AI and Machine Learning Fundamentals

1. Lecture Flow

Introduction to AI & Machine Learning

- What is Artificial Intelligence?

- AI vs Machine Learning vs Deep Learning

- Applications of AI & ML

Fundamentals of Machine Learning

- Supervised, Unsupervised, and Reinforcement Learning

- Key ML Algorithms (Linear Regression, Decision Trees, SVM, etc.)

- Overfitting, Underfitting, and Model Evaluation

Deep Learning & Neural Networks

- Introduction to Neural Networks

- Activation Functions & Backpropagation

- Convolutional Neural Networks (CNNs) & Recurrent Neural Networks (RNNs)

AI & ML Tools and Frameworks

- Python for AI: NumPy, Pandas, Matplotlib

- Machine Learning Libraries: Scikit-Learn, TensorFlow, PyTorch

- Cloud-Based AI: Google AI, AWS SageMaker

Ethics & Future of AI

- Bias in AI & Ethical Concerns

- AI in Business & Industry Trends

- Future Prospects of AI & ML

2. Essential Handbook

Key Concepts

- Feature Engineering & Data Preprocessing

- Train-Test Split & Cross-Validation

- Hyperparameter Tuning & Model Optimization

- Ensemble Learning (Bagging, Boosting)

- Natural Language Processing (NLP) Basics

Popular AI & ML Tools

- Jupyter Notebook & Google Colab

- Scikit-Learn for ML Model Development

- TensorFlow & PyTorch for Deep Learning

- OpenCV for Computer Vision

- NLP Libraries: NLTK, SpaCy

3. Interview Questions

Conceptual Questions

1. Explain the difference between AI, ML, and Deep Learning.

2. What is the difference between supervised and unsupervised learning?

3. How do you prevent overfitting in ML models?

4. What is the purpose of an activation function in a neural network?

5. Explain bias-variance tradeoff in machine learning.

Practical Questions

1. Implement a simple linear regression model using Scikit-Learn.

2. How would you handle missing data in a dataset?

3. Demonstrate how to use a CNN for image classification.

4. Train an NLP model using word embeddings.

5. Optimize a deep learning model using hyperparameter tuning.

4. Assignments

Hands-on Practice

1. **Build a Regression Model:** Train a linear regression model to predict house prices.

2. **Classify Images:** Train a CNN model for image classification using TensorFlow.

3. **Text Classification:** Use NLP techniques to classify emails as spam or not spam.

4. **Deploy an AI Model:** Deploy a trained ML model as an API using Flask.

5. **Analyze Sentiment:** Perform sentiment analysis on tweets using NLP.

End of Handbook