BCE-P517

MACHINE LEARNING – I

MM : 100 **Sessional : 30**

Time : 3 hrs **ESE : 70**

L T P **Credits 3**

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Prerequisite: Understanding of Basic Programming Concept and Mathematics (probability and statistics).

Objectives: The course has following objectives

- To learn the fundamentals of Machine Learning.
- To understand basic component of an intelligence system.
- To explore applications of machine learning.
- To understand different types of machine learning algorithms and tools.
- To learn how to use machine learning model to solve real world problem.

Course Outcome:

On completion of course, student will be able to:

- List various approaches of Machine Learning.
- Describe machine learning algorithms to solve the real-world problems.
- Develop Hypothesis and machine learning models.
- Identify appropriate models for solving machine learning problems.
- Apply learning techniques to solve real world machine learning problems.
- Evaluate and interpret the results of the algorithms.

NOTE: The question paper shall consist of two sections A and B. Section A contains 10 short type questions of 6 marks each and student shall be required to attempt any five questions. Section B contains 8 long type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus.

UNIT-I

Introduction to Machine Learning, Difference between Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning (DL), Applications of Machine Learning, Limitations or need for applying ML algorithms, Types of Machine Learning and their use cases, Types of problem – Regression and Classification, Types of data – Structured Data and Unstructured Data. Batch and online learning.



UNIT- II

Tools required for machine learning- Python Libraries (Numpy, Pandas, Matplotlib etc), Framework for machine learning algorithm (Scikit-learn, TensorFlow, Keras, Anaconda, Google Colab etc), Popular ML Datasets (MNIST Dataset, IRIS Dataset, Wine quality dataset, ImageNet, IMDB reviews, Recommender Systems Dataset etc), Data repositories sources for machine learning practices (UCI Machine learning repository, Kaggle, Wikipedia, CMU, Google Dataset Search, The Big Bad NLP Database etc).

UNIT – III

Basic concept of Probability theory and Linear Algebra, Bias, Variance, Bias-Variance trade-off, overfitting and underfitting. Pre-processing of data - Data cleaning, wrangling and filtering, Handling missing and categorical data, Data scaling, Feature extraction and selection, covariance matrix, Dimensionality Reduction, Train-Test splitting strategy, Training Set, Validation Set, Test Set, Importance of cross validation – Holdout Method and K-fold cross validation.

UNIT- IV

Introduction to performance metrics for Machine Learning Algorithm – Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Confusion Matrix, Classification Accuracy, Classification Report (Precision, Recall/Sensitivity, Specificity, F1-Score, Area Under ROC curve). Fine tuning of model – Grid Search, Randomized Search, Ensemble Method. Concept of Bagging.

UNIT – V

Introduction to regression problems, Types of regression – Linear Regression, Logistic Regression, Polynomial Regression. Introduction to classification problems and Types of classification - Binary Classification, Multi-Class Classification, Multi-Label Classification, Imbalanced Classification. Introduction to reinforcement learning and types - Model-Free and Model-Based RL.

Text Books:

- Introduction to Machine Learning, Alpaydin, E., MIT Press, 2004.
- Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller and Sarah Guido, O'Reilly, 2016.

Suggested Readings:

- Elements of Machine Learning, Pat Langley Morgan Kaufmann Publishers, Inc. 1995.
- The elements of statistical learning, Friedman, Springer series in statistics, 2001.
- The Hundred-page Machine Learning Book, Andriy Burkov, 2019
- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Aurelien Geron, O'Reilly, 2017.