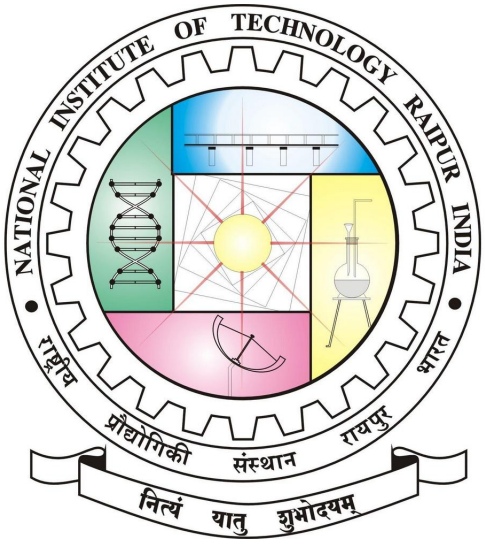

National Institute of Technology Raipur

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
  - Decision Trees
  - Random Forest
  - Support Vector Machines (SVM)
  - Neural Networks

- **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 is another ensemble learning technique that aims to improve the performance of weak learners by combining them sequentially. Models are trained in iterations, where each subsequent model focuses on correcting the errors made by the previous ones. Misclassified instances are given higher weights to emphasise learning from them.

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.