

EE512: Machine Learning

Lecture Schedule		See Time Table	Course Type, Semester	Fall 2018
Credit Hours		Three	Pre-requisite	Linear Algebra, Applied Probability and Statistics
Instructor		Kashif Javed, PhD	Contact	kashif.javed@uet.edu.pk
Office		First Floor EE Department	Office Hours	TBA
Teaching Assistant		TBA	Lab Schedule	None
Course Description		This is a graduate level course on Machine Learning. The major topics we will cover include supervised learning (e.g., classification, and regression), unsupervised learning (e.g., principle component analysis and K-means, EM algorithm), Hidden Markov Models, and Reinforcement Learning. Students will also design and analyze real-world machine learning applications as part of assignments and a course project.		
Measurable Learning Outcomes	CLOs	Description	PLOs	Level
	CLO1	Explain supervised and unsupervised machine learning algorithms.	Cognitive, two	PLO1 Low
	CLO2	Analyze real world problems where machine learning can be applied.	Cognitive, four	PLO2, Medium
	CLO3	Design and develop solutions for real machine learning applications.	Cognitive, six	PLO3, High
	CLO4	Evaluate engineering problems, do literature review and conduct experiments to interpret and analyze results.	Cognitive, five	PLO4, High
Textbooks		<ul style="list-style-type: none">E. Alpaydin, “<i>Introduction to Machine Learning</i>” 3rd Ed, The MIT Press 2014.T. Mitchell, “<i>Machine Learning</i>”, McGraw Hill, 1997.Peter Flach, “<i>Machine Learning: The Art And Science Of Algorithms That Make Sense Of Data</i>”, Cambridge university press, 2012C Bishop, "<i>Pattern Recognition and Machine Learning</i>" Springer, 2006.		
Grading Policy vis-à-vis CLO Mapping		Course Project	15%	CLO4
		Quizzes	10%	CLO1 to CLO3
		H.W/Assignments	5%	CLO4

	Midterm	30%	CLO1 to CLO3
	Final	40%	CLO1 to CLO3

Lecture Plan

Lectures	Topics	Readings & CLOs
1*	Introduction to the course Tasks: the problems that can be solved with machine learning, Models, Features	Prologue (Book3) CLO1, CLO2, CLO3
1*	Performance Evaluation, Decision Trees (DT) Assessing classification performance (e.g. precision, recall, ROC etc.) for binary classification, DT representation, The basic DT learning algorithm	Chap 2 and 3 (Book3, Book2) CLO1, CLO2, CLO3
2*	Artificial Neural Networks Linear separability, Gradient descent search, Perceptron and Feed-forward network, Back propagation algorithm	Chap 4 (Book2) CLO1, CLO2, CLO3
2*	Probabilistic Methods Estimating probabilities, naive Bayes and Logistic Regression, Parametric methods (univariate and multivariate)	Chap 2,3 and Chapters 4,5 (Books 2 and 1) CLO1, CLO2, CLO3
2*	Support Vector Machines Optimal Separating Hyperplane The Non separable Case: Soft Margin Hyperplane	Chap 13, 7 (Books 1, 3) CLO1, CLO2, CLO3
	Mid Term Exam	
1*	Dimensionality Reduction Mutual information based feature ranking, Feature Subset Selection, mRMR algorithm Principal Component Analysis	Chap 6 (Book1) and research papers CLO1, CLO2, CLO3
1*	Linear Regression The least-squares method, Multivariate linear regression	Chap 7 (Book3) CLO1, CLO2, CLO3
2*	Unsupervised Learning Algorithms K-means Clustering, K-medoids, Mixture of Gaussians, EM algorithm, Hierarchical clustering	Chap 9, 8 (Books 4, 3) CLO1, CLO2, CLO3
2*	Sequential Data Markov Models, Hidden Markov Models	Chapter 13 (Book4) CLO1, CLO2, CLO3
1*	Reinforcement Learning Q learning, Nondeterministic Rewards and Actions	Chap 13 (Book2) CLO1, CLO2, CLO3
1*	Student Course Project Presentations	CLO4
	Final Exam	

* - Tentative