Fundamentals of AI and Machine Learning

TC1 CSE504 (All Tracks Common)

(L,T,P,C: 3-1-2-5)

Track objectives:

CSE-Artificial Intelligence (AI) and Machine learning*:*

This Track course has been designed to prepare the engineering graduates who can:

1. Design machine learning algorithms to solve real world problems.
2. Have hands-on experiences with modern AI frameworks.
3. Design business applications using AI engineering to solve complex problems.
4. Provide engineering services to e-Commerce domains.
5. Collaborate with leading AI front runner and other domain experts for the design and implementation of new business and implementation techniques.

Course outcomes:

This Track course has been designed and expects the engineering graduates:

1. To be able to apply the basic principles, models, and algorithms of AI
2. to recognize, model, and solve problems in the analysis and design of information systems.
3. To be able to analyze the structures and algorithms of a selection of techniques
4. To understand techniques related to searching, reasoning, machine learning, and language processing.

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Module-1: Introduction to Artificial Intelligence

Meaning and Scope of Artificial Intelligence, features of Artificial Intelligence, Three Stages of Artificial Intelligence, Intelligent agents (what is an agent? structure of agents, types of agents, environments), The AI Cycle, Applications of Artificial Intelligence. Metaheuristic Optimization methods **(Lecture: 1-5)**

Module-2: Introduction to AI Components:

Basics of Linear Algebra (vectors, matrices, and linear transforms), Probability distribution for artificial Intelligence **(Lecture: 6-11)**

Module-3: Fundamentals of Machine Learning

Meaning of Machine Learning, Relationship between Machine Learning and Statistical Analysis, Process of Machine Learning, Types of Machine Learning Algorithms (Supervised learning, Semi-supervised learning, Unsupervised learning, Transduction, Reinforcement learning)

(Lecture: 12-16)

Module-4: Machine Learning Models

Classification Algorithms, Regression Algorithms, Clustering Algorithms, Dimensionality Reduction Techniques **(Lecture: 17-24)**

Module-5: Performance Measures of Models

Model selection and Performance metrics, Intelligent Automation and robotics**,** basics of deep learning **(Lecture: 24-30)**

Reference Books:

1. "Artificial Intelligence: A Modern Approach" by Stuart J. Russell and Peter Norvig
2. "Machine Learning for Beginners" by Chris Sebastian
3. "Machine Learning: The New AI" by Ethem Alpaydin

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Mid Term - I: Evaluation (20 marks)

Mid Term - II: Evaluation (20 marks)

End Semester: Evaluation (50 marks)

Practical: Lab Evaluation (50 marks)

Course Activities

1. Assignments
2. Quiz
3. Oral Test
4. Group Presentation
5. Surprise Test
6. Group Project (Application-based)

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Experiment 1: Optimization algorithm

To find the parameters or coefficients of a function where the function has a minimum value using gradient Descent optimization algorithms

Experiment 2: Linear algebra

a. Write a python program to Add Two Matrices.

b. Write a python program to Transpose a Matrix

Experiment 3: Intelligent Agent

To write a program to implement the Tic-Tac-Toe game using python.

Experiment 4: Decision Trees

To write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. How to find the Entropy and Information Gain in Decision Tree Learning

Experiment 5: Machine Learning Classifier

a. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

b. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

Experiment 6: Machine Learning Regression

Implement the non-parametric Support Vector Regression algorithm to fit data points. Select appropriate data set for your experiment and draw graphs

Experiment 7: Clustering

a. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm.

b. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Experiment 8: Deep Learning

To build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.