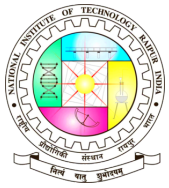

National Institute of Technology Raipur

assignment 01

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QUESTIONS:

Question 1: Explain the different types of Machine learning and also explain the five best algorithms of each type.

Answer: Machine learning is a field of artificial intelligence that focuses on developing algorithms and models that enable computers to learn from data and make predictions or decisions without being explicitly programmed. There are several types of machine learning, each with its unique characteristics:

- **SUPERVISED LEARNING:** In supervised learning, the algorithm learns from labelled training data, where the input features are paired with their corresponding target labels. The goal is to learn a mapping from inputs to outputs.
  Algorithms:
  - Linear Regression- Linear regression is a classic algorithm used for predicting numerical values based on historical data. It finds the best-fitting line that represents the relationship between variables, making it a fundamental tool in fields like economics and physics.
  - Decision Trees-Decision trees excel in classification tasks by segmenting data into subsets based on attributes, leading to a tree-like structure. Each internal node represents a decision based on a feature, while the leaves provide the predicted outcome. This algorithm is widely used in diagnostics, fraud detection, and more.
  - Random Forest- Random Forest is an ensemble learning algorithm that combines multiple decision trees to enhance predictive accuracy. It reduces overfitting and increases generalization, making it a go-to choice for applications like remote sensing and bioinformatics.
  - Support Vector Machines (SVM)- SVM is a powerful algorithm for both classification and regression tasks. It aims to find a hyperplane that best separates different classes in the feature space. Its versatility makes it suitable for image recognition, text categorization, and bioinformatics

- **Unsupervised Learning:** Unsupervised learning deals with unlabeled data and aims to find patterns, relationships, or structure within the data.
  Algoritms:
  - K-Means Clustering
  - Hierarchical Clustering
  - Principal Component Analysis (PCA)
  - Gaussian Mixture Models (GMM)
  - t-Distributed Stochastic Neighbour Embedding (t-SNE)

- **Semi-Supervised Learning:** This type combines labelled and unlabeled data to improve learning when only a portion of the data is labelled.
  Algorithms:
  - Self-Training
  - Co-Training
  - Multi-View Learning
  - Expectation-Maximization (EM)
  - Tri-Training

- **Reinforcement Learning:** Reinforcement learning involves training agents to interact with an environment to maximise a reward signal. It's used in scenarios where decisions lead to consequences.
  Algorithms:
  - Q-Learning
  - Deep Q Networks (DQN)
  - Policy Gradient Methods
  - Proximal Policy Optimization (PPO)
  - Actor-Critic Methods

Question 2: Explain Bagging and Boosting Ensemble Learning with an example.

Answer:

Bagging (Bootstrap Aggregating): Bagging is an ensemble learning technique that involves training multiple instances of the same model using bootstrapped subsets of the training data. Each model is trained on a slightly different subset of the data, and their predictions are aggregated to produce the final result.
Example: Random Forest is a popular bagging ensemble method. It creates an ensemble of decision trees, each trained on a bootstrapped subset of the data. The final prediction is obtained by averaging or voting on the predictions of individual trees.

Boosting: Boosting, another ensemble technique, aims to improve the predictive accuracy of weak models by iteratively focusing on misclassified instances. It assigns higher weights to these instances to guide the model's learning process and emphasize difficult-to-classify cases.

Example: AdaBoost (Adaptive Boosting) is a well-known boosting technique. In each iteration, it assigns higher weights to misclassified instances and trains a new model. The final prediction is obtained by weighing the predictions of all models based on their performance.

Both bagging and boosting techniques enhance the overall predictive power of machine learning models by reducing overfitting, improving generalisation, and capturing different aspects of the data.