GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering Syllabus

Subject Code : 3175201

Subject Name : Advanced Machine Learning

WEF Academic Year :	
Semester :	7
Category of the Course :	Professional Core

Prerequisite :	**Basic machine learning, probability, linear algebra, statistics**
Rationale :	This course will provide an introduction to fundamental principles in pattern recognition and machine learning. It will cover several algorithms that are used for tasks such as classification, regression, clustering, and probabilistic modeling. Essentially, this course will offer a comprehensive perspective on the fundamental problems that arise when applying algorithms to analyze data, including the often used terminology and potential faults that may occur if they are used wrongly.

Course Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content :

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Machine Learning - Deep Learning - Difference between Machine Learning and Deep Learning - Machine Learning process - Probability Theory, Parametric vs Non-parametric methods - Elements of Computational Learning Theory - Ensemble Learning: Bagging, Boosting, Random Forest	12	25%
2	**Neural Networks:** Biological motivation for Neural Network ; Neural network Representation-Applications -Perceptron-Backpropagation(first Phase and Second Phase) **Multilayer Perceptrons:** Introduction to Deep Learning-Applications-Multilayer Perceptron-Convolutional neural network-Recurrent neural network-Hybrid Neural network	8	16%
3	Kernel Methods for non-linear data, Support Vector Machines, Kernel Ridge Regression, Structure Kernels, Kernel PCA, Latent Semantic Analysis	8	16%
4	Bayesian methods for using prior knowledge and data, Bayesian inference, Bayesian Belief Networks and Graphical models, Probabilistic Latent	8	16%

	Semantic Analysis, The Expectation-Maximisation (EM) algorithm, Gaussian Processes		
5	Dimensionality Reduction - CCA, LDA, ICA, NMF - Canonical Variates - Feature Selection vs Feature Extraction	8	16%
6	Machine Learning Tools: Python/Anaconda, Tensor Flow, Keras	4	11%
	Total		**100**

Reference Book :

- Pattern Recognition and Machine Learning, Christopher M. Bishop
- The Elements of Statistical Learning, Springer 2009
- Tom Mitchell, "Machine Learning", First Edition, McGraw- Hill, 1997.
- Saikat Dull, S. Chjandramouli, Das, "Machine Learning", Pearson
- Mark Fenner, "Machine Learning with Python for Everyone", Pearson
- Machine Learning Algorithms, 2nd Edition, Giuseppe Bonaccorso, Packt Publication
- TensorFlow Machine Learning, Nick McClure, Packt Publication

Course Outcome :

After Completion of the Course, Student will able to :

No	Course Outcomes	RBT Level*
01	Understand basic machine learning approaches	UN
02	Create neural network to solve real word application and evaluate the model	CR
03	Apply dimension reduction and kernel methods for feature extraction and classification	AP
04	Understand the working principle of Bayesian network and its applications	UN

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List :

- 10 experiment based on above content
- Mini project in group of 2
- Write individual research paper on recent topic

List of Laboratory/Learning Resources Required :

https://www.tensorflow.org/resources/learn-ml/theoretical-and-advanced-machine-learning
https://in.mathworks.com/campaigns/offers/machine-learning-with-matlab.html
https://www.tableau.com/
https://blog.ml.cmu.edu/
https://machinelearningmastery.com/blog/

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