

## Machine Learning Fundamentals — AI Engineer Notes

### 1. Machine Learning Overview

Machine learning enables systems to learn patterns from data and make predictions without explicit rules.

### 2. Supervised Learning

Uses labeled data to learn input-output mappings. Common tasks include regression and classification.

### 3. Unsupervised Learning

Uses unlabeled data to discover hidden patterns such as clusters or latent structure.

### 4. Regression

Predicts continuous numerical values such as cost, demand, or workload.

### 5. Classification

Predicts discrete class labels such as yes/no or categories.

### 6. Bias–Variance Tradeoff

Bias is error from overly simple models; variance is error from sensitivity to noise. Good models balance both.

### 7. Regression Metrics

MAE, MSE, RMSE, and R<sup>2</sup> measure prediction error magnitude and consistency.

### 8. Classification Metrics

Accuracy, Precision, Recall, F1-score, and ROC-AUC measure classification quality.

### 9. scikit-learn

A Python library providing tools for preprocessing, modeling, evaluation, and ML pipelines.

### 10. MLflow

An ML lifecycle platform for experiment tracking, model versioning, and deployment.

### 11. Why These Matter

These fundamentals underpin nearly all applied ML systems in production.

### 12. Interview Summary

Supervised vs unsupervised learning, regression vs classification, bias–variance, metrics, scikit-learn, and MLflow form the core of ML engineering.

### 13. Key Takeaway

Strong fundamentals matter more than complex algorithms.