
1. Environment Setup & Data Analysis

Preparing the digital factory and understanding raw materials (Data)

- Setting up Anaconda and venv virtual environments
- Advanced Python review: Lists, Dicts, Lambdas
- Handling data formats: CSV, JSON, Parquet
- Data structuring: Features vs Labels
- Cleaning missing data and statistical processing
- Data Visualization to extract patterns

Technologies: Pandas, NumPy, Matplotlib, Seaborn

2. Machine Learning (Supervised, Unsupervised & Reinforcement)

Building classic, advanced, and adaptive predictive engines

- Supervised Learning: Regression and Classification
- Unsupervised Learning: Clustering and Dimensionality Reduction
- Reinforcement Learning: Agents, Environments, Rewards, and Policies
- Classification algorithms: SVM, Random Forest, KNN
- Regression algorithms: Linear & Polynomial
- Clustering: K-Means
- Performance metrics & Overfitting prevention

Technologies: Scikit-Learn, Joblib, Scipy, OpenAI Gym

3. Deep Learning

Simulating the human brain with Neural Networks

- Neural Network architecture: Layers, Neurons, Activation
- Handling weights and Backpropagation
- PyTorch fundamentals and Tensors
- Building Loss Functions and Optimizers
- Convolutional Neural Networks (CNN)
- Recurrent Neural Networks (RNN)

Technologies: PyTorch, CUDA, TensorBoard

4. Natural Language Processing (NLP)

Enabling computers to read and understand human text

- Arabic and English text cleaning techniques
- Word Embeddings
- Using revolutionary Transformer models
- Sentiment Analysis
- Building QA Systems
- Using AraBERT for Arabic

Technologies: Transformers, HuggingFace, NLTK, AraBERT

5. Computer Vision

Analyzing images and understanding visual content

- Digital image processing basics using OpenCV
- Convolutional Neural Networks (CNN)
- Transfer Learning and using pre-trained models
- Real-time Object Detection
- Data Augmentation
- Using YOLO for fast object detection

Technologies: OpenCV, Pillow, Torchvision, YOLO

6. Speech AI

Converting speech to text and understanding tone

- Representing sound waves and frequencies (Spectrograms)
- Extracting audio features (MFCC)
- Speech-to-Text using Whisper
- Advanced Wav2Vec2 models

Technologies: Librosa, Torchaudio, Whisper, SoundFile

7. Final Projects

Crowning your learning journey by developing integrated practical projects

- Reinforcement Learning Agent (e.g., MountainCar or CartPole)
- Gesture Volume Control
- Hand Distance Measurement
- Virtual Calculator
- AI Virtual Keyboard
- Car Plate Recognition
- Image Steganography
- AI Virtual Mouse
- People Tracking and Counting
- Speech Recognition
- Building Multi-Task NLP model
- Text Summarization

Technologies: OpenCV, MediaPipe, YOLO, Transformers, Librosa, Gymnasium