

Generative AI

1. Foundations of Python

- Python Basics
 - Variables, expressions, and data types.
 - Conditional and looping statements.
 - Input/output and file handling.
- Data Structures
 - Lists, tuples, sets, and dictionaries.
 - Comprehensions and advanced operations.
 - Practical tasks: Build a basic calculator or simple data parser.
- Functions and Best Practices
 - Functions: Lambda, map, filter, reduce, decorators.
 - Writing modular and reusable code.
 - Debugging techniques and tools (e.g., pdb).
 - Virtual environments and dependency management (pip, venv).

2. Foundations of Data Analysis

- Introduction to NumPy and pandas
 - NumPy: Arrays, indexing, and broadcasting.
 - pandas: Series, DataFrames, and basic operations.
 - Hands-on: Clean and transform a sample dataset.
- Advanced pandas
 - Merging, pivoting, and custom aggregations.
 - Grouping and time-series analysis.
 - Practical: Perform EDA on a dataset with real-world challenges.
- Visualization with Matplotlib and Seaborn
 - Basics of matplotlib: Line, bar, scatter plots.
 - Seaborn: Heatmaps, pair plots, and advanced visualizations.
 - Practical: Visualize insights from the EDA dataset.

3. Machine Learning

- Introduction to Machine Learning
 - Overview: Types of ML (supervised, unsupervised, reinforcement).
 - ML workflow: Data preprocessing, training, evaluation.
 - Evaluation techniques: Train-test split, cross-validation.
 - Hands-on: Simple regression using scikit-learn.
- Supervised Learning
 - Regression: Linear and logistic regression.
 - Classification: Decision trees, Random Forests.
 - Hands-on: Build a classification model (e.g., predicting loan approval).
- Mini Project
 - End-to-end ML pipeline: Data cleaning, model training, evaluation.

4. Deep Learning

- Introduction to Neural Networks
 - Basics: Perceptrons, activation functions, backpropagation.
- Advanced Architectures

- ANN (Artificial Neural Networks).
- CNN (Convolutional Neural Networks): Architecture and applications.
- Transfer learning with pre-trained models (e.g., ResNet).
- Introduction to GANs
 - Basics: Generator and discriminator networks.
 - Hands-on: Simple GAN implementation.
- Mini Project
 - Build a simple image classifier or data generator using CNN or GAN.

5. Natural Language Processing (NLP)

- NLP Basics
 - Text preprocessing: Tokenization, stemming, lemmatization.
 - Named Entity Recognition (NER) and POS tagging.
 - Word embeddings: Word2Vec, GloVe.
- Advanced NLP Techniques
 - RNN, GRU, LSTM: Concepts and applications.
 - Transformers: Introduction and comparison with RNNs.
- Mini Project
 - Build a sentiment analysis or text generation tool.

6. Generative AI and LLMs

- Introduction to Language Models
 - Basics of LLMs: Tokens, embeddings, pretraining, fine-tuning.
 - Popular models: GPT, BERT, T5.
- Prompt Engineering
 - Basics: Zero-shot, one-shot, few-shot prompting.
 - Advanced: Chain-of-thought prompting, controlling style/tone.
 - Hands-on: Experiment with OpenAI API to refine prompts.
- Building LLM Applications
 - Develop applications using OpenAI, Hugging Face, or similar APIs.
 - Hands-on: Build a chatbot or summarization tool.
- LangChain
 - Introduction: Basics of LangChain and pipeline building.
 - Advanced: Customizing components, agents, and tools.
 - Hands-on: Implement a custom pipeline with LangChain.
- RAG and Semantic Search
 - Basics of retrieval-augmented generation (RAG).
 - Using vector databases (e.g., Pinecone) for semantic search.
 - Hands-on: Build a search tool with LangChain and vector databases.
- Fine-Tuning LLMs
 - Dataset preparation and fine-tuning basics.
 - Practical: Fine-tune a small model using Hugging Face.

7. Latest Cutting-Edge Topics

- Large Multimodal Models
 - CLIP and Flamingo: Concepts and applications.

- Hands-on: Experiment with image-text models like DALL-E or Stable Diffusion.
- LLM Agents and Plugins
 - ChatGPT Plugins and tool augmentation.
 - Hands-on: Build a custom agent with advanced tools.

8. AI and Society

- Ethical considerations and AI regulations.
- Real-world AI use cases in business.

Projects

1. Python Mini-Projects

Project Name: Personal Budget Tracker

- Objective: Build a Python program to track and categorize daily expenses.
- Skills Covered: Loops, conditionals, functions, dictionaries.

2. Data Analysis Mini-Projects

Project Name: Customer Purchase Analysis

- Objective: Use pandas and NumPy to analyze a dataset of customer purchases (e.g., total spending, most purchased items).
- Skills Covered: Data cleaning, grouping, pivot tables, and visualizations with seaborn/matplotlib.

3. Machine Learning Mini-Projects

Predict House Prices

- Objective: Build a regression model to predict house prices using features like area, bedrooms, and location.
- Skills Covered: Data preprocessing, linear regression, and model evaluation.

4. Deep Learning Mini-Projects

(a) Image Classification with CNNs

- Objective: Build a CNN to classify images from a dataset (e.g., CIFAR-10 or MNIST).
- Skills Covered: Neural networks, convolutional layers, and activation functions.

(b) Digit Generation with GANs

- Objective: Implement a basic GAN to generate handwritten digits similar to the MNIST dataset.
- Skills Covered: Generative modeling, discriminator/generator networks.

5. NLP Mini-Projects

(a) Sentiment Analysis

- Objective: Build a sentiment analysis model to classify customer reviews (positive/negative).
- Skills Covered: Text preprocessing, vectorization (TF-IDF/Word2Vec), and classification models.
- Bonus: Deploy the model using Streamlit.

(b) Text Summarizer

- Objective: Create a tool to summarize long articles using Hugging Face Transformers.
- Skills Covered: Fine-tuning transformers, text tokenization.

6. Generative AI Mini-Projects

(a) Chatbot with GPT API

- Objective: Create a chatbot using OpenAI's GPT API for customer support.
- Skills Covered: Prompt engineering, API integration, and context management.

(b) Semantic Search Engine

- Objective: Build a semantic search engine using vector databases (e.g., Pinecone) and LLMs.
- Skills Covered: Embedding generation, vector search, and retrieval-augmented generation (RAG).

7. Advanced Topics Mini-Projects

(a) RAG Pipeline for Document QA

- Objective: Create a retrieval-augmented generation pipeline using LangChain and an LLM.
- Skills Covered: Knowledge retrieval, embeddings, and vector databases.

(b) Image-Text Generation with Stable Diffusion

- Objective: Use a pre-trained Stable Diffusion model to generate images from text prompts.
- Skills Covered: Multi-modal AI, image generation.

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Project Training

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