

2024 Roadmap to Generative AI Mastery:

From Basics to Advanced Concepts

Here's a step-by-step guide designed for absolute beginners looking to acquire skills in **Generative AI**.

The roadmap incorporates free learning resources for both technical and tool-related skills.

Different Positions or Different Levels:

- Developer Level 1 or Beginner Level
- Devoloper Level 2 or Senior Level
- Researcher Level



This Roadmap is broken into many sections:



What is Generative AI?

Generative AI generates new data based on training samples. Generative models can generate Image, Text, Audio, Videos etc. data as output.

So generative AI is a very huge topic,

- Generative Image Model(GANs, Various Diffusions Models)
- Generative Language Model(LLMs)

When I refer to large language models, I mean natural language processing. Since NLP forms the foundation of massive language-generated models(LLMs).

Useful Learning Resource:

- **Gen AI Introduction Video In English-**
<https://www.youtube.com/watch?v=ajWheP8ZD70&t=3906s>
- **Gen AI Introduction Video In Hindi-**
https://www.youtube.com/watch?v=l_a5hop_KU&t=3160s
- **Gen AI Foundation Free Course -**
<https://bit.ly/3HcxVAx>
- **GenAI Introduction by Krish Naik-**
<https://www.youtube.com/watch?v=PoKwTzmrAts&t=1880s>

Generative AI with Large Language Models

Prerequisite:

Programming Language:

Python is the most commonly used programming language for Data Science, Machine learning and Ai domain.

Here are some reasons why:

- **Community Support:** Active community of developers, researchers, and practitioners in the machine learning and AI domains.
- **Libraries and Frameworks:** Many key libraries and frameworks for generative AI, such as TensorFlow, PyTorch, and Keras, have Python interfaces.
- **Flexibility and Productivity:** Python is known for its readability, simplicity, and ease of use, making it an ideal language for rapid prototyping and experimentation.
- **Data Analysis and Visualization:** Python is widely used in data science, and it has excellent support for data manipulation and visualisation libraries, such as NumPy, Pandas, and Matplotlib.

Topics to Learn-

- Variables, Numbers, Strings
- Lists, Dictionaries, Sets, Tuples
- If condition, for loop
- Functions, Lambda Functions
- Modules (pip install)
- Read, Write files
- Exception handling
- Classes, Objects

Useful Learning Resource:

- Python Complete Playlist- <https://bit.ly/4aK9SGR>
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SQL Database(Optional)

Deep learning projects often involve working with large volumes of unstructured data, such as images, text, or audio. In many cases, traditional SQL databases may not be the primary choice for storing such unstructured data, and other types of data storage solutions might be more appropriate

But for the machine learning project it is important to.

My Preference: MySql or Sqlite3

SQL Topics to Learn:

Basics of Relational Databases

Basic Queries: SELECT, WHERE LIKE, DISTINCT, BETWEEN, GROUP BY, ORDER BY

Advanced Queries: CTE, Subqueries, Window Functions

Joins: Left, Right, Inner, Full

Useful Learning Resource:

- SQL Complete Playlist - <https://bit.ly/3vBFMF7>

NoSQL Database:

The need for a NoSQL database in a deep learning project depends on the nature of your data and the specific requirements of your project. Deep learning projects often involve working with large volumes of unstructured data, such as images, text, or audio. In many cases, NoSQL databases are used to store and manage such unstructured data efficiently.

Reason by you should Nosql Database:

- Scalability and Flexibility:
- Variety of Data Types:
- Real-time Data Ingestion:
- Distributed Computing:
- Schema-less Design:

My Preference: MongoDB or CassandraDB

Useful Learning Resource:

Fundamental Video of MongoDB-

https://www.youtube.com/watch?v=VIAcD6P_Etc

<https://www.youtube.com/watch?v=KWoyJwqt22I&t=4498s>

Fundamentals

- Math and Statistics for Data Science(*optional*)

Reason why we need to learn it-

Math and statistics are fundamental for data science and AI as they draw meaningful insights from complex datasets.

Topics to Learn in Statistics

- Basics: Descriptive vs inferential statistics, continuous vs discrete data, nominal vs ordinal data
- Basic plots: Histograms, pie charts, bar charts, scatter plot etc.
- Measures of central tendency: mean, median, mode
- Measures of dispersion: variance, standard deviation
- Probability basics
- Distributions: Normal distribution
- Correlation and covariance
- Central limit theorem
- Hypothesis testing: p value, confidence interval, type 1 vs type 2 error, Z test, t test, ANOVA

Topics to Learn in Mathematics

- Probability
- Linear Algebra
- Calculus

Useful Learning Resource:

Video of Statistics and Mathematics by Krish Naik- <https://bit.ly/47u8qp1>

Basic Deep Learning

Topics to Learn

- Artificial Neural Networks
- activation functions and Loss functions
- Backpropagation, optimizers
- Regularisation, Normalisation
- Convolutional Neural Networks (CNNs)
- Recurrent Neural Networks (RNNs)
- Get hands-on experience with frameworks like TensorFlow or PyTorch.

Useful Learning Resource:

Deep Learning Community Session by krish Naik- <https://bit.ly/48s3Jxs>

Basics of Natural Language Processing

Topics to Learn

- Text Preprocessing: Regex, Lowercasing, Tokenization, Removing Punctuation, Removing Stop Words, Stemming, Lemmatization
- Text Representation: Count vectorizer, TF-IDF, BOW, OHE
- Text Classification: Naive Bayes
- Fundamental library: Spacy & NLTK

Useful Learning Resource:

NLP Community Session by Krish Naik- <https://bit.ly/3NYzkP7>

Word Embedding Techniques:

Topics to Learn

- Word2Vec
- GloVe
- ELMO
- Fast Text

Useful Learning Resource:

Deep Learning Community Session by Krish Naik- <https://bit.ly/3NYzkP7>

Advance NLP Concepts

Topics to Learn

- Advance RNN like LSTM & GRU
- Encoder decoder & Encoder decoder with Attention Mechanism
- Transformer architecture: Self attention mechanism, key, query, value(KQV), Layer Normalisation & Positional Encoding
- BERT: Contextual embedding and mask language modelling
- GPT: Autoregressive Modelling

An Important Concept Needs To Be Learnt.

Transfer Learning: Learned from past work and applied it to the current challenge.

Fine-Tuning Of Model: Fine-Tuning refers to the process of taking a pre-trained model and further training it on a domain specific task.

Different Sequence Mapping: One To Many, Many To One, Many To Many

Useful Learning Resource:

NLP Community Session by Krish Naik- <https://bit.ly/3NYzkP7>

Core Generative Models:

Large Language Models(LLMs)

Topics to Learn

- **Milestone LLM Models**
 - **BERT:** Bidirectional Encoder Representations from Transformers (BERT) was developed by Google
 - **GPT:** GPT stands for "Generative Pre-trained Transformer".The model was developed by OpenAI
 - **XLM:** Cross-lingual Language Model Pretraining by Guillaume Lample, Alexis Conneau.
 - **T5:** The Text-to-Text Transfer Transformer It was created by Google AI
 - **Megatron:** Megatron is a large, powerful transformer developed by the Applied Deep Learning Research team at NVIDIA
 - **M2M-100:** multilingual encoder-decoder (seq-to-seq) model researchers at Facebook

- **OpenAI LLM Models**

- GPT-4 and GPT-4 Turbo: A set of models that improve on GPT-3.5 and can understand as well as generate natural language or code
- **GPT-3.5**: A set of models that improve on GPT-3 and can understand as well as generate natural language or code
- **DALL-E**: A model that can generate and edit images given a natural language prompt
- **TTS**: A set of models that can convert text into natural sounding spoken audio
- **Whisper**: A model that can convert audio into text

- **Google AI LLM models:**

- PaLM2
- Gemini-pro
- Gemini -pro-vision

- **Meta AI LLM Models**

- LLaMA & LLaMA2

- **Open Source LLM Models**

- BLOOM
- Llama 2
- PaLM
- Falcon
- Claude
- MPT-30B
- Stablelm

Useful Learning Resource:

- Hugging face Models Hub- <https://huggingface.co/models>
- OpenAI Models- <https://platform.openai.com/docs/models>
- BERT Research Paper- <https://arxiv.org/abs/1810.04805>
- GPT Research Paper- <https://bit.ly/48JHwdW>

Prompt Engineering

Topics to Learn

- **Type of Prompting:**
 - Zero shot prompting(Direct Prompting)
 - Few shot prompting
 - Chain-of-thoughts prompting
- **Prompt Creation:** Length, context structure and specific instruction
- **Prompt Communities:** PromptHero, FlowGPT, Snack Prompt

Useful Learning Resource:

Video link from Gen AI community session-<https://bit.ly/3Saq0Ku>

Developing Applications Powered by LLMs-

Explore Generative Model APIs:

Topics to Learn

- OpenAI API
- Hugging Face API
- Gemini API

Useful Learning Resource:

- Link from GENAI community session course-
<https://bit.ly/3vxuQbN>
- Link from Krish sir community session for GEMINI:
<https://bit.ly/3NWiwZ5>
- Documentation Link-
<https://ai.google.dev/docs>
<https://huggingface.co/docs>
<https://platform.openai.com/docs/introduction>

Framework for Developing LLM application

Topics to Learn

- LangChai
- Chainlit
- LlamaIndex2

Useful Learning Resource

- Link from GENAI community course-

<https://bit.ly/3Saq0Ku>

<https://bit.ly/48smFMi>

- Documentation Link:

<https://docs.chainlit.io/get-started/overview>

<https://docs.llamaindex.ai/en/stable/>

https://python.langchain.com/docs/get_started/introduction

Vector Databases

Topics to Learn

- ChromaDB
- Waviet
- Pinecone
- OpenAI Faiss

Useful Learning Resource

- Link from GENAI community course-

<https://bit.ly/3TNl934>

<https://bit.ly/3S9oOqy>

- Documentation Link:

<https://docs.trychroma.com/>

<https://docs.pinecone.io/docs/overview>

<https://weaviate.io/developers/weaviate>

Tools and Framework for Web-Application

Topics to Learn

- Streamlit
- Gradio
- FastAPI
- Flask

Useful Learning Resource

- **Link from GENAI community course-**

<https://bit.ly/3TOVG9r>

<https://bit.ly/41UbbPo>

- **Documentation Link:** <https://docs.streamlit.io/>

<https://fastapi.tiangolo.com/>

<https://flask.palletsprojects.com/en/3.0.x/>

<https://www.gradio.app/docs/interface>

Deployment of LLM model

Topics to Learn

- AWS
- GCP
- Azure
- LangServe
- HuggingFace Spaces

Useful Learning Resource

Link from GENAI community Course- <https://bit.ly/41UbbPo>

Few Advance Topics:

- **ChatGPT**: Understanding of Chat Gpt Training and RLHF (Reinforcement learning through human feedback) Concept
 - **RAG** : Retrieval-Augmented Generation (RAG) Systems
 - **PEFT** : Parametric efficient fine tuning
 - **Adaptive Ranking**: low rank adaptation(LoRa) and Quantized Low Rank Adaptation(Qlora)
 - **Evaluation of LLMs**: Find evaluation metrics of results generated by LLM
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Projects and Practical Experience:

Hands-on Projects:

Work on small projects to apply what you've learned.

Experiment with different datasets and model architectures.

Kaggle Competitions and Open Source Contributions:

Participate in Kaggle competitions related to generative tasks.

Contribute to open-source projects in the generative AI field.

Useful Learning Resource

- **Link of iNeuron Internship Portal-**

<https://internship.ineuron.ai/>

- **Link of iNeuron Job Portal-**

<https://jobs.ineuron.ai/>

Miscellaneous Topics

Platform To Explore:

- **LIDA** (Automatic Generation of Visualisations and Infographics)
Slides (AI Presentation Maker)
- **Content Creation** (Jasper, Copy.ai, Anyword)
- **Grammar checkers and rewording tools** (Grammarly, Wordtune, ProWritingAid)
- **Video creation** (Descript, Wondershare Filmora, Runway)
- **Image generation** (DALL-E 2, Midjourney)
- **Research** (Genei, Aomni)

GANs:

Variational Autoencoders (VAEs)

Generative Adversarial Networks (GANs)

Stable Diffusion Models:

Deliberate, Realistic Vision etc.

Stable Diffusion Models:

High end performance GPUs (GCP, AWS, Azure), Data Crunch, PaperSpace, Google colab and google colab pro, Kaggle instance etc.

Continuous Learning:

Keep up with the latest: news, trends, research paper and community

Useful Learning Resource

- **For latest Research and News -**

<https://www.marktechpost.com/>

<https://paperswithcode.com/>

<https://aimagazine.com/>

- **Link of NeuronLAB:**

<https://neurolab.ineuron.ai/>

Advice for Productive Learning:

- Define specific, achievable learning goals
- Consistent learning
- Don't forgot to Implementing your learning
- Experiment and Iterate
- Constructive feedback

FAQs

- **Do I need a background in machine learning or deep learning to start learning Generative AI?**

While a basic understanding of machine learning concepts is beneficial, some introductory courses in machine learning can help bridge the knowledge gap.

Deep learning is a fundamental part of Generative AI, and a background in it is highly recommended. Familiarity with neural networks, backpropagation, RNNs and common deep learning frameworks like TensorFlow or PyTorch is advantageous for comprehending generative models.

- **How much mathematics knowledge is required for Generative AI?**

Mathematics is a key component of understanding the algorithms behind generative models. Students inquire about the level of mathematical knowledge needed, with a focus on linear algebra, calculus, and probability. A foundational understanding of these mathematical concepts is beneficial.

- **Can I start with Generative AI without prior experience in AI or computer science?**

Yes, you can start but a background in AI or computer science can provide a smoother start, there are beginner-friendly resources available to help newcomers build their skills. You can refer to this [video](#) for more details.

Mastering Generative AI with OpenAI, LangChain, and LlamaIndex Batch Launch: <https://bit.ly/3NS1hl3>

Course Link for Mastering Generative AI: <https://bit.ly/3HeguzF>