3-Week AI-ML Learning Roadmap

Week 1: Foundations & Core ML

Python & Math Essentials

- Python basics: data types, loops, functions, OOP concepts
- NumPy fundamentals: arrays, broadcasting, vectorization
- Linear algebra basics: vectors, matrices, dot products
- Statistics: mean, median, standard deviation, distributions

Data Handling & Visualization

- Pandas: DataFrames, data cleaning, merging, groupby operations
- File handling: CSV, JSON, text files
- Matplotlib/Seaborn: plots, charts, heatmaps
- Data preprocessing: handling missing values, scaling, encoding
- **Mini Project**: Exploratory Data Analysis (EDA) on a dataset

Supervised Learning - Regression

- Linear Regression theory and implementation
- Polynomial Regression
- Regularization: Ridge, Lasso, ElasticNet
- Evaluation metrics: MSE, RMSE, MAE, R^2
- Train-test split, cross-validation
- **Project**: Price Predictor using dataset

Supervised Learning - Classification

- Logistic Regression
- Decision Trees & Random Forests
- K-Nearest Neighbors (KNN)
- Evaluation: confusion matrix, precision, recall, F1-score, ROC-AUC
- **Project**: Classification or Prediction

Week 2: Advanced ML & Deep Learning

Unsupervised Learning

- K-Means Clustering
- Hierarchical Clustering
- Principal Component Analysis (PCA)
- Dimensionality reduction techniques
- **Project**: Customer Segmentation using K-Means

Introduction to Neural Networks

- Perceptron and activation functions
- Forward propagation and backpropagation
- Gradient descent and optimizers
- Building neural networks with NumPy
- Introduction to TensorFlow/Keras
- **Project**: MNIST Digit Classifier (Simple NN)

Deep Learning - CNNs

- Convolutional layers and filters
- Pooling layers
- CNN architectures
- Image preprocessing and augmentation
- Transfer learning basics
- **Project**: Cat vs Dog Image Classifier

Deep Learning - RNNs

- Sequential data and RNN basics
- LSTM and GRU cells
- Time series forecasting
- Text sequence processing
- **Project**: Simple Stock Price Predictor or Text Generation

Week 3: NLP, Modern AI & Deployment

Natural Language Processing

- Text preprocessing: tokenization, stemming, lemmatization
- Bag of Words, TF-IDF
- Word embeddings: Word2Vec basics
- Sentiment analysis techniques
- Named Entity Recognition (NER)
- **Project**: Movie Review Sentiment Analyzer

Transformers & Modern NLP

- Attention mechanism basics
- Introduction to Transformers
- Using Hugging Face models
- Pre-trained models: BERT, GPT basics
- Fine-tuning for specific tasks
- **Project**: Text Classification with BERT

LLMs & Prompt Engineering

- Introduction to Large Language Models
- OpenAI API basics
- Prompt engineering patterns
- Few-shot learning
- Building simple chatbots
- **Project**: Q&A Bot using OpenAI API

LangChain Fundamentals

- Chains and prompt templates
- Memory management
- Basic agent concepts
- **Project:** AI-powered chatbot with context awareness

RAG (Retrieval-Augmented Generation) Fundamentals

- Introduction to FAISS
- LangChain retrieval-augmented generation (RAG) tasks
- Ingestion of data for RAG systems: collecting and processing raw data
- Storing and indexing embeddings for efficient retrieval
- Retrieval process: searching for relevant documents or data based on query
- **Project:** Chatbot with access to Vector DB