Comprehensive Generative AI Learning Path

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Contents

1 Foundations of Generative AI

1.1 Introduction to Generative AI

- Overview of generative models and applications.
  - DeepLearning.AI Generative AI for Beginners
    https://github.com/microsoft/generative-ai-for-beginners
  - Big Book of Generative AI by Databricks
    https://www.databricks.com/resources/ebook/big-book-generative-ai

1.2 Large Language Models (LLMs) Basics

- Learn about LLMs, tokenization, embeddings, and transformers.
  - Building LLMs from Scratch (15 Lectures)
    https://lnkd.in/gifp9PkM
  - Transformer Architecture Explained
    https://jalammar.github.io/illustrated-transformer/
  - Transformers from Scratch in Python
    https://towardsdatascience.com/build-your-own-transformer-from-scratch-using-pytorch-84c850470dcb

2 Prompt Engineering

2.1 Basics of Prompt Engineering

- Techniques like zero-shot, one-shot, few-shot learning, and chain-of-thought prompting.
  - Prompt Engineering Guide
    https://aman.ai/primers/ai/prompt-engineering/
  - LangChain Prompt Templates
    https://lnkd.in/dVkuiizQ

2.2 Advanced Prompt Engineering

- Generated knowledge, prompt chaining, and ReAct.
  - Prompt Tuning with Hugging Face
    https://huggingface.co/docs/peft/task_guides/clm-prompt-tuning
  - NVIDIA Blog on Prompt Engineering
    https://developer.nvidia.com/blog/an-introduction-to-large-language-models-prompt-engineering-and

3 Generative Models

3.1 Diffusion Models

- Learn how diffusion models generate images and other content.
  - Diffusion Models Explained
    https://towardsdatascience.com/diffusion-models-made-easy-8414298ce4da
  - Illustrated Stable Diffusion
    https://jalammar.github.io/illustrated-stable-diffusion/

3.2 GANs (Generative Adversarial Networks)

- Explore GAN architectures and applications.
  - Understanding GANs
    https://towardsdatascience.com/understanding-generative-adversarial-networks-gans-cd6e4651a29
  - GAN Lecture Series
    https://lnkd.in/eSf66zT

4 Building AI Agents

4.1 AI Agent Frameworks

- Learn frameworks like LangChain, CrewAI, and AutoGen.
  - LangChain Crash Course
    https://medium.com/databutton/getting-started-with-langchain-a-powerful-tool-for-working-with-lar
  - CrewAI GitHub Repository
    https://github.com/joaomdmoura/crewAI

4.2 Multi-Agent Systems

- Practical workflows for multi-agent environments.
  - Multi AI Agent Systems with CrewAI
    https://lnkd.in/dTudrD55
  - OpenAI Agents SDK in Python
    https://github.com/openai/openai-agents-python

5 Retrieval-Augmented Generation (RAG)

5.1 Basics of RAG

- Combine LLMs with external knowledge bases using vector databases.
  - Guide to RAG Frameworks
    https://deepchecks.com/practical-guide-to-crafting-your-first-llm-powered-app-using-rag-framework
  - LangChain for RAG Applications
    https://medium.com/mlearning-ai/create-a-chatbot-in-python-with-langchain-and-rag-85bfba8c62d2

5.2 Vector Databases

- Learn about vector search and embedding storage solutions.
  - Introduction to Vector Databases
    https://weaviate.io/blog/what-is-a-vector-database
  - FAISS Tutorial
    https://medium.com/mlearning-ai/mastering-similarity-searches-building-a-faiss-index-with-cosine-

6 Fine-Tuning LLMs

6.1 Parameter-Efficient Fine-Tuning (PEFT)

- Techniques like LoRA and QLoRA for efficient tuning.
  - Fine-Tuning with LoRA
    https://abvijaykumar.medium.com/fine-tuning-llm-parameter-efficient-fine-tuning-peft-lora-qlora-p
  - Hugging Face Blog on PEFT
    https://huggingface.co/blog/trl-peft

6.2 Instruction Fine-Tuning

- Customize LLMs for specific tasks using instruction tuning.
  - Instruction Fine-Tuning Guide
    https://medium.com/@ud.chandra/instruction-fine-tuning-llama-2-with-pefts-qlora-method-d6a801ebb1
  - Fine-Tune Your Own Llama Model in Colab
    https://towardsdatascience.com/fine-tune-your-own-llama-2-model-in-a-colab-notebook-df9823a04a32

7 Reinforcement Learning from Human Feedback (RLHF)

7.1 Introduction to RLHF

- Understand how RLHF improves model alignment with human preferences.
  - Hugging Face RLHF Blog
    https://huggingface.co/blog/rlhf
  - Short Course on RLHF by DeepLearning.AI
    https://www.deeplearning.ai/short-courses/reinforcement-learning-from-human-feedback/

8 Model Context Protocol (MCP)

8.1 Fundamentals of MCP

- Understanding the Model Context Protocol for LLM interactions.
  - Anthropic's MCP Guide
    https://github.com/anthropics/anthropic-cookbook/blob/main/model_context_protocol/model_context_pr
  - Claude MCP Documentation
    https://docs.anthropic.com/claude/docs/model-context-protocol

8.2 Implementing MCP in Applications

- Practical implementations and best practices.
  - Structured Outputs with Claude 3 MCP
    https://medium.com/@saitejasagi/structured-outputs-with-anthropics-claude-3-model-context-protoco
  - OpenAI's Approach to Structured Outputs
    https://github.com/openai/openai-cookbook/blob/main/examples/How_to_format_inputs_to_ChatGPT_models

8.3 Advanced MCP Patterns

- Complex data extraction and validation patterns.
  - Anthropic Research on MCP
    https://www.anthropic.com/research/claude-3-model-context-protocol
  - MCP Implementation Examples
    https://github.com/ArnaudBuchholz/reserve-mcp

9 Deployment of Generative AI Models

9.1 Local Deployment

- Run models locally on your machine.
  - 5 Free Tools for Local Deployment of LLMs
    https://lnkd.in/dJsRrn2c

9.2 Serverless Deployment

- Deploy serverless applications using platforms like AWS Bedrock.
  - Serverless Workflows with Amazon Bedrock
    https://lnkd.in/dENcD795

9.3 Edge Deployment

- Bring generative AI capabilities to edge devices.
  - Deploying LLMs at the Edge with NVIDIA IGX Orin Developer Kit
    https://lnkd.in/d94BxVjw

10 Evaluation Metrics for Generative AI Models

10.1 Error Metrics and Loss Computation

- Evaluate model performance using metrics like BLEU score and perplexity.
  - Foundations of NLP Metrics: BLEU Score and WER Metrics
    https://towardsdatascience.com/foundations-of-nlp-explained-bleu-score-and-wer-metrics-1a5ba06d81
  - Perplexity in Language Models Explained
    https://medium.com/@priyankads/perplexity-of-language-models-41160427ed72

10.2 Advanced Evaluation Frameworks

- Comprehensive evaluation strategies for generative models.
  - OpenAI Evals Framework
    https://github.com/openai/evals
  - Hugging Face Evaluation Leaderboard
    https://huggingface.co/spaces/evaluate-measurement/leaderboard

11 Practical Projects and Applications

11.1 End-to-End Gen AI Projects

- Build complete applications leveraging generative AI.
  - LangChain Practical Projects
    https://github.com/gkamradt/langchain-tutorials
  - Microsoft TaskWeaver Framework
    https://github.com/microsoft/TaskWeaver

11.2 Industry-Specific Applications

- Learn how generative AI is transforming specific industries.
  - McKinsey: Generative AI in Healthcare
    https://www.mckinsey.com/capabilities/quantumblack/our-insights/generative-ai-in-healthcare
  - AWS Gen AI Case Studies
    https://aws.amazon.com/solutions/case-studies/generative-ai/

12 Ethical Considerations and Responsible AI

12.1 Ethical Frameworks

- Understanding ethical considerations in generative AI development.
  - Stanford HAI Ethics Framework
    https://hai.stanford.edu/sites/default/files/2020-09/AI-Ethics-Framework_HDSI.pdf
  - UNESCO AI Ethics Guidelines
    https://www.unesco.org/en/artificial-intelligence/recommendation-ethics

12.2 Bias Mitigation

- Techniques to identify and reduce bias in generative models.
  - Ethical Considerations in NLP Research
    https://huggingface.co/blog/ethics-soc-2
  - Anthropic's Red Teaming Approach
    https://www.anthropic.com/research/red-teaming-language-models-to-reduce-harms

13 Future Directions in Generative AI

13.1 Multimodal Models

- Explore models that handle multiple modalities (text, image, audio).
  - GPT-4V System Card
    https://openai.com/research/gpt-4v-system-card
  - Multimodal Reasoning in LLMs
    https://huggingface.co/blog/multimodal-reasoning

13.2 AI Research Frontiers

- Cutting-edge research directions in generative AI.
  - Mamba: State-Space Models
    `https://arxiv.org/abs/2312.11805`
  - Practical Guide to LLMs in Production
    `https://github.com/Mooler0410/LLMsPracticalGuide`

14 Community Resources and Continuous Learning

14.1 Open Source Communities

- Join communities to collaborate and learn from peers.
  - Hugging Face Community
    `https://huggingface.co/`
  - LAION AI Organization
    `https://github.com/LAION-AI`

14.2 Conferences and Workshops

- Stay updated with the latest research through conferences.
  - NeurIPS Conference
    `https://neurips.cc/`
  - ACL Conference Proceedings
    `https://aclanthology.org/venues/acl/`