



Department of Computer Applications
National Institute of Technology, Tiruchirappalli

1. Course Outline			
Course Title	MACHINE LEARNING TECHNIQUES		
Course Code	CA605		
Department	CA	No. of Credits	3
Programme	M.Tech.	Learning Hours	3
Course Type	Programme Core	Course Teacher	Dr. U.SRINIVASULU REDDY
Pre-requisites	NA		
E-mail	usreddy@nitt.edu	Telephone No.	0431-2503746
Course Type	Core Course	Office	Lyceum 104

2. Course Content

Covers practical issues in machine learning and basic principles of the theory of data mining techniques and its applications. Topics include learning techniques, preprocessing techniques, classification algorithms, regression techniques, clustering algorithms, neural networks, parameters estimation. Implement supervised and unsupervised algorithms using R and PYTHON packages.

3. Course Objectives

1. To introduce the basic concepts and techniques of Machine Learning.
2. To develop the skills in using recent machine learning software for solving practical problems.
3. To be familiar with a set of well-known supervised, semi-supervised and unsupervised learning algorithms.

4. Course Learning Outcomes (CO)

Students will be able to:

1. Understand overview of machine learning theory and different forms of learning using R and Python packages
2. Perform classification techniques on variety of data.
3. Implement Graphical and sequential models for solving practical problems.
4. Perform clustering techniques on variety of data using R and visualize the outcome.

5. Perform neural networks techniques on variety of data using R, PYTHON and visualize the outcome.

5. Course Outcome (CO)	Aligned Programme Outcome (PO)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand overview of machine learning theory and different forms of learning using R and Python packages	H	H	A	M	H	A	A	A	L	L	A	L
Perform classification techniques on variety of data	H	H	A	M	H	A	A	A	L	L	A	L
Implement Graphical and sequential models for solving practical problems	H	H	A	A	H	A	A	L	L	L	A	A
Perform clustering techniques on variety of data using R,Python and visualize the outcome	H	H	A	A	H	A	L	L	L	L	A	A
Perform neural networks techniques on variety of data using R, Python and visualize the outcome.	H	A	H	A	A	A	H	H	L	A	H	H

Lectures

Class lectures and class exercise with self-learning course materials will form the primary teaching activity, the schedule for which is outlined below. Lecture material will address the intended learning objectives, and loosely follow the readings as specified in the course syllabus. The lecture material will be made available before the class. The lectures are meant to be interactive, where learning takes place through interactive discussion in class.

Guest Lectures

Structured lectures will be supplemented by guest lectures by practitioners and researchers from industry and academia. These will serve to show the practical relevance of the course content and also expose the students to the open problems for research.

6. Course Teaching and Learning Activities		
Week	Mode of Delivery	Topics
1.	Classroom activity	Introduction, overview of machine learning, Different forms of learning, Generative learning.
		Gaussian parameter estimation, maximum likelihood estimation
		MAP estimation- Bayesian estimation, bias and variance of estimators
2.	Classroom activity	Missing and noisy features, nonparametric density estimation
		Applications, software tools
3.	Classroom activity	Classification Methods, Nearest neighbors
		Decision trees, Linear Discriminant Analysis.
		Logistic regression, Perceptrons
4.	Classroom activity	Large margin classification, Kernel methods, Support Vector Machines
		Classification and Regression Trees
5.	Classroom activity	Graphical and sequential models, Bayesian networks
		Conditional independence, Markov random fields
		Inference in graphical models, Belief propagation
6.	Classroom activity	Markov models, Hidden Markov models
		decoding states from observations
		Learning HMM parameters.
7.	Classroom activity	Clustering Methods, Partitioned based Clustering
		K-means, K-medoids
		Hierarchical Clustering - Agglomerative
8.	Classroom activity	Divisive, Distance measures
		Density based Clustering, DBScan; Spectral clustering.
9.	Classroom activity	Neural networks, the perceptron algorithm
		Multilayer perceptron's, back propagation
		Nonlinear regression, multiclass discrimination
10.	Classroom activity	Training procedures, localized network structure
		Dimensionality reduction interpretation

- All relevant material will be made available to the students in advance. Classroom activity includes lectures, tutorials, quiz, simulation exercise, laboratory exercise, mini-project, group task and seminar.

The assessment details for this course are given below. The assessment will be done for a total of 100 marks.

7. Course Assessment Methods – Theory					
Sl. No.	Mode of Assessment	Portions	Schedule	Duration in Minutes	Weightage (%)
1.	Test – 1	Unit I,II	4 th week	60	20
2.	Test – 2	Unit III,IV	8 th week	60	20
3.	Assignment	UNIT V	10 th week	60	10
6.	End Semester Exam	All Units	November	180	50
Total					100

* Evaluated based on participation in lecture class and class activity.

8. Essential Learning material (Textbooks, Reference books, Websites, Journals, etc.)
<ol style="list-style-type: none"> 1. T. Hastie, R. Tibshirani and J. Friedman, “Elements of Statistical Learning”, Springer, 2009. 2. E. Alpaydin, “Machine Learning”, MIT Press, 2010. 3. K. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012. 4. C. Bishop, “Pattern Recognition and Machine Learning, Springer”, 2006. Shai Shalev-Shwartz, Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, 2014. John Mueller and Luca Massaron, “Machine Learning For Dummies“, John Wiley & Sons, 2016.
9. Course Exit Survey
<ul style="list-style-type: none"> • The students may give their feedback at any time to the course Teacher or through an email message, which will be duly addressed. • The students may also give their feedback during Class Committee meeting and fill up the feedback form at the end of the semester.
10. Course Policy (including plagiarism, academic honesty, attendance, etc.)
<p>Classroom Behavior</p> <ul style="list-style-type: none"> • Ensure that the course atmosphere, both in the class and discussions outside the class room with Teacher, is conducive for learning. Participate in discussions but do not dominate or be abusive. Be considerate of your fellow students and avoid disruptive behavior. <p>Exam policy</p> <ul style="list-style-type: none"> • Each student is required to take all exams at the scheduled times. All exceptions must be cleared with the professor prior to the exam time. Exams missed for insufficient reason and without being cleared with the professor prior to the exam time will be assigned a score of zero. <p>Assignments</p> <ul style="list-style-type: none"> • All assignments are due on or before the mentioned date and time. <p>Late assignments</p> <ul style="list-style-type: none"> • Late submissions are not accepted.

- The students are expected to come out with their original work on term activity, assignments and tests/examinations. If found to be plagiarized, it will be assigned a score of zero.

Attendance

- Attendance is expected. If a student misses a class, the student is still responsible for the material that is studied and for completing any assignments by the due date that may have been handed out by the instructor during class.

Academic Honesty

- i) No type of academic dishonesty will be tolerated. If the student is caught cheating (on the assignments, exams, or project) the punishment will be the most severe penalty allowed by the Institute policy.
- ii) Possession of any electronic device, if any, found during the test or exam, the student will be debarred for 3 years from appearing for the exam and this will be printed in the Grade statement/Transcript.
- iii) Tampering of MIS records, if any, found, then the results of the student will be withheld and the student will not be allowed to appear for the Placement interviews conducted by the Office of Training & Placement, besides (i).

11. Additional Course Information

- The students can get their doubts clarified during class.
- Prior request for appointment through mail, stating the subject matter to be discussed, is required to fix a time for discussion of subject matter outside class. Appointment time will be communicated through reply mail.

For Senate's Consideration



(Dr. U. Srinivasulu Reddy)

Course Faculty



(Dr. R. Eswari)

PAC Chairperson



(Dr. S. R. Balasundaram)

HoD