

AI Engineer Lab Exercises

Basic Level (30+ Exercises)

Objective: Build foundational understanding of AI, Python programming, and core ML concepts.

Python for AI

- Write Python programs using loops, lists, and dictionaries.
- Develop functions and classes in Python.
- Handle exceptions and file operations.
- Use NumPy for array manipulation.
- Use Pandas for data loading and analysis.

Data Visualization

- Plot data using Matplotlib.
- Create interactive plots with Plotly.
- Build dashboards using Streamlit or Dash.
- Visualize correlations using Seaborn heatmaps.
- Display time-series trends and histograms.

Mathematics for AI

- Implement linear algebra operations using NumPy.
- Solve optimization problems with gradient descent.
- Plot sigmoid, tanh, and ReLU functions.
- Perform statistical analysis (mean, variance, std).
- Build a basic matrix multiplication engine.

Intro to Machine Learning

- Load datasets (Iris, Titanic) using Scikit-learn.
 - Split data into training/test sets.
 - Apply Linear Regression to predict values.
 - Train a classification model with Decision Trees.
 - Evaluate model accuracy using confusion matrix.
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Expertise : **AI, Machine Learning & Data Science \ Cybersecurity & Ethical Hacking**
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□ Intermediate Level (40+ Exercises)

Objective: Apply machine learning algorithms, work with real datasets, and start building intelligent systems.

Supervised Learning

- Implement Logistic Regression for binary classification.
- Train SVM on spam detection.
- Apply Random Forest for customer churn prediction.
- Use K-Nearest Neighbors for image classification.
- Optimize models using GridSearchCV.

Unsupervised Learning

- Apply K-Means clustering to customer segmentation.
- Use PCA for dimensionality reduction.
- Implement hierarchical clustering.
- Detect anomalies using Isolation Forest.
- Visualize clusters in 2D using T-SNE.

Natural Language Processing (NLP)

- Tokenize and clean text using NLTK.
- Build a sentiment analysis model using TF-IDF and Naive Bayes.
- Use spaCy for named entity recognition (NER).
- Create a chatbot with rule-based logic.
- Generate word clouds from review data.

Deep Learning Foundations

- Build neural networks using Keras or TensorFlow.
- Implement forward and backward propagation.
- Train a model for handwritten digit recognition (MNIST).
- Use dropout to prevent overfitting.
- Visualize training loss and accuracy.

□ Advanced Level (40+ Exercises)



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Objective: Engineer intelligent AI systems using advanced tools, models, and deployment techniques.

Advanced Neural Networks

- Implement CNN for image classification (CIFAR-10).
- Build LSTM models for time-series forecasting.
- Design a transformer model from scratch.
- Apply attention mechanisms for translation tasks.
- Use autoencoders for anomaly detection.

Generative AI

- Build a GAN to generate handwritten digits.
- Train a StyleGAN for facial synthesis.
- Use DALL·E/Stable Diffusion APIs for text-to-image generation.
- Generate music with RNN-based models.
- Create prompts for ChatGPT and fine-tune a GPT model.

Reinforcement Learning

- Build a Q-learning agent to play a simple grid game.
- Train an agent with Deep Q Networks (DQN).
- Simulate environments using OpenAI Gym.
- Use policy gradient methods.
- Analyze convergence and reward trends.

AI in Production

- Save and load ML models using joblib or pickle.
- Build REST APIs for model inference using FastAPI.
- Containerize AI models with Docker.
- Monitor AI models using Prometheus and Grafana.
- Set up CI/CD pipelines for MLOps.

Capstone Projects

- AI-powered chatbot with voice interface.
- Recommendation system for movies or products.
- Fraud detection system using supervised ML.
- Face recognition attendance system.
- AI assistant using NLP + voice commands.



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