

# Learning Large Language Models (LLMs) from Scratch

## 1. Fundamentals of NLP & Deep Learning

- NLP Basics: Tokenization, Word Embeddings (Word2Vec, GloVe), POS Tagging, etc.
- Deep Learning: Neural Networks, Backpropagation, Optimizers, Loss Functions

## 2. Transformers & Attention Mechanism

- Self-Attention & Multi-Head Attention
- Positional Encoding
- Encoder-Decoder Architecture
- Study Paper: 'Attention is All You Need'

## 3. Understanding LLM Architectures

- BERT, GPT, T5, LLaMA, Falcon
- Retrieval-Augmented Generation (RAG)
- Fine-tuning vs. Prompt Engineering

## 4. Training LLMs from Scratch

- Pretraining (Masked Language Modeling, Causal Language Modeling)
- Fine-Tuning (Supervised Fine-Tuning, RLHF)
- Dataset Preparation & Tokenization

## 5. Deployment & Optimization

- Quantization, LoRA, Model Distillation
- Running LLMs on Edge Devices
- Using APIs: OpenAI, Hugging Face, Groq, LLaMA

## 6. Building Applications with LLMs

- Chatbots & Conversational AI
- Text Summarization, Translation, Q&A Systems
- Using LangChain & LlamaIndex

## 7. Future Trends & Advanced Topics

- Multi-modal LLMs (GPT-4V, CLIP, Flamingo)
- Agentic LLMs (AutoGPT, BabyAGI)
- Ethics & Bias in LLMs

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## Suggested Learning Path

1. Learn NLP & Deep Learning basics
2. Study Transformers & implement attention mechanisms
3. Learn about GPT/BERT/T5 & fine-tune models
4. Work on real-world projects
5. Explore LLM optimization & deployment
6. Experiment with LangChain & LlamaIndex