AI ENGINEER PROFESSIONAL PROGRAM – 2025 EDITION

"Turn intelligent algorithms into impactful AI solutions"

Market Demand Note

The demand for AI Engineers is surging as organizations integrate AI into their products and services. From recommendation engines to speech recognition systems, AI Engineers are essential for designing, developing, and deploying AI applications that solve complex real-world problems.

Duration: 12 Weeks | Mode: Online/Offline

📘 AI Engineer Professional Program — 2025 Edition

Key Tools & Technologies:
Python, TensorFlow, PyTorch, Hugging Face Transformers, OpenCV, FastAPI, LangChain, Scikit-learn, Pandas, NumPy, Matplotlib, Docker, GitHub.

Learning Objectives

By the end of this program, learners will be able to:

1. Perform complex data wrangling and cleaning operations.
2. Conduct exploratory data analysis (EDA) with advanced visualization.
3. Build predictive models using machine learning.
4. Communicate insights using dashboards and storytelling techniques.
5. Apply data science workflows to solve real-world problems.

Table of Contents

Week	Title	Core Topics
1	AI Fundamentals & Project Setup	AI landscape, industry use cases, Python/PyTorch/TensorFlow setup, workflow overview
2	Data Handling for AI	Large-scale data loading, preprocessing for images, text, audio, feature engineering
3	Machine Learning Review	Supervised/unsupervised refresher, feature engineering, scikit-learn/pandas practice
4	Deep Learning Fundamentals	Neural networks (PyTorch/TensorFlow), training loops, evaluation, debugging
5	Computer Vision Applications	Image classification, object detection, transfer learning (ResNet, EfficientNet)
6	NLP Foundations	Tokenization, embeddings, transformers, sentiment/classification tasks
7	Advanced NLP with Hugging Face	BERT, GPT-style models, fine-tuning transformers for custom tasks
8	Speech & Audio AI	Speech-to-text, audio classification, open-source audio tools (Librosa, torchaudio)
9	Model Deployment	Model serialization, FastAPI, containerization (Docker), serving at scale
10	AI in the Cloud	AWS SageMaker, Azure ML, GCP Vertex AI, scaling workloads, cost optimization
11	Real-World AI Project	End-to-end solution building, testing, optimization, team collaboration
12	Capstone Project Presentation	Peer review, portfolio building, job preparation, live demos

Detailed Content

Week 1: AI Fundamentals & Project Setup

- AI Overview: History, current landscape, and industry applications (healthcare, finance, retail, IoT).
- Environment Setup: Python 3.10+, PyTorch 2.x, TensorFlow 2.x, JupyterLab, CUDA/GPU support.
- Datasets: Kaggle, Hugging Face, government open data.
- Workflows: Understanding the AI development lifecycle—data → model → train → test → deploy → monitor.
- Hands-on: Set up environment, explore datasets, and outline a project plan.

Industry Trend:
Companies expect AI engineers to be comfortable with both research and deployment stacks, and to understand the end-to-end ML workflow.

Week 2: Data Handling for AI

- Large-scale Data: Reading/writing from disk, databases, streaming sources.
- Preprocessing: Text (tokenization, cleaning), images (scaling, augmentation), audio (normalization, spectrograms).
- Feature Engineering: Creating new features, handling class imbalance, time-series processing.
- Hands-on: Preprocess a mixed dataset (text + images + audio), benchmark with Dask/Polars for large data.

Industry Demand:
Data engineering is now a core AI skill—expect to handle terabytes, streaming, and multimodal data.

Week 3: Machine Learning Review

- Supervised/Unsupervised: Regression, classification, clustering, dimensionality reduction.
- Feature Engineering: Domain-specific transforms, encoding (one-hot, embeddings), scaling.

- Hands-on: Build and optimize a pipeline on a real dataset (tabular, image, or text).

Job Market:
Engineers must know when to use classic ML vs. deep learning, and how to debug data issues.

Week 4: Deep Learning Fundamentals

- Neural Networks: Perceptrons, activation functions, backpropagation, loss functions.
- PyTorch/TensorFlow: Eager vs. graph mode, GPU acceleration, distributed training.
- Model Evaluation: Metrics, confusion matrices, learning curves.
- Hands-on: Train, validate, and interpret a neural net on a Kaggle dataset.

Current Tools:
PyTorch Lightning, TensorFlow Extended (TFX), JAX (for research) are trending.

Week 5: Computer Vision Applications

- Image Classification: From scratch and using transfer learning.
- Object Detection: YOLO, Faster R-CNN basics, custom datasets.
- Pretrained Models: ResNet, EfficientNet, Vision Transformers (ViT).
- Hands-on: Fine-tune a CNN on a custom image dataset, deploy as API.

Industry Application:
Computer vision is exploding in manufacturing, healthcare, retail, and smart cities.

Week 6: NLP Foundations

- Tokenization: WordPiece, SentencePiece, subword.
- Embeddings: Word2Vec, GloVe, FastText, contextual embeddings.
- Transformers: Attention, encoder/decoder, BERT/GPT architecture basics.
- Hands-on: Build and evaluate a sentiment analysis or text classification model.

Trend:
Most NLP is now transformer-based; fluency with Hugging Face is a job requirement.

Week 7: Advanced NLP with Hugging Face

- Pretrained Models: BERT, RoBERTa, GPT-3, T5, multilingual models.
- Fine-Tuning: Adapting models to domain tasks, parameter-efficient tuning (LoRA).
- Prompt Engineering: Zero-shot, few-shot, chain-of-thought.
- Hands-on: Fine-tune a transformer on a custom task, optimize prompts for quality.

Market Relevance:
Prompt engineers and LLM specialists are in high demand globally.

Week 8: Speech & Audio AI

- Speech-to-Text: Whisper, Wav2Vec, CTC/Transformer architectures.
- Audio Classification: Environment sound, speaker ID, emotion detection.
- Open-Source Tools: Librosa, torchaudio, ESPnet.
- Hands-on: Build a speech recognition or audio classification pipeline.

Trend:
Voice interfaces, call center analytics, and multimedia indexing are growth areas.

Week 9: Model Deployment

- Serialization: ONNX, TorchScript, TensorFlow SavedModel.
- APIs: FastAPI/Flask for model serving, Swagger/OpenAPI docs.
- Containerization: Docker for reproducibility, Kubernetes for scaling.
- Hands-on: Containerize and deploy a model as a REST API.

Industry Standard:
MLOps, CI/CD, and API-first deployment are now required skills.

Week 10: AI in the Cloud

- Cloud Platforms: SageMaker, Azure ML, Vertex AI—managed training, hosting, AutoML.
- Scaling: Spot/preemptible instances, auto-scaling, distributed training.
- Cost Optimization: Monitoring, rightsizing, serverless inferencing.
- Hands-on: Train and deploy a model on AWS/GCP/Azure, compare costs.

Cloud Skills:
Most enterprises run AI in the cloud; multi-cloud experience is a plus.

Week 11: Real-World AI Project

- Project Scope: Choose from capstone ideas or industry datasets (e.g., medical imaging, transaction logs, customer support tickets).
- End-to-End Pipeline: Data → prep → model → evaluate → deploy → monitor.
- Testing: Unit, integration, load testing.
- Hands-on: Deliver a production-grade AI solution with documentation.

Portfolio Value:
Recruiters prioritize candidates with shipped, documented projects.

Week 12: Capstone Project Presentation

- Peer Review: Code review, architecture feedback, bias/fairness analysis.
- Portfolio: GitHub repo, README, demo video, live API if possible.
- Job Prep: Resume tips, interview practice, LinkedIn/portfolio optimization.
- Hands-on: Present your project, answer technical and business questions.

Industry Expectation:
Strong communication, ethics awareness, and deployment experience separate juniors from seniors.

Capstone Project Ideas

- AI-Powered Customer Support Chatbot: Integrate LLM (GPT-4, Llama 2) with sentiment analysis for real-time assistance.

- Real-Time Object Detection: Deploy YOLO or EfficientDet for surveillance, retail analytics, or industrial quality control.
- Document Summarization & Classification: Automate legal, medical, or business document processing with NLP.

Tools & Platforms

- Languages: Python 3.10+
- Frameworks: PyTorch, TensorFlow, Hugging Face Transformers, OpenCV, FastAPI
- Data: Dask, Polars, Pandas, NumPy, scikit-learn
- Cloud: AWS (SageMaker, S3, EC2), Azure (ML, Blob), GCP (Vertex AI, Storage)
- Deployment: Docker, Kubernetes, GitHub Actions, MLflow
- Audio/Speech: Librosa, torchaudio, Whisper, Wav2Vec
- Visualization: Matplotlib, Seaborn, Plotly

Industry Trends & Market Demand (2025)

- Transformer Dominance: BERT, GPT, and vision transformers are the backbone of most AI applications.
- Multimodal AI: Combining text, image, and audio in single systems (e.g., CLIP, Flamingo).
- Cloud-Native AI: Training, inference, and monitoring are increasingly cloud-based.
- Ethics & Explainability: Responsible AI, bias detection, and model interpretability are now non-negotiable.
- MLOps Maturity: CI/CD, monitoring, retraining, and cost control are expected in production roles.
- Global Job Market: AI engineers with deployment, cloud, and communication skills command top salaries.