

# **Machine Learning**

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## **1. Introduction to Machine Learning**

- **What is Machine Learning; definition and applications**
  - **Types of learning: supervised, unsupervised, (brief intro to reinforcement)**
  - **Role of ML in AI, data science, and industry applications**
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## **2. Mathematics & Statistics for Machine Learning**

- **Linear Algebra essentials: vectors and matrices**
  - **Probability & Statistics basics**
  - **Calculus: gradients and optimization**
  - **Bias-variance tradeoff concepts**
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## **3. Python Programming & Libraries for ML**

- **Python basics for ML implementation**
  - **Libraries: NumPy, Pandas, Matplotlib**
  - **Introduction to Scikit-Learn for ML modeling**
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## **4. Data Preprocessing & Feature Engineering**

- **Cleaning datasets, handling missing values**
  - **Scaling and normalization**
  - **Feature selection and extraction**
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## **5. Supervised Learning: Regression Methods**

- **Linear regression: simple and multiple**
- **Cost function and gradient descent**
- **Polynomial regression and model tuning**

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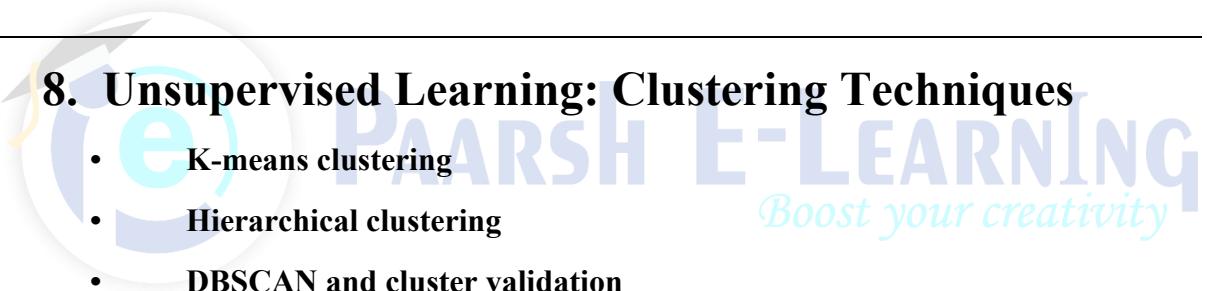
## **6. Supervised Learning: Classification Algorithms**

- **Logistic regression**
  - **K-nearest neighbors (KNN)**
  - **Support Vector Machines (SVM)**
  - **Decision trees and Naive Bayes**
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## **7. Model Evaluation, Validation & Selection**

- **Train/test split, cross-validation**
  - **Confusion matrix and metrics: precision, recall, F1-score**
  - **ROC curve and AUC**
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## **8. Unsupervised Learning: Clustering Techniques**

- **K-means clustering**
  - **Hierarchical clustering**
  - **DBSCAN and cluster validation**
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- The logo for Paarsh E-Learning features a stylized blue 'P' and 'e' intertwined. To the right of the 'P' is the word 'PAARSH' in a large, bold, blue sans-serif font. To the right of 'PAARSH' is the word 'E-LEARNING' in a larger, bold, blue sans-serif font. Below 'E-LEARNING' is the tagline 'Boost your creativity' in a smaller, italicized, light blue script font.

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## **9. Unsupervised Learning: Dimensionality Reduction**

- **Principal Component Analysis (PCA)**
  - **t-SNE and other dimensionality techniques**
  - **Curse of dimensionality**
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## **10. Ensemble Methods & Advanced Supervised Methods**

- **Bagging and Random Forests**
- **Boosting algorithms (e.g., AdaBoost, Gradient Boosting)**
- **Handling imbalance and advanced classifiers**

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## **11. Introduction to Neural Networks**

- **Basics of neural networks**
  - **Perceptrons and multi-layer networks**
  - **Brief intro to deep learning concepts**
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## **12. Practical Machine Learning Projects & Case Studies**

- **Implementation of ML models on real datasets**
  - **End-to-end model workflow**
  - **Problem statements and group presentations**
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## **13. Industry Tools & ML Deployment Basics**

- **Using ML tools like Jupyter, Google Colab**
  - **Introduction to model saving and basic deployment**
  - **Overview of cloud / ML Ops basics**
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## **14. Ethics, Challenges & Emerging Trends in ML**

- **AI & ML ethics**
  - **Challenges like bias, explainability**
  - **Trends: AutoML, scalable machine learning**
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