine Learning Paradigms: Supervised, Unsupervised, Reinforcement Learning

Plan Session 02 :

Data Preprocessing and Exploratory Data Analysis (EDA)

- Data Cleaning, Normalization, and Transformation
- Feature Selection and Dimensionality Reduction
- Exploratory Data Analysis Techniques and Visualization

Plan Session 03 :

Supervised Learning Techniques

- Regression Techniques (Linear Regression, Ridge, Lasso)
- Classification Algorithms (K-Nearest Neighbors, Decision Trees)
- Model Evaluation Metrics (Accuracy, Precision, Recall, F1 Score)

Plan Session 04 :

Unsupervised Learning Techniques

- Clustering Algorithms (K-means, Hierarchical Clustering)
- Principal Component Analysis (PCA) and Applications

Plan Session 05 :

Neural Networks

- Introduction to Neural Networks
- Activation Functions, Loss Functions, and Backpropagation
- Implementing a Basic Neural Network

Plan Session 06 :

Deep Learning

- Deep Learning Architectures (CNNs, RNNs, LSTMs)
- Applications in Image and Text Processing

Plan Session 07 :

Reinforcement Learning Basics

- Fundamentals of Reinforcement Learning (RL)

Plan Session 08 :

Student project presentation

