BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
SECOND SEMESTER 2015-2016
Course Handout Part II

Date: 12/01/2016

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. **: BITS F464**
Course Title **: Machine Learning**
Instructor-in-charge **: MUKESH KUMAR ROHIL (rohil@pilani.bits-pilani.ac.in)**

Course Description:
Machine Learning is an exciting sub-area of Artificial Intelligence which deals with designing machine which can learn and improve their performance from examples/experience. This course introduces the student to the key algorithms and theory that forms the core of machine learning. The course will cover the major approaches to learning namely, supervised, unsupervised, and reinforcement leaning. The course emphasizes various techniques, which have become feasible with increased computational power. The topics covered in the course include regression, decision trees, support vector machines, artificial neural networks, Bayesian techniques, Hidden Markov models, genetic algorithms etc.

Text Book:
T1. Tom M. Mitchell, Machine Learning, Tata McGraw-Hill, 1997.

Reference Books:
R1. Christopher M. Bhisop, Pattern Recognition & Machine Learning, Springer, 2006.
R2. Introduction to Machine Learning, N. J. Nilson, Stanford, Available online at author's website. http://robotics.stanford.edu/people/nilsson/mlbook.html
R3. Machine Learning, Neural and Statistical Classification, D. Michie, D.J. Spiegelhalter, C.C. Taylor (eds), Ellis Horwood publishers, available online at http://www.amsta.leeds.ac.uk/~charles/statlog/

Lecture Plan:

Topic	Topic Details	Lecture#	Chapter Reference
Overview	Introduction	1-2	T1.Ch.01
Preliminaries	• Probability theory • Decision theory • Information theory	3-5	R1.Ch.02
Some important principles/concepts/algorithms	• MAP Hypothesis • Min. Description Length (MDL) principle • Expectation Maximization (EM) Algo. • Bias-variance decomposition • Lagrange Multipliers • Mixture of Gaussians • PCA & SVD	6-8	T1.Ch.06 + class notes
Linear models for Regression	• Linear basis function models • Bayesian linear regression	9-11	R1.Ch.03

Topic	Topic Details	Lecture#	Chapter Reference
Linear models for classification	• Discriminant Functions • Probabilistic Generative Classifiers • Probabilistic Discriminative Classifiers	12-15	R1.Ch.04
Bayesian Learning Techniques	• Bayes optimal classifier • Gibbs Algorithm • Naïve Bayes Classifier	16-17	T1.Ch.06
Non-linear Models & Model Selection	• Decision Trees • Ensemble Classifiers • Neural Networks o Multilayer Perceptron o Network training o Error backpropagation • Instance-based Learning o *K*-NN o Case-based Reasoning	18-24	T1.Ch.03 T1.Ch.04 R1.Ch.05 T1.Ch.08
Margin/Kernel BasedApproach	Support Vector Machines	25-27	R1.Ch.07 + Class Notes
Graphical Models	• Bayesian Networks • Hidden Markov Models	28-31	T1.Ch.06 + Class Notes
Unsupervised Learning	• Mixture Models • *K*-means Clustering	32-33	T1.Ch.06 R1.Ch.09
Genetic Algorithms	• Hypothesis space search • Genetic programming • Models of evaluation & learning	34-35	T1.Ch.09
Reinforcement Learning	• Q Learning • Non-deterministic rewards & actions • Temporal difference learning • Generalization	36-37	T1.Ch.13
Advanced Topics	• Active earning • Deep Learning	38-40	Class Notes

Evaluation Scheme:

Component	Duration	Weight (& Nature)	Date (Time)
Mid-semester Test	90 Mins.	35% (Closed Book)	16/3 2:00 -3:30 PM
Project	10 to 14 days	20% (Open Book)	**TBA**
Comprehensive Exam.	3 Hours	45% (Closed Book)	9/5 FN

Notices: Will be either displayed on LMS server or CSIS notice-board or announced in class.
Chamber Consultation Hour: M–10 (05:00 PM to 05:50 PM)
Makeup Policy: Makeup will be granted only for genuine cases if prior request is given.
Class Schedule: As per the ID announced time-table

Instructor-in-charge
BITS F464