ADaSci Certified Generative AI Engineer
Syllabus

1. **Foundations of Generative AI**
    a. Machine Learning (ML) Paradigms
    b. Neural Networks, Architectures, Activation Functions, Optimization Techniques
    c. Representation Learning, Embeddings, Feature Engineering
    d. Probabilistic Models, Bayesian Networks, Hidden Markov Models (HMMs)
    e. Reasoning and Planning
    f. Natural Language Processing, Tokenization, Part-of-Speech (POS) tagging, Named Entity Recognition (NER), Word2Vec
    g. Computer Vision, Image classification, Object detection, Image segmentation
    h. Foundation Models and Their Roles

2. **Language Modelling and Transformers**
    a. Sequential Data Modeling, Recurrent Neural Networks (RNNs), Encoder-Decoder Models
    b. Natural Language Generation and Understanding
    c. Multilingual Language Models, Cross-lingual learning
    d. Attention Mechanisms, Transformers, Self-attention, Multi-head attention
    e. Pre-trained Transformers: BERT, GPT, T5, XLNet, LaMDA, etc.
    f. Conditional Language Generation, Text summarization, Question answering
    g. Textual Encoding and Decoding: Tokenization, Byte Pair Encoding (BPE)

3. **Large Language Models**
    a. Weight, Bias and Parameters of Language Models
    b. Reasoning and Commonsense Knowledge Integration
    c. Multimodal Learning and Embeddings
    d. Memory and Efficiency Optimization
    e. GPT, LLaMA, LaMDA, PaLM, Gemini, Falcon, BLOOM
    f. Zero-shot and Few-shot Learning
    g. Evaluation Metrics for LLMs

4. **Generative AI and LLM Frameworks**
    a. Tensorflow and PyTorch
    b. Hugging Face
    c. LangChain
    d. LlamaIndex
    e. Generative AI providers - OpenAI, Cohere, Anthropic, LLMFlow
    f. Generative AI Agents, AutoGPT, AgentGPT, BabyAGI
    g. Code Generative Tools - Amazon CodeWhisper, OpenAI Codex
    h. Open-source Tools and Resources for Generative AI

5. **Image Generative Models**
    a. Autoencoder and its Variants
    b. Generative Adversarial Networks (GANs)
    c. Style Transfer and Image Transformation
    d. Latent Diffusion Model
    e. Stable Diffusion
    f. DALL.E
    g. Contrastive Language-Image Pre-Training (CLIP)
    h. Attention Mechanisms in Image Generation
    i. Hierarchical Text-Conditional Image Generation with CLIP Latents

6. **Prompt Engineering**
    a. Prompt Design Strategies
    b. Task Formulation in Prompts
    c. Prompt Patterns
    d. Prompt Tuning Techniques
    e. Fine-tuning Prompts for Specific Tasks
    f. Domain-specific Prompt Engineering
    g. Dynamic and Adaptive Prompting
    h. Zero-shot learning, Chain-of-thought, Self-consistency
    i. Evaluating Prompt Performance

7. **Vector Databases and Search**
    a. Vector Databases
    b. High-dimensional Data Storage
    c. Vector Embeddings
    d. High-Dimensional Semantic Similarity
    e. Personalized Search, Multimodal Search, Knowledge Graph Search
    f. Semantic search, Conversational search, Visual search
    g. Personalization and Relevance Ranking
    h. Evaluation of Search Systems

8. **Fine Tuning and Optimizing the LLMs**
    a. Hyperparameter Tuning and Optimization
    b. Data Augmentation for Fine-tuning
    c. Prompt Tuning
    d. Retrieval-Augmented Generation (RAG)
    e. Parameter Efficient Fine Tuning (PEFT) Techniques
    f. Reinforcement Learning from Human Feedback (RLHF)
    g. Efficient Training Pipeline

9. **Deployment and Scaling of Generative Models**
    a. Model Deployment Strategies
    b. Scalability and Resource Management for Generative Models

c. Automated Pipelines for Model Deployment
d. Versioning and Rollback Strategies
e. Model Monitoring and Performance Tracking
f. Interoperability and Compatibility
g. Robustness and Error Handling in Model Deployment
h. Security Measures in Model Deployment
i. AIOps and LLMOps

10. Security, Ethics and Bias in Generative AI

a. Deepfakes and Misinformation
b. Privacy and Data Security
c. Privacy-Preserving Generative Models
d. Explainability and Transparency
e. Bias Detection and Mitigation
f. Impact of Generative AI on Society
g. Accountability and Responsibility

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