Program Name: Gen AI Engineering Fellowship:

Unlock Your AI Potential: Transition from software development to Generative AI engineering. Learn to build and deploy Large Language Model (LLM) applications using industry best practices, cutting-edge tools, and hands-on projects.

Who is the ideal participant?

The ideal participant is a software developer with experience in coding, building applications, and basic understanding of programming concepts, eager to transition into AI/LLM (Large Language Model) engineering. They are individuals who want to enhance their careers by acquiring cutting-edge skills in the field of Generative AI and large-scale language models.

What is their current knowledge or skill level?

- Participants are typically proficient in programming (Python is preferable), familiar with version control systems like Git, and comfortable with cloud platforms. They may have some exposure to machine learning concepts but lack deep expertise in applying AI, specifically LLMs, to real-world scenarios.

- The program is designed for individuals **with a developer-level background** rather than complete beginners. It is not a 0-to-1 program but aims to help experienced software developers and leaders transition into AI/LLM engineering roles and become technologically equipped.

Each week addresses a core component of **NLP, LLMs, RAG**, **Images** and **Agentic AI frameworks**—now with **dedicated focus** on Haystack and LlamaIndex.

Program Goal: You'll end up with a **production-ready, multi-agent AI application** that incorporates **retrieval ranking, response evaluation, and explanation**.

This course equips learners with the skills to **build enterprise-grade AI solutions** using **Python, NLP, LLMs, RAG**, and **Agentic AI frameworks**.

Program Schedule:

Program Onboarding/Kickoff Date - 12th April i.e Saturday 9AM - 12PM IST / 11th April i.e Friday 10:30PM - 1:30 AM EST)

Basecamp - two weeks

Main Program Start date (Live classes) - 26th April i.e Saturday 9AM - 12PM IST / 25th April i.e Friday 10:30PM - 1:30 AM EST)

Rest of the week - Watch session recordings, join community sessions, attempt assignments, clarify doubts through **Teaching Assistants** and attend guest sessions from Engineering leaders (once a month)

Phase 1 <> Base Camp: Environment Setup & Python Refresher

Session 1 – (12th April i.e Saturday 9AM - 12PM IST / 11th April i.e Friday 10:30PM - 1:30 AM EST)

🔷 **Setting Up Your Development Environment**

- Installing & configuring essential tools: **Groq, Virtual Environments, VS Code, Jupyter Lab, GitHub, GitHub Copilot, Gradio/Streamlit, Google Colab notebook, and Docker**
- Best practices for managing dependencies and optimizing your workspace

Session 2 - (13th April i.e Sunday 9AM - 12PM IST / 12th April i.e Saturday 10:30PM - 1:30 AM EST)

🔷 **Python Fundamentals & Performance Optimization**

- Core Python concepts: **Data structures (lists, tuples, dictionaries), string operations, slicing, loops, list comprehensions**
- Advanced techniques: **Iterators, generators, and functional programming (map, filter, reduce)**
- **Parallel Processing:** Understanding **threading vs. multiprocessing** for efficiency

Hands-On Exercises: Python coding challenges to solidify key concepts and boost problem-solving skills

Phase 2 <> Base Camp: FastAPI and App building

- **Session 1 - (19th April i.e Saturday 9AM - 12PM IST / 18th April i.e Friday 10:30PM - 1:30 AM EST)**
    - Intro to FastAPI: Creating RESTful APIs for AI services
    - Streamlit/Gradio basics for rapid prototyping of interactive UIs
- **Session 2 - (20th April i.e Sunday 9AM - 12PM IST / 19th April i.e Saturday 10:30PM - 1:30 AM EST)**
    - Building a basic web app using FastAPI + Streamlit/Gradio
    - Integrating simple NLP or classification endpoints

Task: Outline a Streamlit-based AI App for your capstone project

GenAI Engineering fellowship – 24-Week Plan

Week 1: NLP Processing with Python & Capstone Project Identification

Topics:

- **Session 1 - (26th April i.e Saturday 9AM - 12PM IST / 25th April i.e Friday 10:30PM - 1:30 AM EST)**
    - Text Data Techniques: Tokenization, String manipulation, Basic encodings (one-hot, multi-label), Intro to embeddings
    - Working with structured data (Pandas): Selecting, filtering, aggregations, joins
    - File Operations & Web Crawling (CSV, JSON, PDF, etc.)
- **Session 2 - (27th April i.e Sunday 9AM - 12PM IST / 26th April i.e Saturday 10:30PM - 1:30 AM EST)**
    - Brainstorming & discussion on potential capstone projects
    - Finalize project requirements

Task: Formalize capstone project scope based on data requirements and feasibility

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Week 2: Hugging Face Models

Topics:

- **Session 1 - (3rd May i.e Saturday 9AM - 12PM IST / 2nd May i.e Friday 10:30PM - 1:30 AM EST)**
    - Hugging Face: Overview of pre-trained models
    - Use cases: Classification, generation, summarization, translation, QA, image processing, Diffusion models
- **Session 2 - (4th May i.e Sunday 9AM - 12PM IST / 3rd May i.e Saturday 10:30PM - 1:30 AM EST)**
    - Customizing a pre-trained model with your own data
    - Best practices for fine-tuning

Task: Incorporate Hugging Face models into your capstone project for a specific NLP, CV, or translation task

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Week 3: LLMs, Prompt Engineering & Chatbot Building

Topics:

- **Session 1 - (10th May i.e Saturday 9AM - 12PM IST / 9th May i.e Friday 10:30PM - 1:30 AM EST)**
    - LLM Choices: GPT, LLaMA, and others
    - Prompt Engineering: Zero-shot, few-shot learning strategies, Code Generation
- **Session 2 - (11th May i.e Sunday 9AM - 12PM IST / 10th May i.e Saturday 10:30PM - 1:30 AM EST)**
    - LLM responses with user-defined functions
    - Building a Conversational Chatbot using Groq + LLaMA
    - Handling context, memory, and multi-turn dialogue flows

Task: Implement a Conversational Bot (with optional translation capability) for your capstone project

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Week 4: RAG for Text Data – Chunking, Vector Embedding, and Search

Topics:

- **Session 1 - (17th May i.e Saturday 9AM - 12PM IST / 16th May i.e Friday 10:30PM - 1:30 AM EST)**
    - Chunking Strategies for large documents
    - Keyword Search fundamentals
    - Vectorization (transformers, embeddings)
- **Session 2 - (18th May i.e Sunday 9AM - 12PM IST / 17th May i.e Saturday 10:30PM - 1:30 AM EST)**
    - Storing embeddings in a Vector Database (FAISS/QDrant)
    - Keyword-based vs. Semantic Search
    - Intro to Retrieval-Augmented Generation (RAG)

Task: Implement an AI-powered Search Engine in your capstone project

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Week 5: Advanced RAG Concepts

Dates: (24 & 25th May i.e Saturday and Sunday 9AM - 12PM IST / 23rd and 24th May i.e Friday and Satuday 10:30PM - 1:30 AM EST)

Topics:

- Chunking Strategies: Overlapping, Augmented, fixed-size, content-aware, KG
- Embedding Strategies: Comparing various embedding models
- Retrieval Strategies: Similarity search, hybrid search, filtering
- RAG Fusion: Combining search results for improved accuracy
- Retrieval Ranking: Tuning for best results
- GuardRails, Response Evaluation & Explanation (DeepEval-like tools)
- **Project Task:** Develop a RAG-based Chatbot from personal or project-specific data, exploring response evaluation and explanations

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Week 6: RAG for Tabular Data

Topics:

- **Session 1 - (May 31st i.e Saturday 9AM - 12PM IST / May 30th i.e Friday 10:30PM - 1:30 AM EST)**
    - Introduction to RDBMS
    - Extracting information from relational databases
- **Session 2 - (1st June i.e Sunday 9AM - 12PM IST / May 31st i.e Saturday 10:30PM - 1:30 AM EST)**
    - Strategies for embedding tabular data or augmenting with text-based RAG
    - Best practices for storing and querying structured data

Task: Extend your capstone project to include structured data retrieval

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Week 7: Multimodal AI

Topics:

- **Session 1 & 2 - (7 & 8th June i.e Saturday and Sunday 9AM - 12PM IST / 6th and 7th June i.e Friday and Saturday 10:30PM - 1:30 AM EST)**
    - Introduction
    - Opportunities of Multimodal AI
    - Comparing multimodal AI and its evolution
    - Multimodal AI applications and business case
    - Implementation Challenges of multimodal AI

Week 8: GPT's visual capabilities

Topics:

- **Session 1 & 2 (14 & 15th June i.e Saturday and Sunday 9AM - 12PM IST / 13th and 14th June i.e Friday and Saturday10:30PM - 1:30 AM EST)**

    - Multimodal Representation
    - Alignment and fusion
    - Multimodal understanding
    - Multimodel generation

- Diffusion model

Week 9: RAG with Image/Video/Audio

Topics:

- **Sessions - (21st June i.e Saturday 9AM - 12PM IST / 20th June i.e Friday 10:30PM - 1:30 AM EST)**
  - RAG in multimodal AI
  - Visual Question answering
  - Image and video captioning
  - Audio processing
  - Capstone Projects
  - Conclusion

Week 10: LLM Use Cases – BrainStorming for Capstone

Session Dates: (28 - 29th June i.e Saturday and Sunday 9AM - 12PM IST / 27-28th June i.e Friday and Saturday 10:30PM - 1:30 AM EST)

Topics:

- Summarization Techniques: Extractive vs. Abstractive
- Text Generation with LLMs
- Real-World Applications: Translation, report generation, document summarization, content writing etc
- Customizing models with custom data

Project Task: Build an LLM-based Summarization (or Translation) Tool for your capstone project

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Week 11: Introduction to Agentic AI

Topics:

- **Session 1 - (5th July i.e Saturday 9AM - 12PM IST / 4th July i.e Friday 10:30PM - 1:30 AM EST)**
    - Understanding AI Agents
    - How Agentic AI extends traditional AI systems with autonomy and decision-making
- **Session 2 - (6th July i.e Sunday 9AM - 12PM IST / 5th July i.e Saturday 10:30PM - 1:30 AM EST)**
    - Agent Framework Overviews: CrewAI, phiData, LangChain, Haystack, LlamaIndex
    - Benefits and pitfalls of using AI agents in enterprise solutions

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Weeks 12–16: Agentic AI Frameworks

Each week covers a unique AI framework, emphasizing specialized tools and integrations:

Week 12: Building AI Agents with CrewAI

Key Focus & Tools:

- **Multi-Agent Collaboration:** Coordinating specialized AI agents
- **Role-Based Agent Design:** Assigning specific capabilities to agents
- **Workflow Automation:** Defining business-specific workflows and task sequencing
- **Custom Tool Integration:** Developing specialized tools tailored for agent tasks

Topics & Labs:

🔷 Session 1 - (12th July i.e Saturday 9AM - 12PM IST / 11th July i.e Friday 10:30PM - 1:30 AM EST)

- Setting up the CrewAI environment and defining agent attributes
- Assigning tools to agents and sequencing task execution
- Integrating CrewAI agents into an existing RAG-based chatbot

🔷 Session 2 – (13th July i.e Sunday 9AM - 12PM IST / 12th July i.e Saturday 10:30PM - 1:30 AM EST)

- Incorporating external tools from frameworks like LangChain
- Designing and implementing custom tools for AI agents
- Testing and debugging multi-agent workflows

Task: Implement a CrewAI-based multi-agent workflow within your capstone project

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Week 13: Building AI Agents with phiData

Key Focus & Tools

- **Data-Centric AI Agents:** Managing structured and unstructured data
- **Data Pipeline Integration:** Connecting to diverse data sources
- **Retrieval Ranking:** Optimizing knowledge base search with LanceDB
- **Response Explainability:** Enhancing AI explanations for tabular data

Topics

🔷 **Session 1 (19th July i.e Saturday 9AM - 12PM IST / 18th July i.e Friday 10:30PM - 1:30 AM EST)**

- Deploying phiData and defining agent structures
- Setting up data ingestion from databases (RDBMS, CSV, JSON)
- Exploring the built-in phiData playground

🔷 **Session 2 (20th July i.e Sunday 9AM - 12PM IST / 19th July i.e Saturday 10:30PM - 1:30 AM EST)**

- Developing an AI-powered analytics agent for financial or stock data
- Building a custom toolkit for advanced data handling and retrieval-augmented generation (RAG)

Task: Integrate a phiData agent to handle data-intensive tasks in your capstone project

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Week 14: Building AI Agents with LangChain/LangGraph

Key Focus & Tools:

- **LLM-Centric Pipelines:** Optimizing memory, context, and prompt chaining
- **Tool & API Integrations:** Connecting to external services and databases
- **Conversation-Driven Agents:** Implementing multi-functional agents (e.g., summarizer, ranker, translator)
- **Response Evaluation:** Assessing outputs using chain-of-thought reasoning