

CHE-434	Subject: Machine Learning in Chemical Engineering	2CH	
		Theory (2)	
Pre-req.	Nil	Category	Elective
Course Contents			
Introduction to machine learning; concept learning: General-to-specific ordering of hypotheses, Version spaces Algorithm, Candidate elimination algorithm. Supervised Learning: decision trees, Naive Bayes, Artificial Neural Networks, Support Vector Machines, Overfitting, noisy data, and pruning. Measuring Classifier Accuracy; Linear and Logistic regression. Unsupervised Learning: Hierarchical Agglomerative Clustering. K-means partitional clustering; Self-Organizing Maps (SOM) k-Nearest-neighbor algorithm; Semi supervised learning with EM using labeled and unlabeled data. Reinforcement Learning: Hidden Markov models, Monte Carlo some inference Exploration vs. Exploitation tradeoffs, Markov Decision Processes, Ensemble Learning using committees of multiple hypotheses, Bagging, and Boosting Applications: The Computational Support of Scientific Discovery, Pré and Post Processing in Machine Learning and Data Mining, Machine Learning in User Modeling, Economics, Finance and Marketing, Medical Applications, Power Systems, Human Language Technology and Intelligent Information Systems.			

Weekly Plan

Week /Lecture	Topic
1-2	Introduction to machine learning; concept learning: General-to-specific ordering of hypotheses, Version spaces Algorithm, Candidate elimination algorithm.
3-5	Supervised Learning: Decision Trees, Naive Bayes, Artificial Neural Networks, Support Vector Machines, Overfitting, noisy data, and pruning. Measuring Classifier Accuracy; Linear and Logistic regression.
6-8	Unsupervised Learning: Hierarchical Agglomerative Clustering. K-means partitional clustering; Self-Organizing Maps (SOM) k-Nearest-neighbor algorithm; Semi supervised learning with EM using labeled and unlabeled data.
9	MID TERM
10-13	Reinforcement Learning: Hidden Markov models, Monte Carlo some inference Exploration vs. Exploitation tradeoffs, Markov Decision Processes, Ensemble Learning using committees of multiple hypotheses, Bagging, and Boosting
14-16	Applications: The Computational Support of Scientific Discovery, Pré and Post Processing in Machine Learning and Data Mining, Machine Learning in User Modeling, Economics, Finance and Marketing, Medical Applications, Power Systems, Human Language Technology and Intelligent Information Systems.
17	Revision
18	End Semester Exam
TEXT AND REFERENCE BOOKS: - Georgios Paliouras, Vangelis Karkaletsis, Constantine D. Spyropoulos. Machine Learning and its Applications, Springer,2001 - Ella Hassanien, Abdel-Badeeh M. Salem, Rabie Ramadan, Tai-hoon Kim, Advanced Machine Learning Technologies and Applications: Proceedings of AMLTA 2021, Volume 1339 of Advances in Intelligent Systems and Computing. - Shahar Mendelson, Alexander J Smola, Advanced Lectures on Machine Learning: Machine Learning Summer School, 2002.	