

CMR Institute of Technology, Bangalore			
Department(s): Information Science & Engineering			
Semester: 07	Section(s): A & B	Lectures/week: 03	
Subject: Machine Learning		Code: 17CS73	
Course Instructor(s): Swathi.Y			
Course duration: 3 rd August 2020 –21 st December 2020			
Course Site: https://sites.google.com/a/cmrit.ac.in/swathi-ml/home			
Google Classroom Link: https://classroom.google.com/u/0/c/MTMwMDE4Njg3Mzg0			

Link to detailed syllabus:	https://drive.google.com/drive/u/0/folders/1wH4kX3trEgShK8rycDiq93hD6SaF3Fxb
Course Objectives/ Expectations	<p>Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. We cover topics such as Bayesian networks, decision tree learning, statistical learning methods, unsupervised learning and reinforcement learning. The course covers theoretical concepts such as inductive bias, Bayesian learning methods. This course is designed to give a graduate-level student a thorough grounding in the methodologies, technologies, mathematics and algorithms currently needed by people who do research in machine learning.</p> <ol style="list-style-type: none"> 1. Define machine learning and problems relevant to machine learning 2. Differentiate supervised, unsupervised and reinforcement learning 3. Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning 4. Perform statistical analysis of machine learning techniques
Prerequisites	<ul style="list-style-type: none"> ➤ Basic programming skills in python ➤ Basics of probability and Statistics

NOTE: First one to two sessions should be marked for expectations setting about the course.

Lesson Plan				
Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids/Course Delivery Methods	% of Syllabus Covered
1-2	NA	Expectation setting about the course		
3-10	TB1 1.1 – 1.3, 2.1-2.5, 2.7	UNIT – 1 INTRODUCTION: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.	PPT, Short Videos, Google colab	20
Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included <ul style="list-style-type: none"> ➤ https://drive.google.com/drive/u/0/folders/1wH4kX3trEgShK8rycDiq93hD6SaF3Fxb ➤ https://www.youtube.com/watch?v=2C4GiluGkSY 				

11-20	TB1 3.1-3.7	UNIT-2 Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.	PPT, Short Videos, Google colab	20
Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included <ul style="list-style-type: none"> ➤ https://drive.google.com/drive/u/0/folders/1wH4kX3trEgShK8rycDiq93hD6SaF3Fxb ➤ https://www.analyticsvidhya.com/blog/2016/04/complete-tutorial-tree-based-modeling-scratch-in-python/ 				
21-30	TB1 4.1 – 4.6	UNIT 3-Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron, Back propagation algorithm	PPT, Short Videos, Google colab	20
Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included <ul style="list-style-type: none"> ➤ https://drive.google.com/drive/u/0/folders/1wH4kX3trEgShK8rycDiq93hD6SaF3Fxb ➤ https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_neural_networks.htm ➤ https://mattmazur.com/2015/03/17/a-step-by-step-backpropagation-example/ 				
31-40	TB1 6.1 – 6.6, 6.9, 6.11, 6.12	UNIT 4- Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm	PPT, Short Videos, Google colab	20
Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included <ul style="list-style-type: none"> ➤ https://drive.google.com/drive/u/0/folders/1wH4kX3trEgShK8rycDiq93hD6SaF3Fxb ➤ https://www.youtube.com/watch?v=E3l26bTdtXI ➤ https://www.youtube.com/watch?v=5s7XdGacztw ➤ https://www.coursera.org/lecture/bayesian-methods-in-machine-learning/expectation-maximization-algorithm-Fm3mY 				
41-52	TB1 5.1-5.6, 8.1-8.5, 13.1-13.3	UNIT 5-Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbour learning, locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning	PPT, Short Videos, Google colab	20
Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included <ul style="list-style-type: none"> ➤ https://drive.google.com/drive/u/0/folders/1wH4kX3trEgShK8rycDiq93hD6SaF3Fxb ➤ https://www.analyticsvidhya.com/blog/2018/03/introduction-k-neighbours-algorithm-clustering/ ➤ https://www.youtube.com/watch?v=b-UqUNJJJ5o ➤ https://artint.info/html/ArtInt_265.html 				

Text Books

1.

Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books

1.	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2.	EthemAlpaydin, Introduction to machine learning, second edition, MIT press.

Syllabus for Internal Assessment Tests (IAT*)

IAT #	Syllabus
IAT-1	Class # 01 –18
IAT-2	Class # 19 - 36
IAT-3	Class # 37 - 52

*See calendar of events for IAT schedule.

Evaluation :Quiz/Assignment/Seminar/Mini Project/Viva : Assignment, Quiz, Mini Project

- *Evaluation of course delivery is based on any one of the above*
- *Evaluation guidelines to be provided to help students understand how the evaluation would be done for assignments, quiz, and so on.*
- *Evaluation tools/method to be mentioned e.g.: Easy polls, Survey Monkey, Typeform or inbuilt poll option in video conferencing tool.*
- *'Work-book' section includes additional activities to support self-learning e.g. exercises, game-based learning, case-study, and so on.*

Evaluation Method	Remarks
No of Assignments/Quiz or any of the mentioned above given	2 assignments,1 quiz, mini project
Quiz 1: Issue: 22 Aug 2020; Submission: 28 Aug 2020 Assignment1: Issue: 18 Sept 2020; Submission: 25 Oct 2020 Assignment 2: Issue: 16 Oct 2020; Submission: 23 Oct 2020 Quiz 2: Issue: 13 Nov 2020; Submission: 20 Nov 2020 Mini project: 20 Nov 2020; Submission: 05 Dec 2020 Mention the issue date and submission date of all the above	As part of 10 marks for AQIS, it is divided into 4 marks for assignments, 2 marks for quiz and 4 marks for mini project. You can refer to evaluation guidelines for more details.

<i>Evaluation guidelines (please provide the link)</i>	https://drive.google.com/drive/u/0/folders/1wH4kX3trEgShK8rycDiq93hD6SaF3Fxb
<i>Evaluation tools/method</i>	Edpuzzle,Nearpod,Mentimeter
<i>Flipped Classroom process for students to understand</i>	NA

Workbook (Additional activities to support self-learning e.g. exercises, game-based learning, case-study etc.)

The below workbook contains exercises that you need to complete for Module1 assessment. This assessment contains numerical, Short answers and guess the output session. Same will be created for further modules.

<i>please provide the link to access the work book information</i>	https://drive.google.com/drive/u/0/folders/1wH4kX3trEgShK8rycDiq93hD6SaF3Fxb
--	---

Peer Learning (teacher should list out the opportunities provided to interact with peers, (through discussions & group work).

Students are asked to form groups and after completion of each module mini projects/seminars were allocated to each group. They need to present it to their peers which emphasizes students simultaneously learning and contributing to other students learning.

Discussion Board (teacher should set up problem-solving forums or discussion boards, and assign students or student teams to monitor and support or direct questions).

1. **Google Classroom** for each section to discuss, comment and to pose questions.
<https://classroom.google.com/u/0/c/MTMwMDE4Njg3Mzg0>
2. Use of online tools like Edpuzzle ,Nearpod and linking to google classroom

Virtual Lab(for lab subject only).Provide the details of various tools for learning, including additional web-resources, video-lectures, animated demonstrations and self-evaluation.

NA

please provide the link to access the virtual lab information

Mention the best practices identified as part of teaching this subject

1. **Comprehensive materials** which include Module wise notes, question bank, assignment and university solved question papers.
2. **Mini projects based on real world applications**
3. Share a set of very clear expectations for students and for myself as to (1) how i will communicate and (2) how much time students should be working on the course each week
4. Explaining the concepts by taking real time datasets available and creating more practice problems for each and every concept.
5. Practical demonstration of all the problems through google Colab. We can import an image dataset, train an image classifier on it, and evaluate the model, all in just a few lines of code.

Mention the Importance of this subject along with Real Time Applications

Machine learning is a sub category of AI, so from a hierarchical point of view, they are not similar.

Machine learning relies on data. ML algorithms try to analyze data and find meaningful patterns to later classify or predict something. Whereas AI, it usually does not rely on data, but on intelligent variations of algorithms generally inspired from nature (genetic algorithms, ant system, simulated annealing...) to solve maximization or minimization optimization problems.

Data mining and machine learning both be about learning from data and making better decisions. But the way they go about this is different. While data mining is simply looking for patterns that already exist in the data, machine learning goes beyond what's happened in the past to predict future outcomes based on the pre-existing data.

Importance: Machine learning is given so much importance because it helps in predicting behavior and recognizing patterns that humans with their limited capacity cannot predict. For example, let's take up amazon. If amazon is able to predict what its customer wants accurately and present it to them then it can generate a lot more profit. It does so by observing patterns in the customer's choices and other factors that it takes into account while presenting its prediction.

Applications:

1. Image Recognition
2. Speech Recognition
3. Traffic prediction:

4. Product recommendations
5. Self-driving cars
6. Email Spam and Malware Filtering
7. Virtual Personal Assistant
8. Online Fraud Detection
9. Stock Market trading
10. Medical Diagnosis
11. Automatic Language Translation

Course Outcomes (COs)

➤ **By the end of this course, students will be able to :**

Identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.

Explain theory of probability and statistics related to machine learning.

Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q Learning.

CO-PO and CO-PSO Mapping

Course Outcomes		Blooms Level	Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning	L3	1,2,3,4,5	3	3	2	2	2	2	-	-	1	-	-	-	2	-	-	
CO2	Explain theory of probability and statistics related to machine learning	L2	1,2,3,4,5	3	3	2	2	2	1	-	-	1	-	-	-	2	-	-	
CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q Learning.	L3	3,4,5	3	3	2	2	1	1	-	-	1	-	-	-	2	-	-	

Identified curriculum gap if any and Justification:

Identified Gap	Justification
Not application oriented	Syllabus is a just basic level and doesnot cover much applications

Proposed Actions to fill the identified gaps:

Some important applications will be identified and make the students to complete the mini projects on the same.

Course Instructor Signature/s

CCI Signature

HOD