Department of Electrical and Computer Engineering
Pak-Austria Fachhochschule: Institute of Applied Sciences & Technology

COMP-240 Machine Learning

Course Code:	COMP-240	**Semester:**	5th
Credit Hours:	2-1	**Pre-req. Course**	Artificial Intelligence
Instructor:	Dr. Abid Ali	**Class:**	BSAI-F23 Red
Office:	Block C2, SPCAI	**E-mail:**	abid.ali@paf-iast.edu.pk
Lecture Days:	Thursday	**Consulting Hours:**	By appointment via email

Course Description

Machine learning is one of the fastest growing areas of computer science, with far-reaching applications. The aim of this course is to: a) Present the basic machine learning concepts; b) Present a range of machine learning algorithms along with their strengths and weaknesses; c) Apply machine learning algorithms to solve problems of moderate complexity.

Course Learning Outcomes (CLOs)		BT Level*
At the end of the course the students will be able to:		
CLO1	**Knowledge**: Describe basic machine learning concepts, theories and applications.	C1
CLO2	**Apply:** Apply supervised learning techniques to solve classification problems of moderate complexity.	C3
CLO3	**Apply:** Apply unsupervised learning techniques to solve clustering problems of moderate complexity	C3
CLO4	**Apply:** Apply reinforcement learning algorithms to environments with complex dynamics.	C3
CLO5	**Create:** Develop a reasonable size project using suitable machine learning technique.	C6
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Mapping of CLOs to Program Learning Outcomes (PLOs)

PLOs	CLO 1	CLO 2	CLO 3
PLO 1 (Engineering Knowledge)	X		
PLO 2 (Problem Analysis)		X	
PLO 3 (Design/Development of Solutions)			X
PLO 4 (Investigation)			
PLO 5 (Modern Tool Usage)			
PLO 6 (The Engineer and Society)			
PLO 7 (Environment and Sustainability)			
PLO 8 (Ethics)			
PLO 9 (Individual and Teamwork)			
PLO 10 (Communication)			
PLO 11 (Project Management)			

Mapping of CLOs to Assessment Modules and Weightages

Assessments	Weightage	CLO1	CLO2	CLO3
Quizzes:	10	5	10	5
Assignments:	10	2	4	4
Presentations	5	3	4	5
Mid-term Exam:	25	10	10	0
End Semester Exam:	50	10	18	22
Total:	100	27	42	31

Books

Textbooks:

- Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press,2012.

Reference books:

- Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press,2012.
- The Elements of Statistical Learning: Data mining, Inference, and Prediction, by Hastie, Tibshirani, Friedman
- Machine Learning Engineering

COURSE CONTENTS

Week 1	Introduction to Artificial Intelligence, Machine Learning and related Fields
Week 2	Understanding the basic idea of learning, Minimizing Error Function
Week 3	Introduction to Linear Regression, Polynomial and Additive Linear Regression
Week 4	Linear Classifier, Logistic Regression, Probability Approach of Logistic Regression
Week 5	Overfitting, Underfitting, Generalization, Cross Validation
Week 6	Perceptron, Error Back propagation, Multi-Layer Perceptron
Week 7	K Nearest Neighbors,
Week 8	Classification with k-NN, Regression with k-NN
Week 9	Naïve Bayesian Classifier
Week 10	Performance of NBC, Understanding NBC with Example
Week 11	K Nearest Neighbors, Classification with k-NN, Regression with k-NN
Week 12	Basic Idea of Decision tree- ID3
Week 13	Entropy, Review of ID3
Week 14	C4.5, CART: Classification and Regression Tree
Week 15	Random Forests
Week 16	Support Vector Machine

Course Policies:	
Quiz:	The quizzes may be unannounced and normally last for ten minutes. The question framed is to test the concepts involved in last few lectures.
Assignment	Email will be the primary source for announcements and submitting assignments.
Plagiarism:	Collaboration and group wok is encouraged but each student is required to submit his/her own contribution(s). Your writings must be your own thoughts. You must cite and acknowledge all sources of information in your assignments. Cheating and plagiarism will not be tolerated and will lead to strict penalties including zero marks in assignments as well as referral to the Dean for appropriate action(s).