

CE 392: MACHINE LEARNING FUNDAMENTALS
B.TECH 6TH SEMESTER (CIVIL)
PROGRAMME ELECTIVE - III

Credits and Hours:

Teaching Scheme	Theory	Practical/Tutorial	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Objective of the course:

The main objectives for offering the course Artificial Intelligence are:

- To learn about the most effective machine learning techniques, and gain practice implementing them.
- To able to effectively use the common neural network "tricks", including initialization, dropout regularization, Batch normalization, gradient checking,
- To understand industry best-practices for building deep learning applications.
- To learn how to quickly and powerfully apply these techniques to new problems.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to AI and Machine Learning	12
2.	Supervised Learning	16
3.	Evaluation Metrics	06
4.	Unsupervised Learning	10
5.	Neural Network	16

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1.	Introduction to AI and Machine Learning	12 Hours	20%
1.1	Environment Setup. Introduction to Machine Learning Pipeline		
2.	Supervised Learning	16 Hours	27%
2.1	Regression, Simple Linear regression Least Square method, Simple Linear regression Using gradient Descent, Multiple Linear regression: Application,		
2.2	Classification, Logistic Regression, Log Loss. Sigmoid, K-Nearest Neighbour		
3.	Evaluation Metrics	06 Hours	10%
3.1	Regression (SSE, MSE, RMSE)		
3.2	Classification (Accuracy, precision, Recall, F1 Score, Confusion Matrix)		
4.	Unsupervised Learning	10 Hours	16%
4.1	Anomaly Detection		
5.	Neural Network	16 Hours	27%
5.1	Perceptron, Perceptron Algorithm, Single Layer NN, Back Propagation, Tuning, Application (Classification, Regression)		

D. Instructional Method and Pedagogy:

At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Student Learning Outcomes:

The Learning outcomes are listed as followings:

- To solve difficult and complex problem of computer science using AI techniques.
- To select any R&D field related to application of AI.
- To understand soft computing and machine learning courses.
- To develop software solution as per need of today's IT edge which requires high automation and less human intervention.
- To demonstrate working knowledge in Python in order to write and explore more sophisticated Python programs.
- To apply knowledge representation, reasoning, and machine learning techniques to real-world problems

F. Recommended Study Material:

❖ Text Books:

1. Machine Learning, Tom Mitchell, McGraw Hill, 1997. ISBN 0070428077
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2004

❖ Reference Books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Richard O. Duda, Peter E. Hart & David G. Stork, "Pattern Classification, Second Edition", Wiley & Sons, 2001.
3. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The elements of statistical learning", Springer, 2001.
4. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", MIT Press, 1998.

❖ Web Materials:

1. <https://www.youtube.com/watch?v=foHSmB48rY&list=PLKvX2d3IUq586Ic9gIhZj6ubpWV-OJfl4>
2. https://www.youtube.com/watch?v=CS4cs9xVecg&list=PLkDaE6sCZn6EcXTbcXluRg2_u4xOEky0
3. <https://www.youtube.com/watch?v=UzxYlbK2c7E>
4. <https://www.youtube.com/watch?v=fgtUFzxNztA>
5. <http://www-formal.stanford.edu/jmc/whatisai/whatisai.html>

6. https://www.webopedia.com/TERM/A/artificial_intelligence.html

7. https://en.wikipedia.org/wiki/Artificial_intelligence

❖ Software

1. Scikit Learn
2. PyTorch
3. TensorFlow
4. Colab
5. Keras

LIST OF PRACTICALS

Practical No.	Name of Practical
1	Application in Structural Engineering – Damage Detection, Damage Localizations, Damage Quantification, real time Structural Health Monitoring.
2	Application in Geotechnical Engineering – Soil Moisture Estimation, Soil Classification using Machine Learning
3	Application in Construction Management – Site Layout using Machine Learning, Machine Learning for preliminary estimation, Predicting change of rate of material, risk prediction and management systems, construction activity monitoring system, Site safety monitoring by Machine Learning, Project schedule optimization
4	Concrete mix design using Machine Learning
5	Material Recognition and design