

Deep AI Learning Roadmap by DEEPBYTO.

Foundation

Skills / Concepts:

- Python programming: basics, loops, functions, OOP
- Data structures: lists, dictionaries, sets, tuples
- Libraries: numpy, pandas, matplotlib, seaborn
- Mathematics:
 - Linear Algebra: vectors, matrices, dot products
 - Calculus: derivatives, gradients
 - Probability & Statistics: distributions, mean, variance
- Algorithms & Data structures basics

Projects:

- Simple calculator
- CSV data analysis
- Implement linear regression from scratch

Machine Learning

Skills / Concepts:

- ML workflow: data preprocessing → model → evaluation
- Supervised learning:
 - Regression: Linear, Polynomial, Ridge, Lasso
 - Classification: Logistic Regression, KNN, Decision Trees, Random Forest, SVM
- Unsupervised learning:
 - Clustering: K-Means, Hierarchical
 - Dimensionality reduction: PCA, t-SNE
- Evaluation metrics: accuracy, precision, recall, F1-score, confusion matrix

Libraries:

- scikit-learn, xgboost, lightgbm, matplotlib, seaborn

Projects:

- Titanic survival prediction
- Customer segmentation
- Model comparison on dataset

Deep Learning

Skills / Concepts:

- Neural Networks: perceptron, MLP
- Activation functions: Sigmoid, ReLU, Tanh, Softmax
- Loss functions: MSE, Cross-Entropy
- Backpropagation and gradient descent
- Regularization: Dropout, Batch Normalization
- Optimizers: SGD, Adam, RMSProp

Frameworks:

- PyTorch or TensorFlow/Keras

Projects:

- Digit recognition (MNIST)
- Fashion-MNIST classifier
- CIFAR-10 image classifier

Computer Vision (CV)

Skills / Concepts:

- Convolutional Neural Networks (CNNs)
- Transfer learning: ResNet, VGG, EfficientNet
- Object detection: YOLO, SSD
- Image segmentation: U-Net

Projects:

- Face recognition system
- Object detection in real-world images
- Image segmentation for medical images

Natural Language Processing (NLP)

Skills / Concepts:

- Text preprocessing: tokenization, stemming, lemmatization
- Word embeddings: Word2Vec, GloVe, FastText
- Transformers: BERT, GPT, attention mechanisms
- Sequence-to-sequence models

Projects:

- Chatbot
- Sentiment analysis
- Text summarization
- Language translation model

Generative AI

Skills / Concepts:

- Generative Adversarial Networks (GANs): DCGAN, StyleGAN
- Diffusion models: Stable Diffusion, DALL-E
- Large Language Models (LLMs)

Projects:

- AI-generated images
- Text-to-image application
- Music generation using AI

Reinforcement Learning (Optional/Advanced)

Skills / Concepts:

- Agent, environment, reward
- Q-Learning, Policy Gradients, DQN

Projects:

- Train AI to play games (CartPole, Flappy Bird)
- Simple self-learning simulations

Deployment & Production AI

Skills / Concepts:

- Build APIs: Flask, FastAPI
- Create dashboards: Streamlit, Gradio
- Cloud deployment: AWS, GCP, Azure
- Model serving: TensorFlow Serving, TorchServe
- Version control: Git, GitHub

Projects:

- Deploy image classifier online
- Deploy chatbot as web app
- Interactive AI dashboards

Research & Mastery

Skills / Concepts:

- Read and implement AI research papers
- State-of-the-art models: GPT, BERT, DALL-E
- Kaggle competitions for real-world datasets

- Large AI projects: content creation, recommender systems, multi-modal AI

Digital Innovations by DEEPBYTO.