



MACHINE LEARNING COURSE

Prepared By (CTO) SYNTHOQUEST

45 Days Duration

Duration: 45 days × 2 hrs/day = 90 hrs

Goal: Equip learners with practical skills in machine learning algorithms, data preprocessing, model evaluation, and deployment using Python.

Core Domains

1. Introduction to Machine Learning (5%)

- Definition, history, and applications
- Supervised, unsupervised, and reinforcement learning
- ML workflow: data collection → preprocessing → training → evaluation → deployment

2. Mathematics & Statistics for ML (10%)

- Linear algebra: vectors, matrices, operations
- Probability & statistics: distributions, Bayes theorem
- Calculus basics: derivatives, gradients for optimization

3. Python for ML (10%)

- Python fundamentals: variables, loops, functions
- Libraries: NumPy, Pandas, Matplotlib, Seaborn
- Data preprocessing, visualization, and cleaning

4. Supervised Learning (20%)

- Regression: Linear, Polynomial
- Classification: Logistic Regression, Decision Trees, Random Forest, SVM
- Model evaluation: confusion matrix, accuracy, precision, recall, F1-score
- Overfitting, underfitting, cross-validation

5. Unsupervised Learning (15%)

- Clustering: K-Means, Hierarchical, DBSCAN
- Dimensionality reduction: PCA, t-SNE
- Anomaly detection basics

6. Feature Engineering & Model Selection (10%)

- Feature scaling, normalization, encoding categorical variables
- Feature importance and selection
- Hyperparameter tuning: Grid Search, Random Search

7. Advanced ML Algorithms (10%)

- Ensemble methods: Bagging, Boosting (XGBoost, AdaBoost)
- Gradient Boosting Machines
- Introduction to neural networks basics

8. Model Deployment & Tools (10%)

- Saving and loading models (pickle, joblib)
- Model deployment with Flask / FastAPI
- Cloud deployment basics: AWS Sagemaker / Azure ML

9. Project & Best Practices (10%)

- End-to-end ML projects
- Pipeline creation: preprocessing → model → evaluation → deployment
- Documentation, version control, and reproducibility

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