COMSATS University Islamabad
Department of Computer Science
Course Description Form (CDF)

Course Information

Course Code: **AIC354** | Course Title: **Machine Learning Fundamentals**
Credit Hours: **3(2,1)** | Lecture Hours/Week: **2**
Lab Hours/Week: **3** | Pre-Requisites: **None**

Course Objectives

- To present the basic machine learning concepts;
- To present a range of machine learning algorithms along with their strengths and weaknesses;
- To apply machine learning algorithms to solve problems of moderate complexity.

Course Content

Overview; Concept Learning; Classification & Regression, Unsupervised Learning; Representing Data & Engineering Features; Model Evaluation & Improvement; Algorithm Chains & Pipelines; Semi-Supervised Learning; Reinforcement Learning; Ensemble Learning; Optimization; and Dimensionality Reduction.

Unit wise Major Topics

Unit	Topic	No. of Teaching Hours
1.	Machine Learning: Overview, Lifecycle, Learning Paradigms, Tasks and Applications.	3
3.	Data Preprocessing; and Feature Engineering; Supervised Learning: Decision Trees, Naive Bayes, KNN, Linear & Logistic Regression, Artificial Neural Networks, Support Vector Machines; Overfitting, Model Evaluation & Improvement; and Algorithm Chains & Pipelines.	10
4.	Unsupervised Learning: K-means, Agglomerative Clustering, Self-Organizing Maps (SOM), and Expectation Maximization.	5
5.	Reinforcement Learning: Hidden Markov Model, Monte Carlo, and Q-Learning.	4
6.	Ensemble Learning: Bagging, Boosting, & Stacking;	3
7.	Optimization Techniques; and Dimensionality Reduction;	5
Total Contact Hours		**30**

Mapping of CLOs and GAs

Sr.#	Unit #	Course Learning Outcomes	Blooms Taxonomy Learning Level	GA
CLO's for Theory				
CLO-1	1	Explain learning paradigms along with task and applications.	*Understanding*	2
CLO-2	2	Apply supervised learning techniques to solve classification problems.	*Applying*	3,5
CLO-3	3	Apply unsupervised learning techniques to solve clustering problems.	*Applying*	3,5

CLO-4	4-5	Apply reinforcement and ensemble algorithms to environments with complex dynamics.	*Applying*	3,5
CLO-5	6	Apply optimization and dimensionality reduction techniques to improve model performance	*Applying*	3,5
CLO's for Lab				
CLO-6	1-6	Develop a reasonable size project using appropriate machine learning technique.	*Creating*	3-5

CLO Assessment Mechanism

Assessment Tools	CLO-1	CLO-2	CLO-3	CLO-4	CLO-5	CLO-6
Quizzes	Quiz 1	Quiz 2	Quiz 3	Quiz 4	-	-
Assignments		Assignment 1	Assignment 2	Assignment 3	Assignment 4	Lab Assignments
Mid Term Exam	Mid Term Exam	Mid Term Exam	-	-	-	Lab Mid Term
Final Term Exam	Final Term Exam					Project/Lab Final Exam

Text and Reference Books

Textbooks:

1. Machine Learning, Alpaydin., E., The MIT Press, 2021.
2. Machine Learning: An Applied Mathematics Introduction, Wilmott, P., Panda Ohana Publishing, 2019.

Reference Books:

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Géron, A., O'Reilly Media, 2019.
2. Pattern Recognition and Machine Learning, Bishop, C., Springer-Verlag, 2011.
3. Machine Learning, Tom, M., McGraw Hill, 1997.