Introduction to Machine Learning

Chapter 1: Basics

Definition of Machine Learning

Machine Learning is a field of Artificial Intelligence (AI) that enables systems to learn and improve from experience without being explicitly programmed. It focuses on the development of algorithms that can process and analyze data to make decisions or predictions.

Supervised vs Unsupervised

- Supervised Learning involves training a model using labeled data.
- Unsupervised Learning uses unlabeled data to identify patterns and groupings within the dataset.

Common Applications

Machine Learning is widely used in:

- Email spam detection
- Recommendation engines (e.g., Netflix, Amazon)
- Speech and image recognition
- Fraud detection in banking
- Predictive maintenance in manufacturing

Chapter 2: Algorithms

Linear Regression

Linear Regression is one of the simplest and most widely used algorithms in Machine Learning. It models the relationship between a dependent variable and one or more independent variables using a straight line.

Mathematical Formulation

The equation of a simple linear regression model is:

y = b0 + b1*x + e

Where:

- y is the predicted output

- x is the input feature

- b0 is the intercept

- b1 is the coefficient/slope

- e is the error term

Implementation Tips

- Always normalize your data if features vary in scale.

- Use techniques like cross-validation to avoid overfitting.

- Evaluate model performance with R^2 score or Mean Squared Error (MSE).