Important Questions for End-Semester Exam

Machine Learning and Artificial Intelligence

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Contents

Unit-Wise Important Questions

1 Unit I: Introduction

1. Define AI and its applications in real-world scenarios.

2. Explain the history and evolution of machine learning.

3. Describe the role of mathematics (e.g., vectors, matrices) in AI/ML with examples.

4. Compare supervised, unsupervised, and reinforcement learning techniques.

2 Unit II: Supervised Learning

1. Discuss the steps involved in preprocessing data in supervised learning (data cleaning, normalization, etc.).

2. Differentiate between linear regression and logistic regression.

3. Explain the concept of overfitting and underfitting with examples.

4. How is accuracy measured using metrics like confusion matrix, F1-score, precision, and recall? Solve examples.

5. Implement k-NN using the given data and explain the role of the parameter k.

3 Unit III: Unsupervised Learning

1. Differentiate between k-means clustering and hierarchical clustering.

2. Describe dimensionality reduction techniques such as PCA and SVD with examples.

3. How is the performance of clustering models evaluated?

4 Unit IV: Artificial Neural Networks (ANN)

1. Explain the biological inspiration behind neural networks.

2. Compare single-layer and multi-layer ANN architectures.

3. Discuss backpropagation and its significance in training ANNs.

4. What is hyperparameter tuning, and why is it important in training neural networks?

5 Unit V: Applications of AI/ML

1. List and describe real-time applications of AI in cybersecurity, anomaly detection, and healthcare.

2. Discuss the impact of Deepfake technology and how ML models can counteract it.

3. Explain how machine learning promotes fairness, transparency, and accountability in AI systems.

Frequently Asked Practical Questions

1. **Distance Metrics in k-NN:** Compare Euclidean, Manhattan, and Minkowski distances with examples.

2. **Decision Tree Construction:** Given a dataset, build a decision tree using information gain.

3. **Normalization/Standardization:** Perform min-max normalization and standardization for a given dataset.

4. **Confusion Matrix Metrics:** Calculate precision, recall, F1-score, and accuracy for a given confusion matrix.

5. **Regression Analysis:** Solve a least squares regression problem for grade prediction.

6. **Model Evaluation:** Compare models (e.g., logistic regression vs. decision trees) for a specific classification problem.

Critical Theoretical Questions

1. What are the challenges faced in machine learning (e.g., data quality, model selection, bias)?

2. Explain the concept of regularization and its types (L1, L2).

3. Define clustering and discuss its importance in unsupervised learning.

4. How do you optimize ANN models, and what role does the activation function play?

5. Describe the ethical considerations and challenges in deploying AI/ML systems.

Preparation Tips

- Focus on problem-solving: practice k-NN, decision trees, regression problems, and model evaluation metrics.

- Understand key concepts: overfitting, underfitting, and regularization.

- Revise applications of ML in cybersecurity, healthcare, and anomaly detection.

- Prepare diagrams and equations for ANN and regression problems.