COURSE PLAN

A. COURSE OVERVIEW

Degree:	BE	Programme:	CS
Academic Year:	2018-19	Semester:	7
Course Title:	**MACHINE LEARNING**	Course Code:	**15CS73**
L-T-P-S:	3-1-0-0	Duration of SEE	3 Hrs
Total Contact Hours:	50 Hrs	SEE Marks:	80
CIE Marks:	20	Assignment	1 / Module
Credits:	3		
Lesson Plan Author:	Harivinod N	Sign	Date 30/06/2018
Checked By:	Mahesh Prasanna K	Sign	Date 30/06/2018

B. PREREQUISITES

- Design and Analysis of Algorithms (15CS43)
- Design and Analysis of Algorithms Laboratory (15CSL47)
- Fundamentals of Data Structures (15CS33)
- Data Structures Laboratary (15CSL37)
- Computer Programming Laboratory (15CPL16/26)
- Creative thinking, sound mathematical insight and programming skills.

C. COURSE DESCRIPTION

i) Course Outcomes

At the end of the course, the student will be able to;

- Identify the problems for machine learning and apply either supervised, unsupersvised or reinforcement learning technique.
- Explain theory of probability and statistics related to machine learning
- Investigate concept learning, ANN, Bayes classifier, k nearest neighbor,

ii) Relevance of the Course

- Machine learning Laboratary (15CSL76)
- Project work (15CSP78, 15CSP85)

iii) Applications areas

- Image and speach recognition
- Medical diagnosis
- Classification
- Prediction
- Regression

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D1. ARTICULATION MATRIX, CO v/s PO

Mapping of CO to PO

	POs											
COs	1	2	3	4	5	6	7	8	9	10	11	12
1. Identify the problems for machine learning and apply either supervised, unsupersvised or reinforcement learning technique.	3	3	3	3	3	3	2	3	3	2	2	3
2. Explain theory of probability and statistics related to machine learning	3	3	3	2	1	1	-	2	1	-	-	2
3. Investigate concept learning, ANN, Bayes classifier, k nearest neighbor,	3	3	3	3	2	2	2	2	3	2	1	3

Note: Mappings in the Tables D1 (above) and D2 (below) are done by entering in the corresponding cell the Correllation Levels in terms of numbers. For Slight (Low): 1, Moderate (Medium): 2, Substantial (High): 3 and for no correllation: " - ".

D2. ARTICULATION MATRIX, CO v/s PSO

Mapping of CO to PSO

	PSOs		
COs	1	2	3
1. Identify the problems for machine learning and apply either supervised, unsupersvised or reinforcement learning technique.	3	-	-
2. Explain theory of probability and statistics related to machine learning	3	-	-
3. Investigate concept learning, ANN, Bayes classifier, k nearest neighbor,	3	-	-

E. MODULE PLANS

MODULE - I

Title:	Introduction to ML, Concept learning	Appr. Time:	10 Hrs
MO:			RBT
At the end of the Module, the student will be able to:			
1. Know the different phases of ML algorithms			L1
2. Understand and apply concept learningtechniques			L3

Lesson Schedule:

Lecture No.	Portion to be covered	CO
1	Introduction to ML	CO1
2	Well posed learning problems	CO1
3	Designing a Learning system	CO1
4	Perspective and Issues in Machine Learning	CO1
5	Concept Learning, Concept learning task	CO3
6	Concept learning as search,	CO3
7	Find-S algorithm,	CO3
8	Version space,	CO3
9	Candidate Elimination algorithm,	CO3
10	Inductive Bias.	CO3

Application Areas:

- Prediction

- Classification
- Playing games
- Autonomous vehicle driving

Review Questions (CO):

1	List some of the successful applications of machiie learning. (CO 1)
2	Define Machine learning. (CO 1)
3	Explain the stages involved in designing a learning system. (CO 1,3)
4	Briefly explain LMS weight update rule. (CO 1,3)
5	List the issues in Machine learning. (CO 1)
6	Define Concept learning.(CO 1,3)
7	Explain concept learning task. (CO 1,3)
8	Illustrate General-to-Specific Ordering of Hypotheses. (CO 1,3)
9	Explain Find-S algorithm with an example. (CO 1,3)
10	Define consistent hypothesis and vetor spaces. (CO 1,3)
11	Explain candidate elimination algorithm.(CO 1,3)
12	Trace candidate elimination algorithm with an example. (CO 1,3)
13	Write a note on inductive bias. (CO 1,3)
14	Explain inductive bias associated with candidate elimination algorithm. (CO 1,3)

MODULE - II

Title:	**Decision Tree Learning**	Appr. Time:	10 Hrs
MO:			RBT
At the end of the Module, the student will be able to:			
1. Find appropriate problems for decision tree learning			. L1
2. Apply decision tree learningfor the problems.			L3

Lesson Schedule:

Lecture No.	Portion to be covered	CO
1	Decision Tree Learning	CO1
2	Decision tree representation	CO2,3
3	Decision tree representation	CO2,3
4	Appropriate problems for decision tree learning	CO1
5	Appropriate problems for decision tree learning	CO1
6	Basic decision tree learning algorithm	CO1,2,3
7	Basic decision tree learning algorithm	CO1,2,3
8	hypothesis space search in decision tree learning	CO2
9	Inductive bias in decision tree learning	CO2
10	Issues in decision tree learning	CO1

Application Areas:

- Agriculture: Application of a range of machine learning methods to problems in agriculture and horticulture
- Astronomy: Use of decision trees for filtering noise from Hubble Space Telescope images
- Biomedical Engineering: Use of decision trees for identifying features to be used in implantable devices can be found
- Control Systems: Automatic induction of decision trees was recently used for control of

nonlinear dynamical systems

- Manufacturing and Production: Decision trees have been recently used to non-destructively test welding quality
- Object recognition: Tree based classification has been used recently for recognizing three dimensional objects and for high level vision
- Pharmacology: Use of tree based classification for drug analysis can be found
- Physics: Decision trees have been used for the detection of physical particles

Review Questions (CO):

1	List the approriate problems from decision tree learning? (CO 1,3)
2	Explain ID3 learning algorithm (CO 1,2,3)
3	In ID3 walgorithm, exaplin how a attribute is chosen as best classifier? (CO 1,2,3)
4	Illustrate the computation of entropy and information gain. (CO 2)
5	Explain indcuctive bias in decision tree learning. (CO 1,3)
6	Briefly explain the issues in decision tree learning. (CO 1,3)

MODULE - III

Title:	**Artificial Neural Networks**	Appr. Time:	8 Hrs
MO:			RBT
At the end of the Module, the student will be able to:			
1. Understand the ANN			L1
2. Apply ANN learning for suitable problems			L2

Lesson Schedule:

Lecture No.	Portion to be covered	CO
1	Introduction to Artificial Neural Networks	CO1,2,3
2	Artificial Neural Networks	CO1,2,3
3	Neural Network representation	CO1,2,3
4	Appropriate problems	CO1,2,3
5	Perceptrons	CO1,2,3
6	Perceptrons	CO1,2,3
7	Backpropagation algorithm	CO1,2,3
8	Backpropagation algorithm	CO1,2,3

Application Areas:

- Image Processing and Character recognition
- Forecasting: Forecasting in everyday business decisions (e.g. sales, financial allocation between products, capacity utilization), in economic and monetary policy, in finance and stock market.
- Biometrics: Speech Recognition, Human Face Recognition, Signature Verification

Review Questions (CO):

1	Give th biological motivation for ANN. (CO 1,3)
2	List the appropriate problems for neural network learning. (CO 1,3)
3	Explain perceptrons in detail. (CO 1,2,3)
4	Explain gradient descent algorithm for trainng a perceptron. (CO 1,2,3)
5	Explain backpropagation algorithm.(CO 1,2,3)

6	Explaiin the following with respect to Backpropogation algorithm • Convergence and Local Minima • Representational Power of Feedforward Networks • Hypothesis Space Search and Inductive Bias • Hidden Layer Representations • Generalization, Overfitting, and Stopping Criterion

MODULE - IV

Title:	**Bayesian Learning**	Appr. Time:	10 Hrs
MO:			RBT
At the end of the Module, the student will be able to:			
1. Understand the Baysian learning			
2. Apply baysian learning learning for appropriate problems			

Lesson Schedule:

Lecture No.	Portion to be covered	CO
1	Bayesian Learning: Introduction	CO 2
2	Bayes theorem	CO 2
3	Bayes theorem and concept learning	CO 2
4	ML and LS error hypothesis	CO 2
5	ML for predicting probabilities	CO 2
6	MDL principle	CO 2
7	Naive Bayes classifier	CO 1,2,3
8	Naive Bayes classifier	CO 1,2,3
9	Bayesian belief networks	CO 1,2,3
10	EM algorithm	CO 1,2,3

Application Areas:

- Grug testing
- Improving the efficiency in solving real world problems
- Selecting best products among two manufacturers
- Management
- Bio-chemistry
- Business

Review Questions (CO):

1	Explain Bayes theorem. (CO 2)
2	Explain Brute-Force Bayes Concept Learning (CO 2)
3	Briefly explain Maximum Likelihood and Least-Squared Error Hypothese. (CO 2)
4	Briefly explain Maximum Likelihood Hypotheses for Predicting Probabilitie. (CO 2)
5	Write a note on Gradient Search to Maximize Likelihood in a Neural Net (CO 2)
6	Explain Minimum Description Length Principle (CO 2)
7	With example explain naive baysian classifier (CO 1,2,3)
8	Briedly explain baysian belief networks (CO 1,2,3)
9	Explain EM algorithm in detai (CO 1,2,3)

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MODULE - V

Title:	Instance based and Reinforcement Learning	Appr. Time:	12 Hrs
MO:			RBT
At the end of the Module, the student will be able to:			
1. Evaluate hypothesis			L1
2. Understand and apply instance based learning			L2,3
3. Understand and apply reinforcement learning			L2,3

Lesson Schedule:

Lecture No.	Portion to be covered	CO
1	Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy	CO 2
2	Basics of sampling theorem,	CO 2
3	General approach for deriving confidence intervals Difference in error of two hypothesis, Comparing learning algorithms.	CO 2
4	Instance Based Learning: Introduction	CO 1,2,3
5	K-nearest neighbor learning	CO 1,2,3
6	Locally weighted regression	CO 1,2,3
7	Radial basis function,	CO 1,2,3
8	Cased-based reasoning	CO 1,2,3
9	Reinforcement Learning:Introduction	CO 1,2,3
10	Reinforcement Learning task	CO 1,2,3
11	Learning Task	CO 1,2,3
12	Q Learning	CO 1,2,3

Application Areas:

- Robotics and industrial automation
- Data science
- Education and training
- Health and medicine
- Text, speech, and dialog systems
- Finance

Review Questions (CO):

1	Explain various methods to estimating hypothesis aaccuracy. (CO 2)
2	Briefly explain concepts involved in sampling theory. (CO 2)
3	Explain the general approach for deriving confidence intervals. (CO 2)
4	How the diffrence in error of two hypothesis is found, (CO 2)
5	What are the issues to be considered for comparing lerning algorithms. (CO 2)
6	Explain k-nearesrt learning. (CO 1,2,3)
7	List the advantages and disadvantages of k-nearesr learning (CO 1,2,3)
8	Explain locally weighted regression. (CO 1,2,3)
9	Explain Radial basis functions(CO 1,2,3)
10	Briefly explain case based resoning (CO 1,2,3)
11	Write a note on reinforced learnin. (CO 1,2,3)
12	Briefly explain learning task. (CO 1,2,3)
13	Explain Q learning (CO 1,2,3)

COURSE PLAN

F. INTERNAL ASSESSMENT TEST MODEL QUESTION PAPER

Dept: CS	Sem / Div:7 A&B	Course: Machine Learning	Course Code: 15CS73
Date: 18/06/2018	Time: 90 Min.	Max Marks: 40	Elective: N

Note: Answer any 2 FULL questions.

QN		Questions	Marks	RBT	CO
1	a	Explain the stages involved in designing a learning system.	6	L2	1, 3
	b	Explain Find-S algorithm with an example.	8	L3	1, 3
	c	Trace candidate elimination algorithm with an example.	6	L3	1, 3
2	a	Explain ID3 learning algorithm	8	L3	1,2,3
	b	Illustrate the computation of entropy and information gain.	6	L3	2
	c	Explain indcuctive bias in decision tree learning.	6	L2	1,3
3	a	Define consistent hypothesis and vetor spaces.	6	L1	1,3
	b	List the approriate problems from decision tree learning?	6	L1	1,3
	c	In ID3 walgorithm, exaplin how a attribute is chosen as best classifier?	8	L3	1,2,3

G. CONTINUOUS INTERNAL EVALUATION

Evaluation	Weightage in Marks
IA Test – 1	15
IA Test – 2	15
IA Test – 3	15
Marks for Different Components : Assignments ,Additional Assesment Tool (AAT)- (Seminar/ CLT/ Quiz/ Mini Project)	5 To deepen student's understanding and increase his/her confidence in the topics studied. Further, to improve the oral, written skills and engineering aptitudes.