

Subject Code: 01CO1301
Subject Name: Advance Machine Learning
M. Tech. Year - II

Objective: This course will introduce key concepts in pattern recognition and machine learning; including specific algorithms for classification, regression, clustering and probabilistic modeling. In summary, this course will provide a broad view of the general issues arising in the application of algorithms to analyzing data, common terms used, and common errors made if applied incorrectly.

Credits Earned: 4 Credits

Course Outcomes:

At the end of the course, students will be able to:

- To understand key concepts, tools and approaches for pattern recognition on complex data sets
- To learn Kernel methods for handling high dimensional and non-linear patterns
- To implement state-of-the-art algorithms such as Support Vector Machines and Bayesian networks
- To Solve real-world machine learning tasks: from data to inference
- To apply theoretical concepts and the motivations behind different learning frameworks

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term work (TW)	
3	0	2	4	50	30	20	25	25	150

Content:

Sr. No.	Topics	Contact Hours
1	Key concepts Supervised/Unsupervised Learning, Loss functions and generalization, Probability Theory, Parametric vs Nonparametric methods, Elements of Computational Learning Theory Ensemble Learning, Bagging, Boosting, Random Forest	8
2	Kernel Methods for non-linear data, Support Vector Machines, Kernel Ridge Regression, Structure Kernels, Kernel PCA, Latent Semantic Analysis	8
3	Bayesian methods for using prior knowledge and data, Bayesian inference, Bayesian Belief Networks and Graphical models, Probabilistic Latent Semantic Analysis, The Expectation-Maximisation (EM) algorithm, Gaussian Processes	8
4	Dimensionality Reduction - CCA, LDA, ICA, NMF - Canonical Variates - Feature Selection vs Feature Extraction	10
5	Filter Methods - Sub-space approaches - Embedded methods Low-Rank approaches - Recommender Systems .Application areas - Security - Business - Scientific	10
6	Recent trends in supervised and unsupervised learning algorithm, dimensional reducibility, feature selection and extraction	6
	Total Hours	50

Reference Books:

1. Pattern Recognition and Machine Learning, Christopher M. Bishop
2. John Shawe-Taylor and Nello Cristianini, Kernel Methods for Pattern Analysis.
3. The Elements of Statistical Learning, Springer 2009
4. Machine Learning Algorithms, 2nd Edition, Giuseppe Bonaccorso, Packt Publication
5. TensorFlow Machine Learning, Nick McClure, Packt Publication



List of Open Source Software/learning website:

- <https://www.analyticsvidhya.com/blog/2016/01/complete-tutorial-learn-data-science-python-scratch-2/>
- <https://www.springboard.com/resources/learning-paths/machine-learning/python>
- <https://www.rstudio.com/online-learning/>