Getting Started with Llama3

Lucas Soares

11-06-2024

Methodology Notes

The presentation will be organized into the following structure:

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1. Presentation Block

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2. Notebook Demo

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3. Quick Q&A + Summary

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4. Optional Exercise During Q&A

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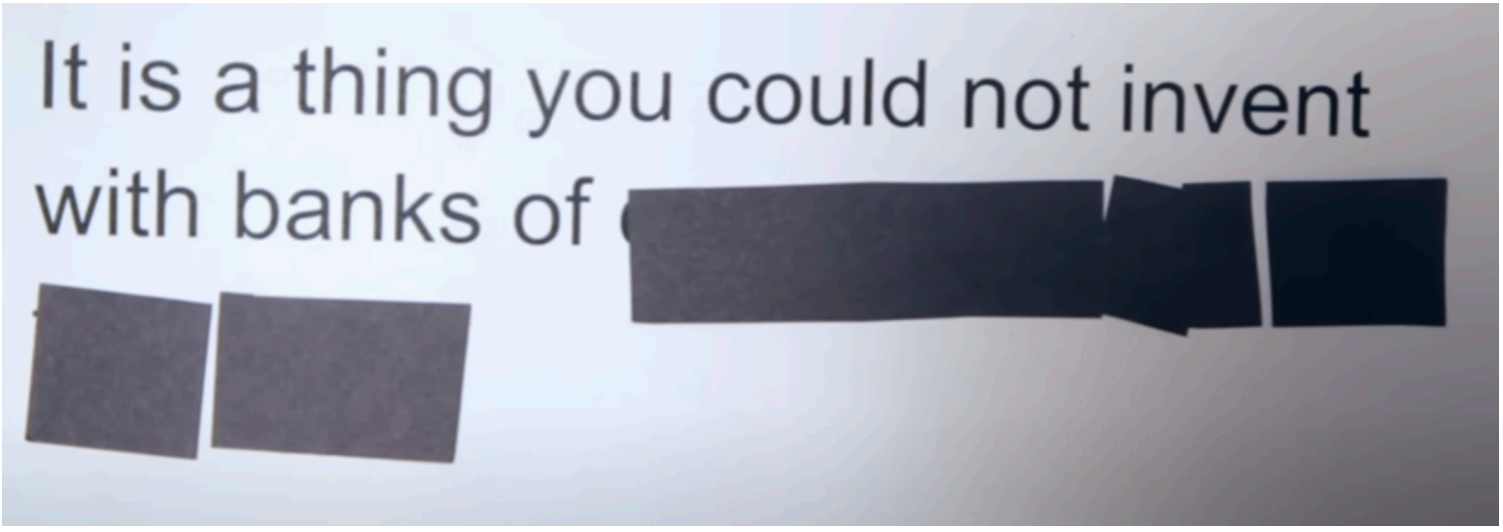
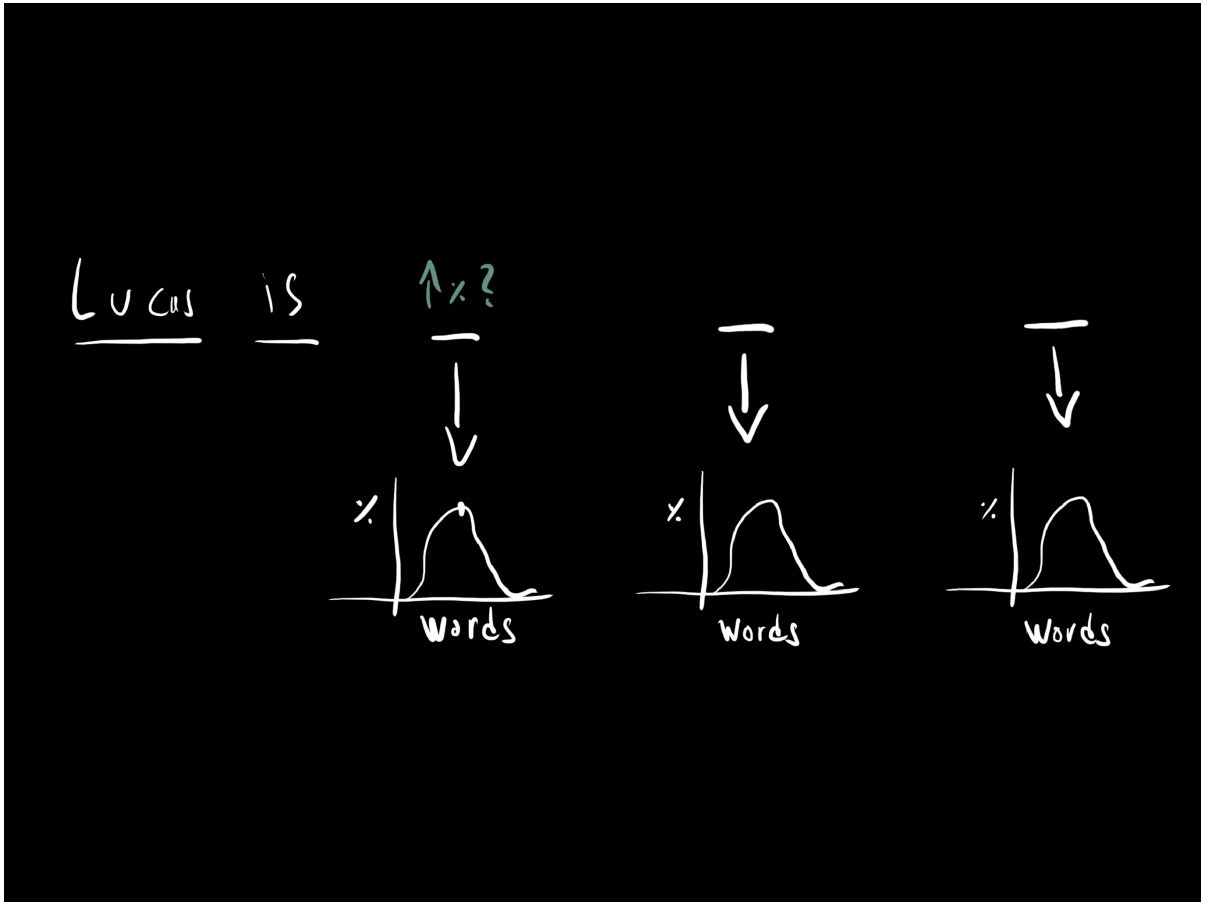
The presentation will be organized into the following structure:

1. Presentation Block
2. Notebook Demo
3. Quick Q&A + Summary
4. Optional Exercise During Q&A
5. Repeat

LLMs Predict the Next Word



LLMs Predict the Next Word



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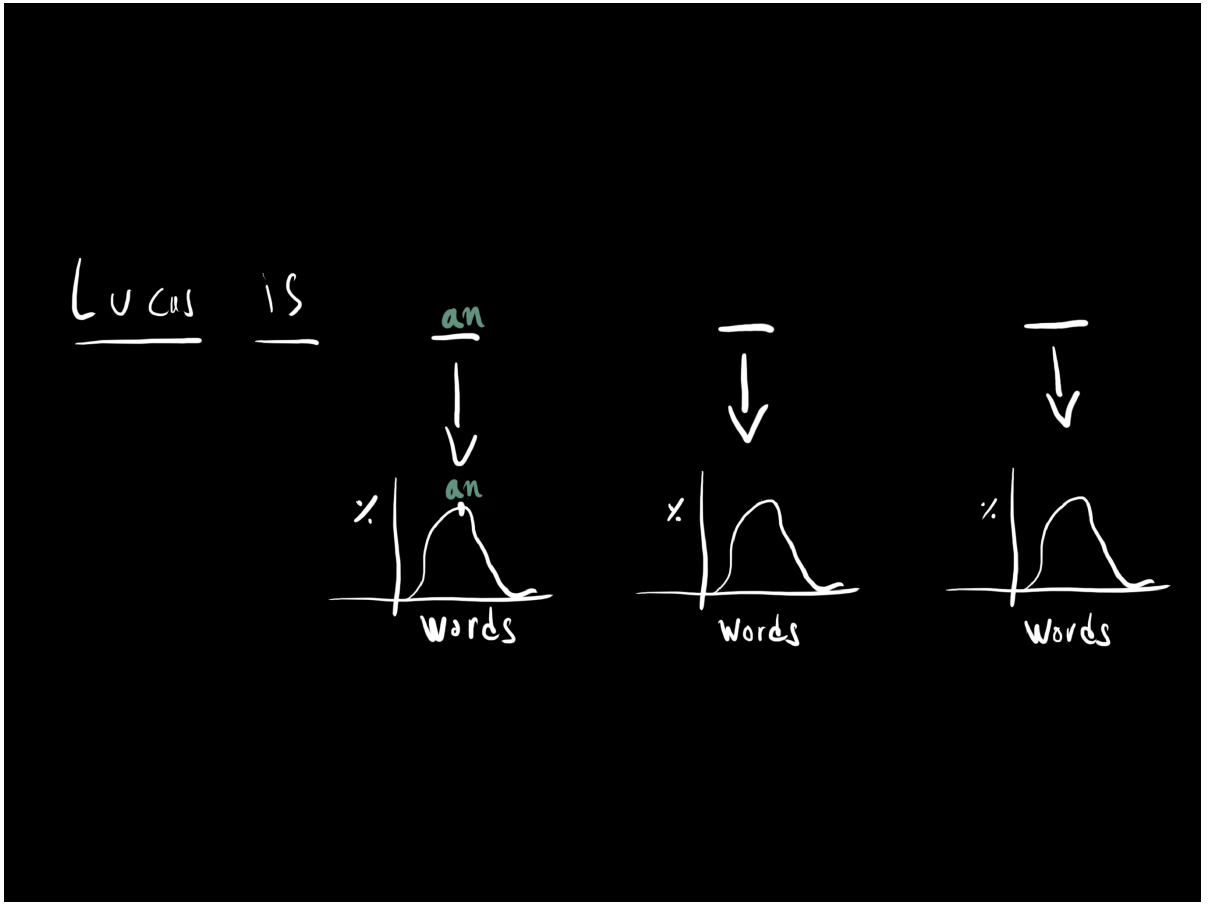

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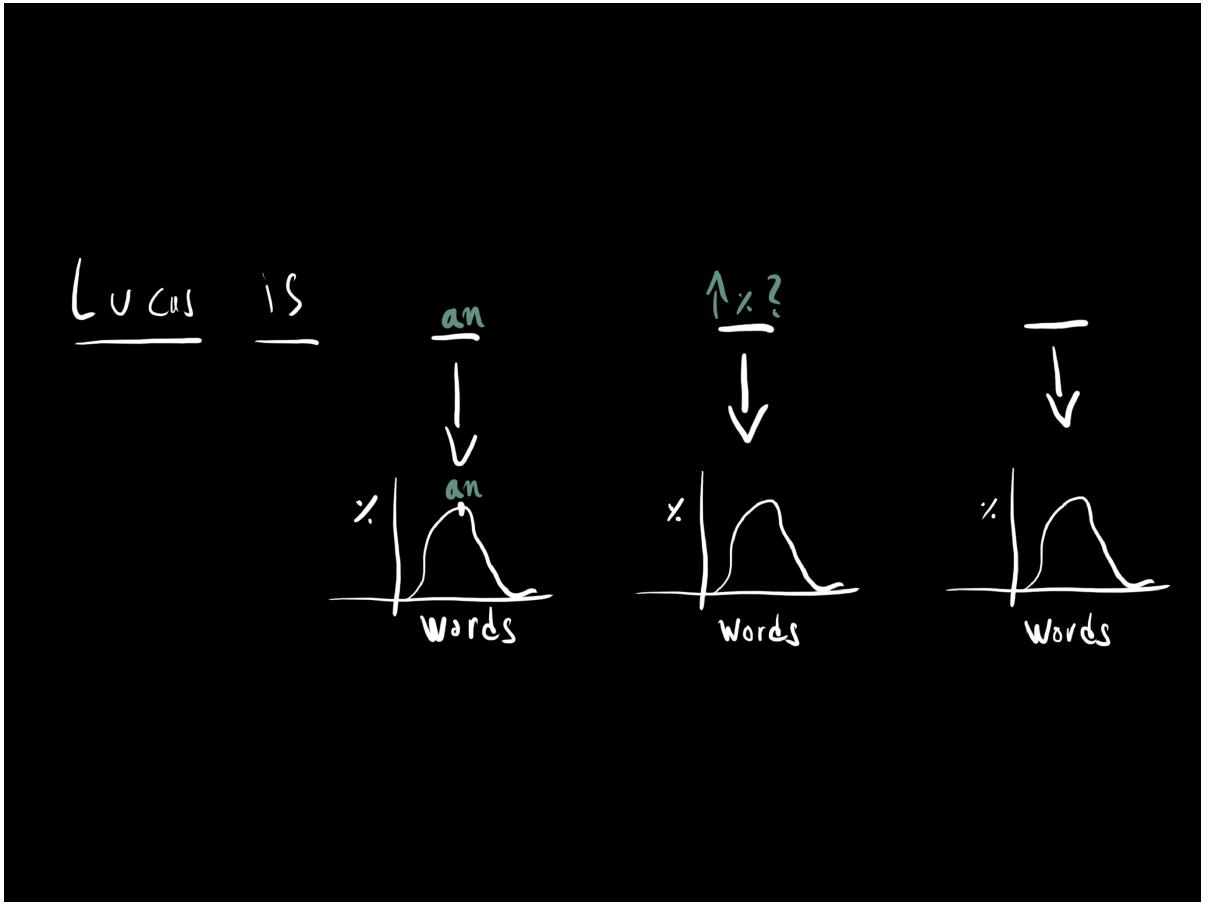
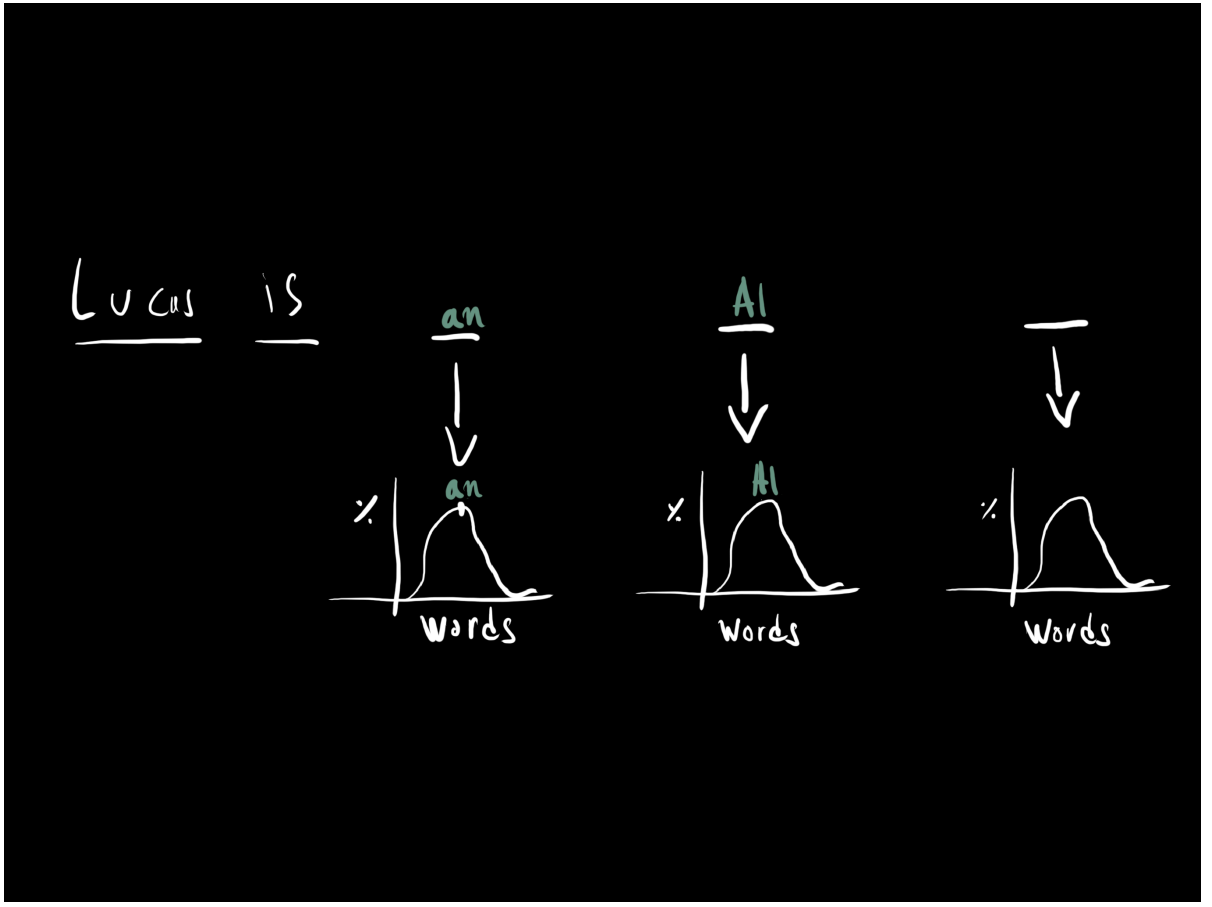


LLMs Predict the Next Word



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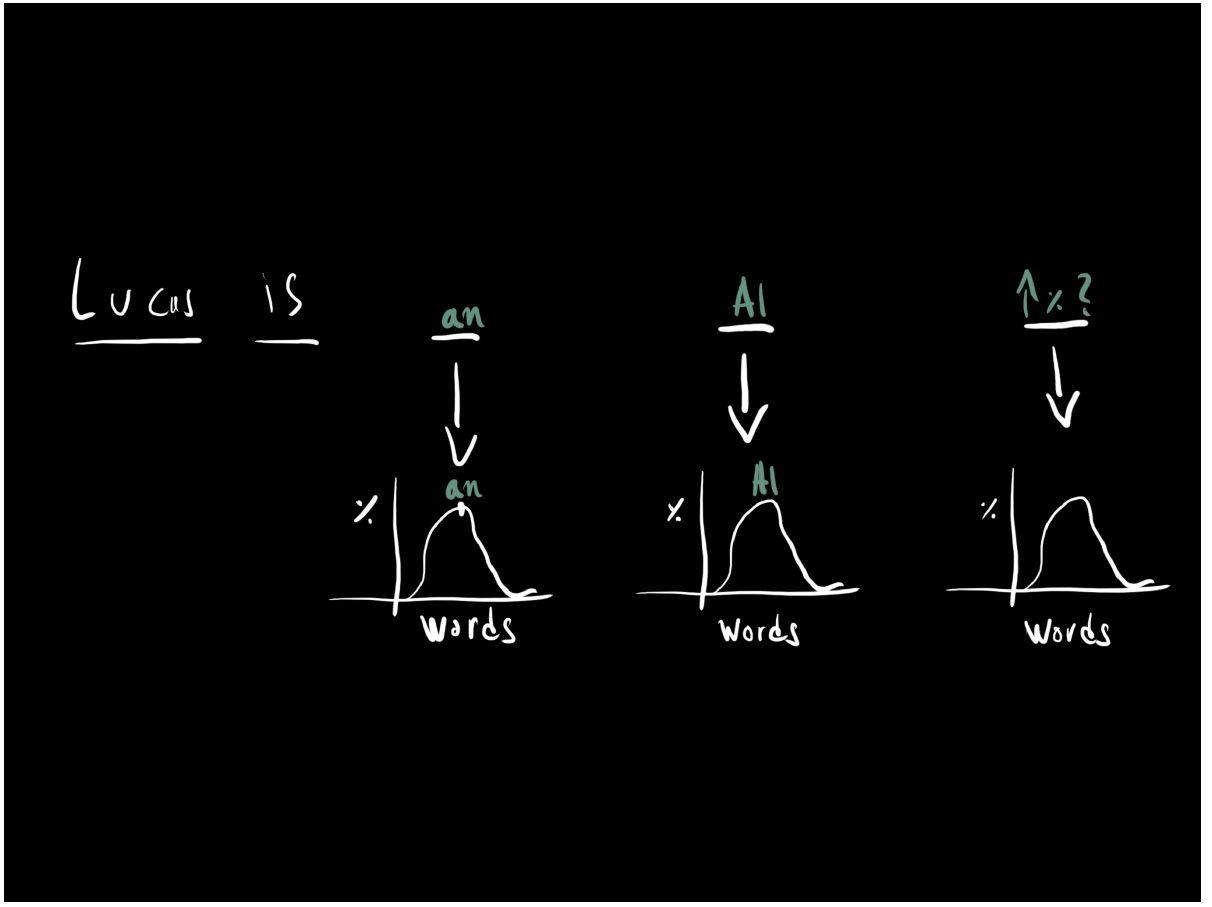
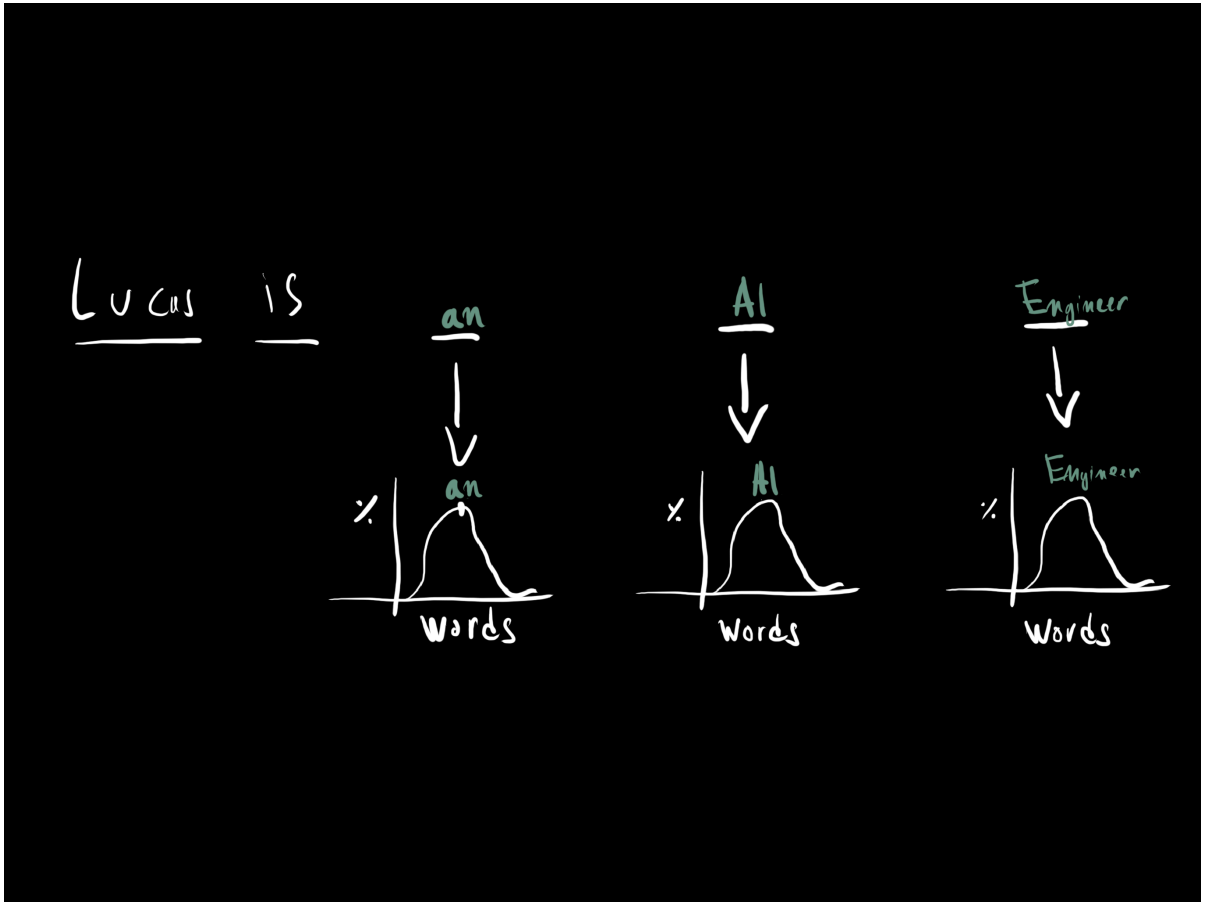
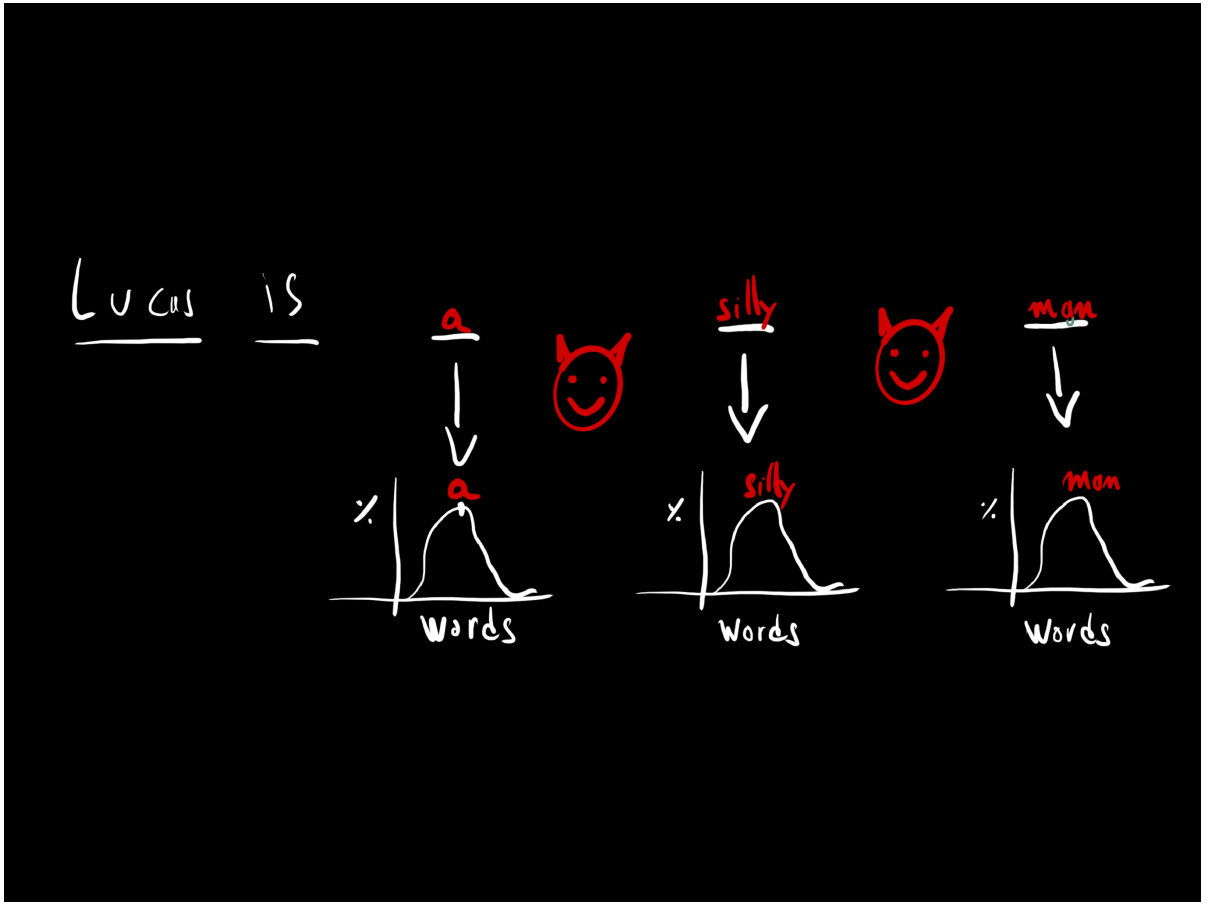
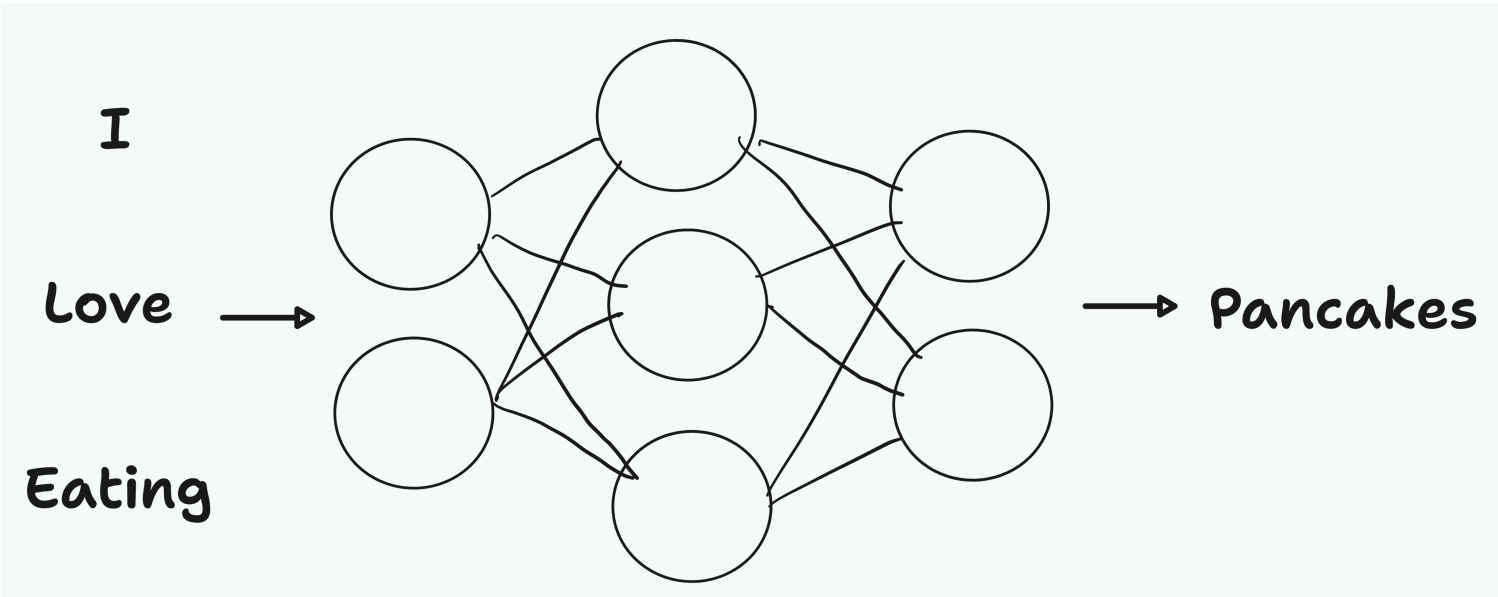


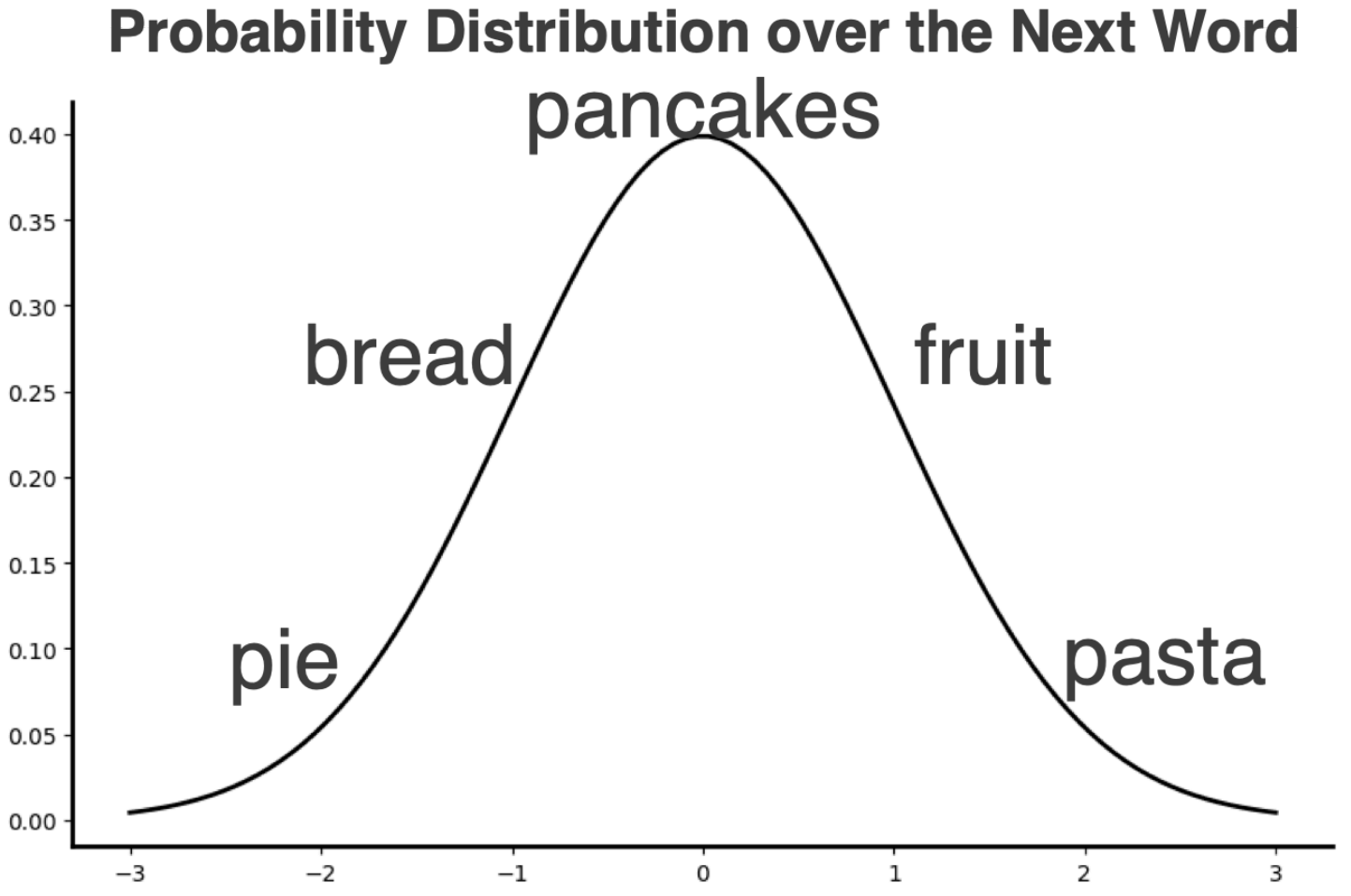
LLMs Predict the Next Word



LLMs Predict the Next Word




I
Love
Eating
Pancakes


Probability Distribution over the Next Word
pancakes
bread
fruit
pie
pasta
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
−3
−2
−1
0
1
2
3

Introduction to Llama3

Llama3 Release

- LLM Released by Meta in April of 2024

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- Open source with a Commercial license (just like Llama2)

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- LLM Released by Meta in April of 2024
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- Meta Llama3 Resources

Incredible Performance in 2 sizes

- Llama3 is OPEN SOURCE
- Released in 2 sizes: 8B and 70B parameters.
- Incredible evaluation performances for both 70B and 8B models

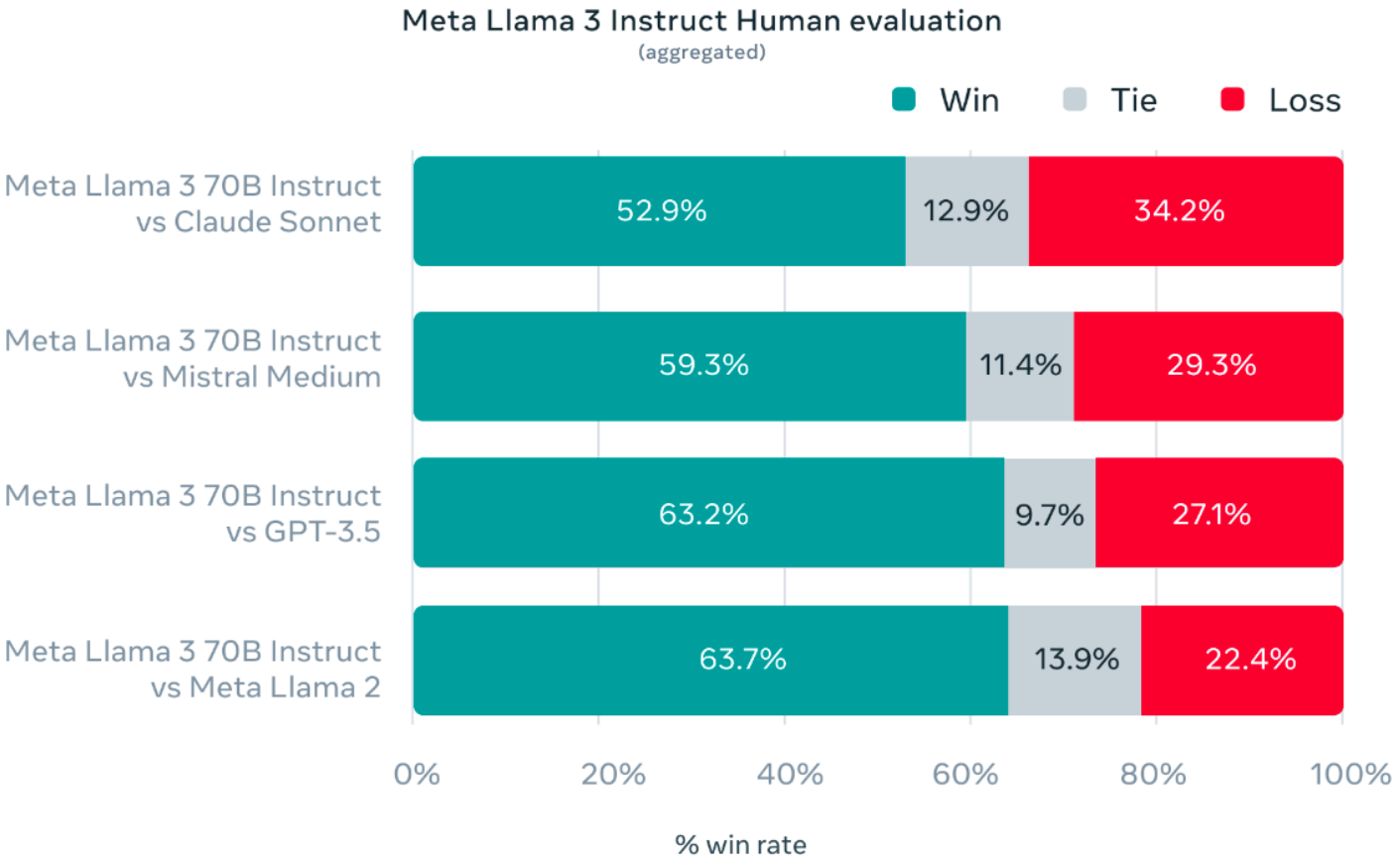
Meta Llama 3 Instruct model performance

	Meta Llama 3 8B	Gemma 7B - It Measured	Mistral 7B Instruct Measured
MMLU 5-shot	**68.4**	53.3	58.4
GPQA 0-shot	**34.2**	21.4	26.3
HumanEval 0-shot	**62.2**	30.5	36.6
GSM-8K 8-shot, CoT	**79.6**	30.6	39.9
MATH 4-shot, CoT	**30.0**	12.2	11.0

	Meta Llama 3 70B	Gemini Pro 1.5 Published	Claude 3 Sonnet Published
MMLU 5-shot	**82.0**	81.9	79.0
GPQA 0-shot	39.5	**41.5** CoT	38.5 CoT
HumanEval 0-shot	**81.7**	71.9	73.0
GSM-8K 8-shot, CoT	**93.0**	91.7 11-shot	92.3 0-shot
MATH 4-shot, CoT	50.4	**58.5** Minerva prompt	40.5

*Please see evaluation details for setting and parameters with which these evaluations are calculated.

Meta AI Llama3 Release Blog Post



[Meta AI Llama3 Release Blog Post]

Meta Llama 3 Pre-trained model performance

	Meta Llama 3 8B	Mistral 7B		Gemma 7B	
		Published	Measured	Published	Measured
MMLU 5-shot	**66.6**	62.5	63.9	64.3	64.4
AGIEval English 3-5-shot	**45.9**	--	44.0	41.7	44.9
BIG-Bench Hard 3-shot, CoT	**61.1**	--	56.0	55.1	59.0
ARC-Challenge 25-shot	78.6	78.1	78.7	53.2 0-shot	**79.1**
DROP 3-shot, F1	**58.4**	--	54.4	--	56.3

	Meta Llama 3 70B	Gemini Pro 1.0	Mixtral 8x22B
		Published	Measured
MMLU 5-shot	**79.5**	71.8	77.7
AGIEval English 3-5-shot	**63.0**	--	61.2
BIG-Bench Hard 3-shot, CoT	**81.3**	75.0	79.2
ARC-Challenge 25-shot	**93.0**	--	90.7
DROP 3-shot, F1	**79.7**	74.1 variable-shot	77.6

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Llama3 Technical Details

- Data: Trained on over 15 trillion tokens of text data

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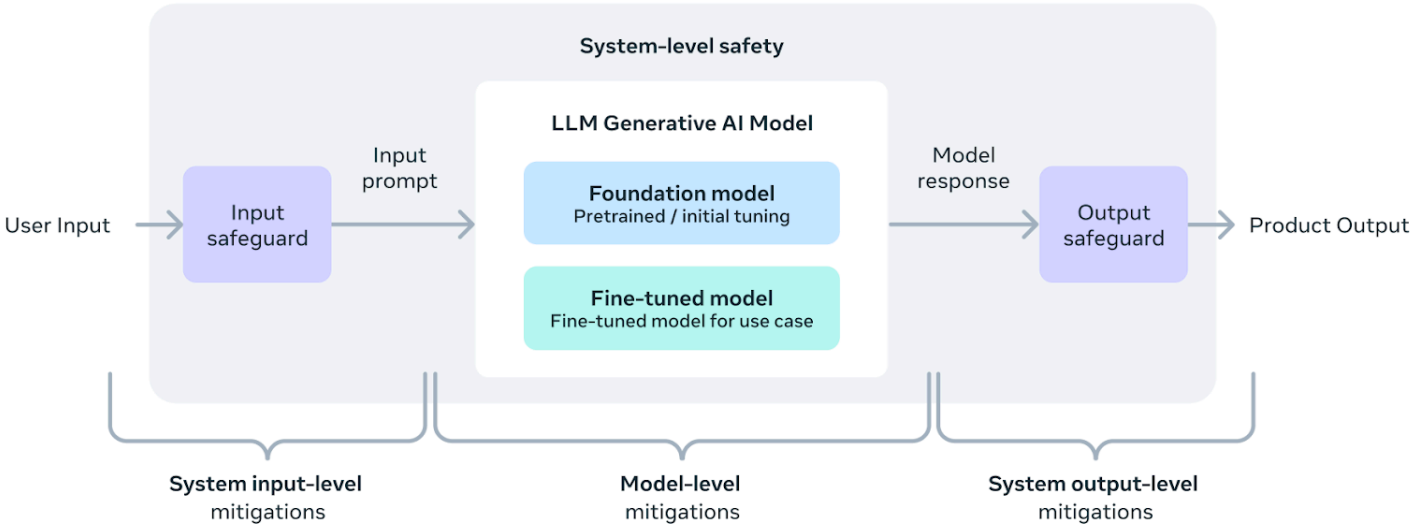
- Context length: 8192 tokens
- System level approach for responsible development



[Meta AI Llama3 Release Blog Post]

Notebook Demo - Introduction to Llama3

Query Your Docs Locally with Llama3

- Need for LLMs with access to context-relevant data.

Query Your Docs Locall with Llama3

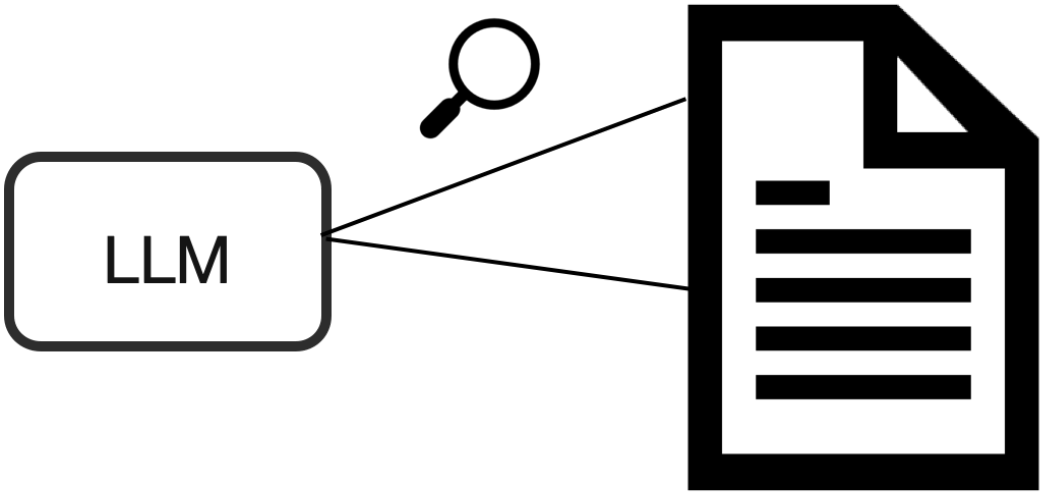
- Privacy concern with closed source LLMs.

Query Your Docs Locall with Llama3

- Solution? Llama3!

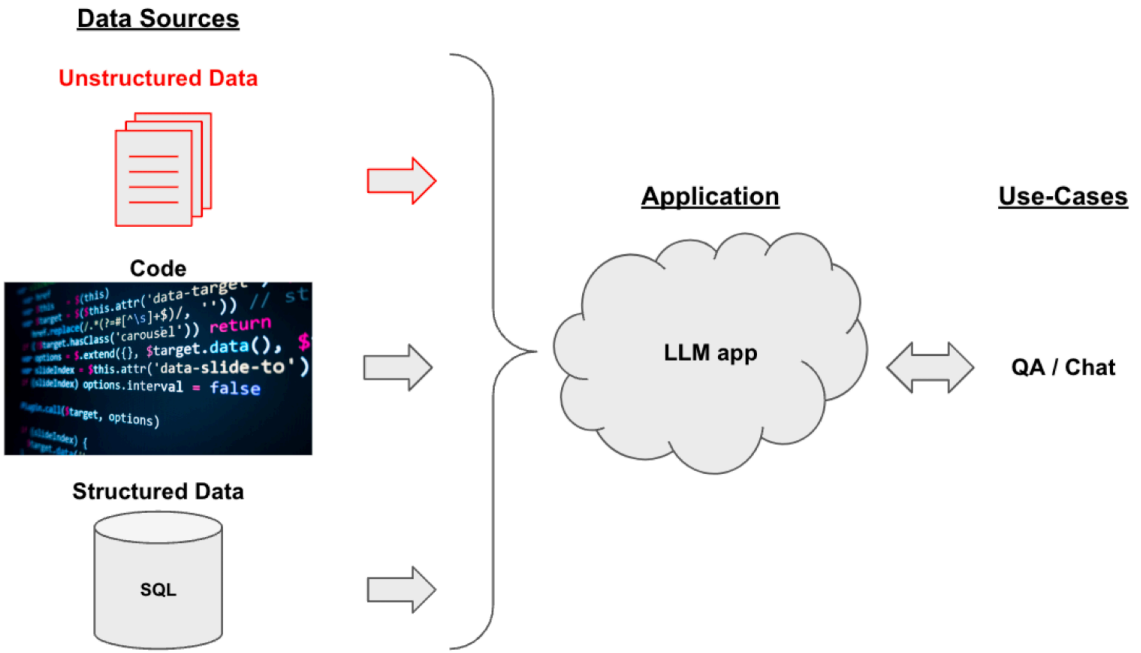
RAG with Llama3

- RAG - Retrieval Augmented Generation



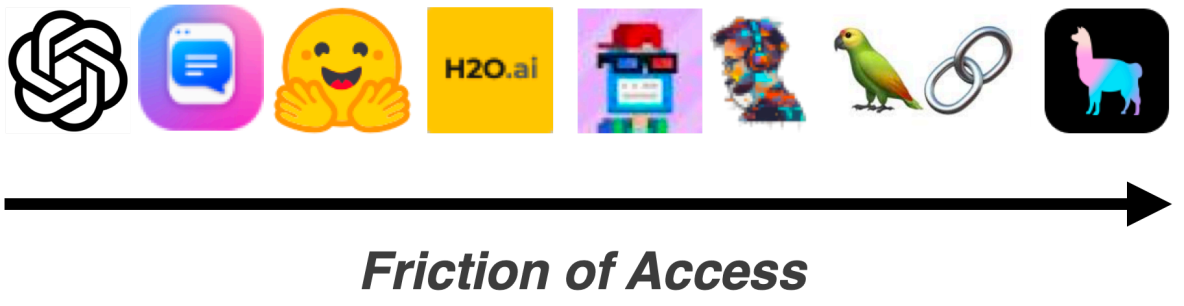
RAG with Llama3

- LLMs have a limited context length



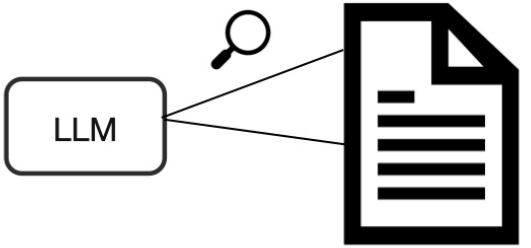
Q&A RAG Tech Friction of Access

- Framework for RAG Systems
- Friction of Access



Langchain Docs

RAG - Retrieval Augmented Generation



Langchain Docs

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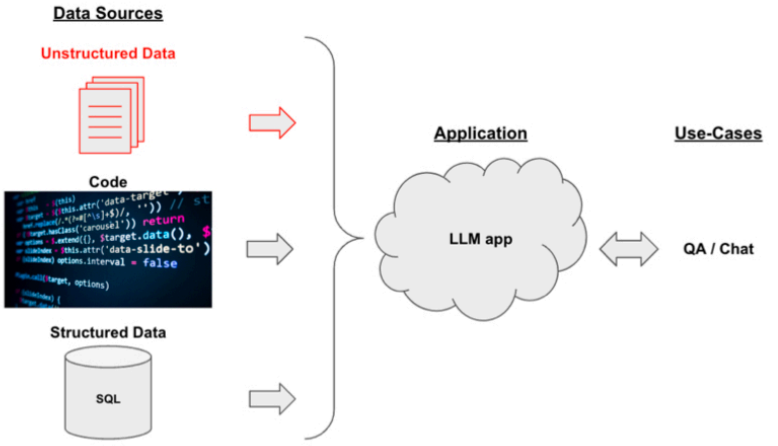

[Langchain Docs]

- RAG - Retrieval Augmented Generation
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Langchain Docs

- RAG - Retrieval Augmented Generation
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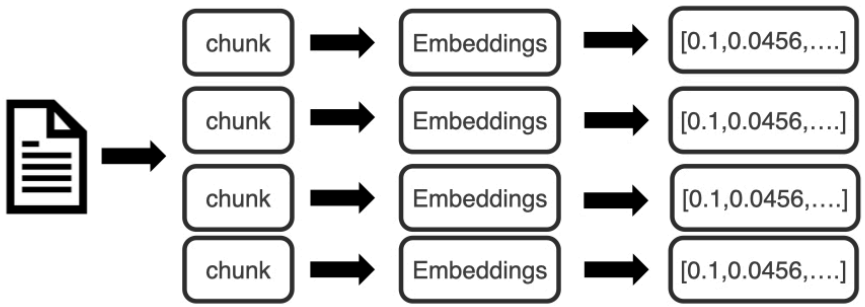
- **Embeddings**: capture content and meaning



Langchain Docs

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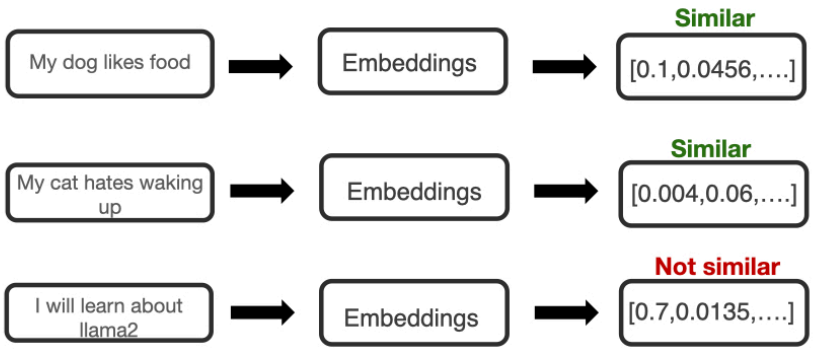

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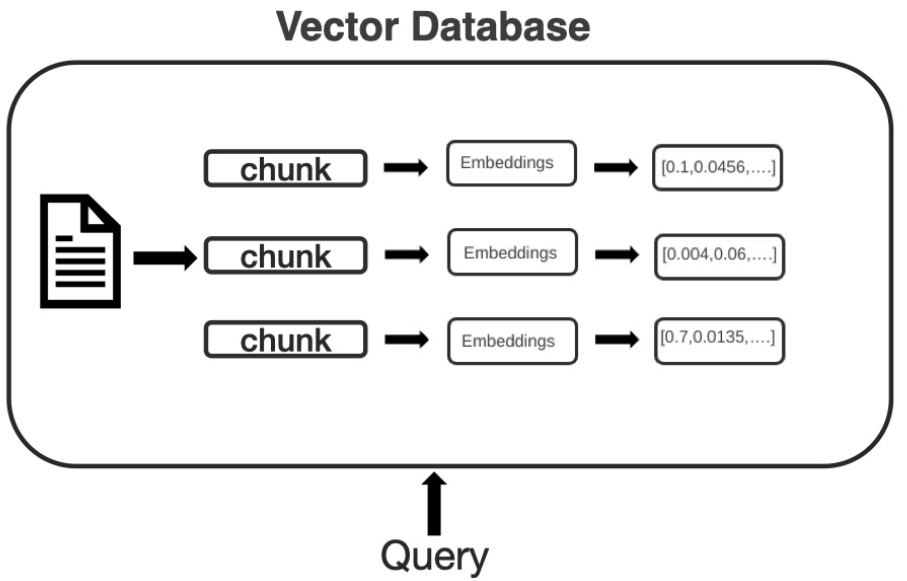
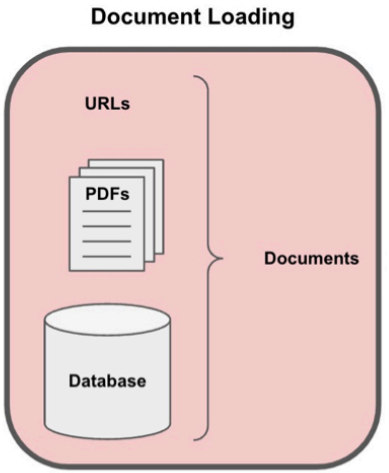


Langchain Docs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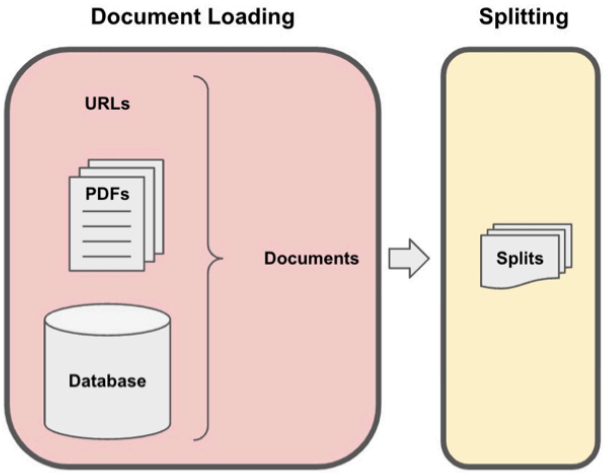
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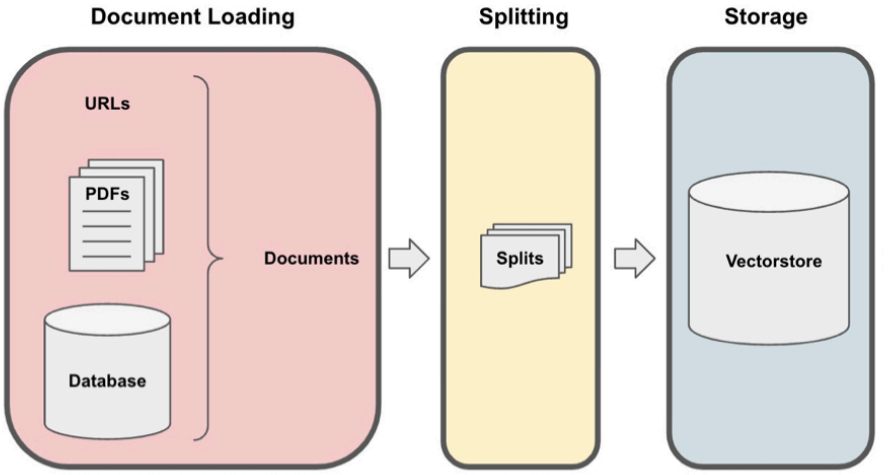
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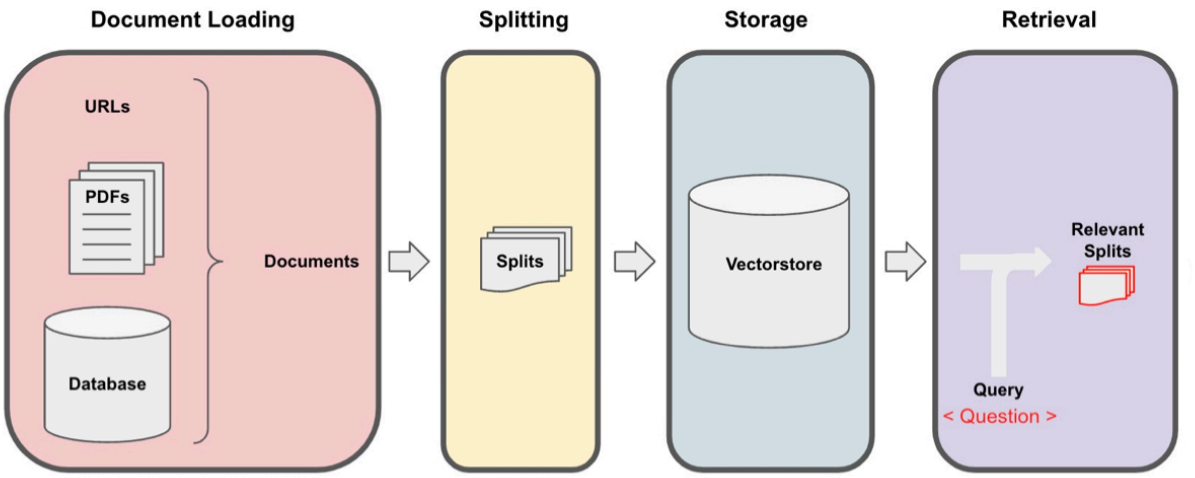
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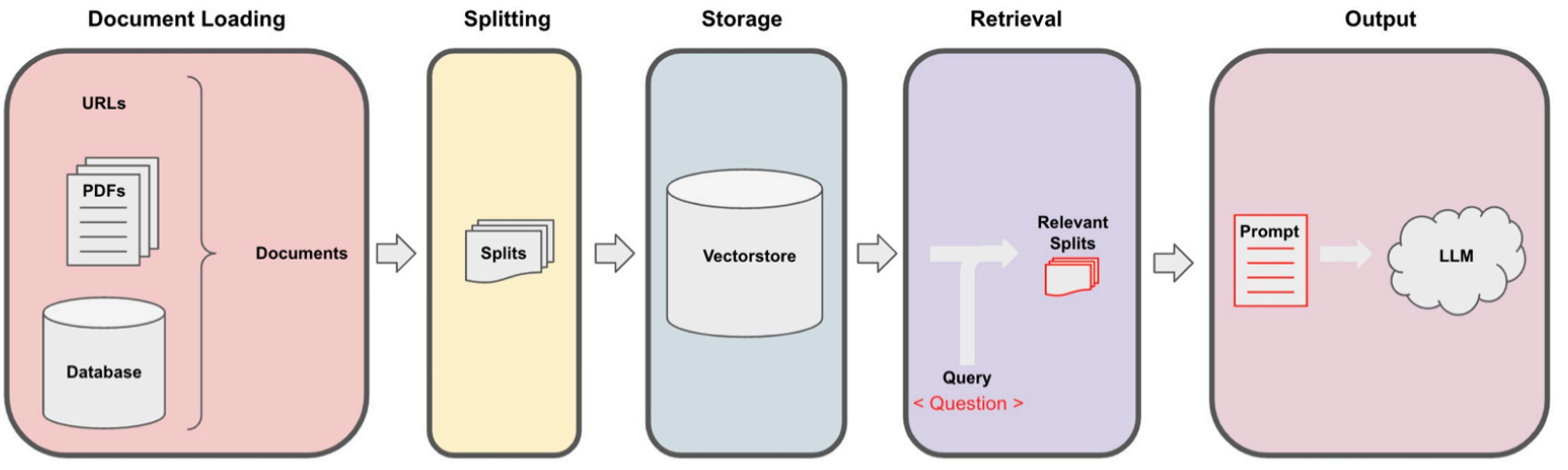
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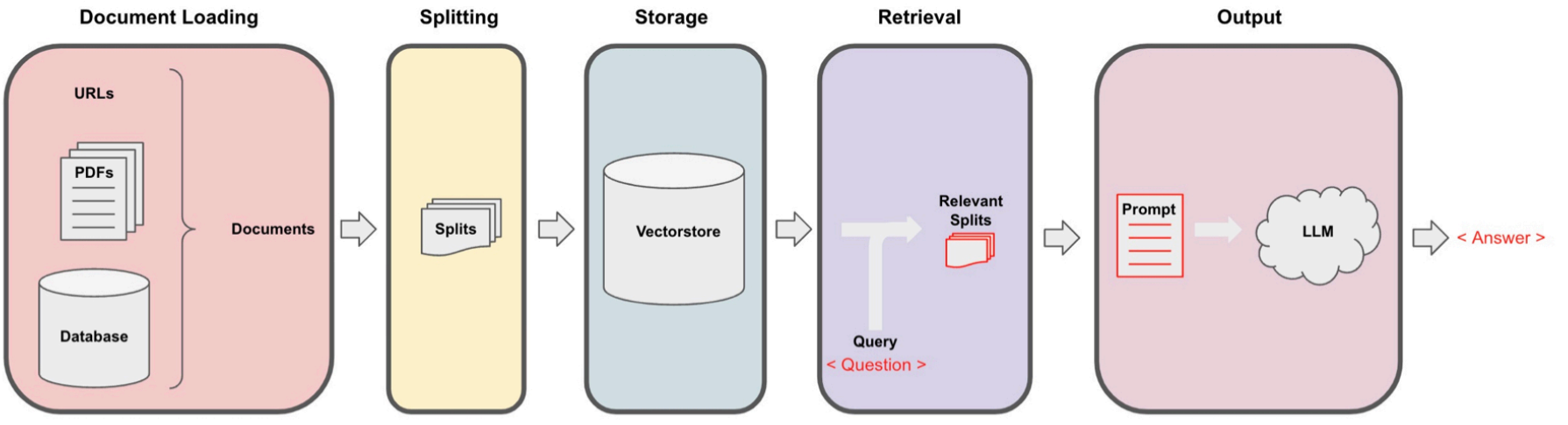
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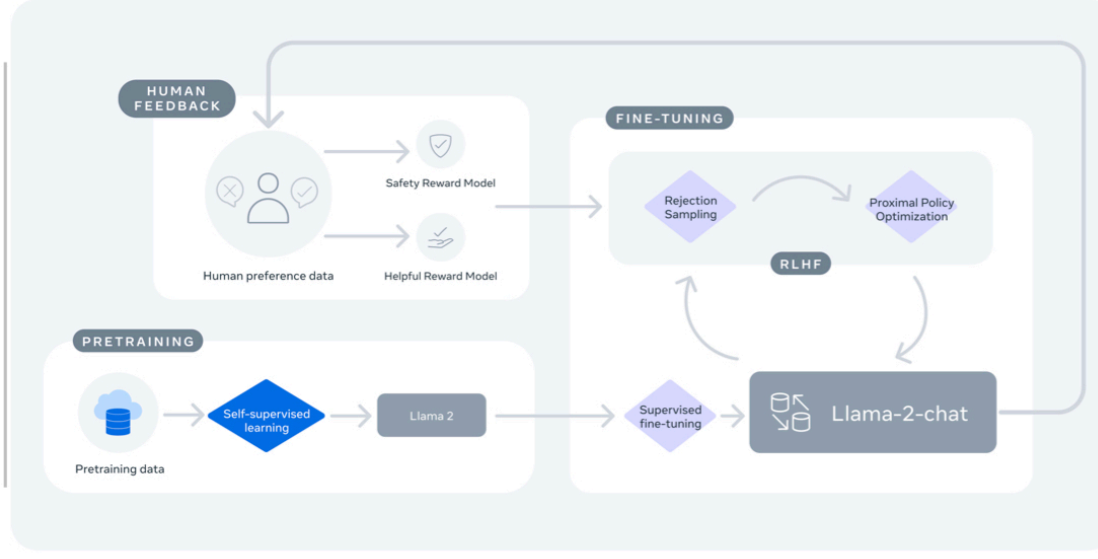
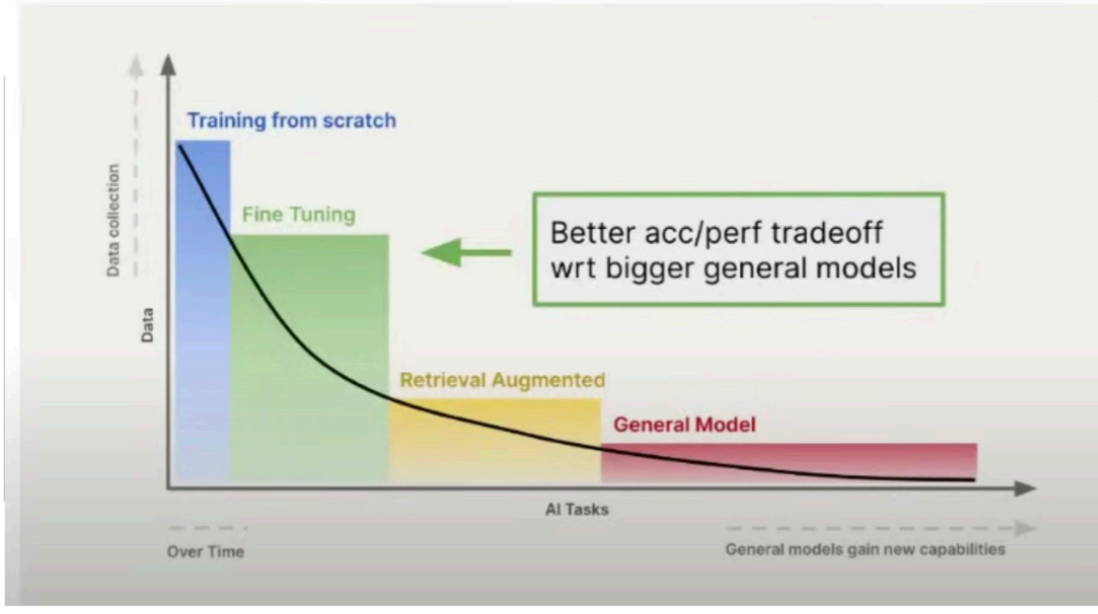
Q&A / Break

What is Fine Tuning?



LLama2 Paper

- What is Fine Tuning?
- Why Fine Tune?



[Efficient Fine-Tuning for Llama-v2-7b on a Single GPU]

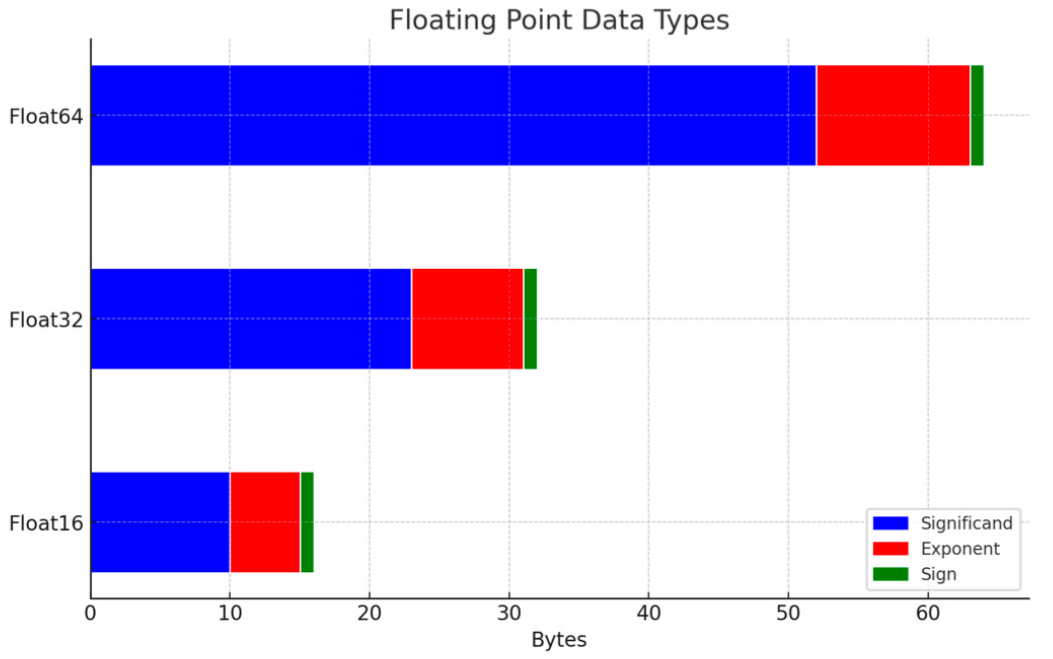
- What is Fine Tuning?
- Why Fine Tune?
- Memory cost of LLMs: parameters, gradients, optimiser states

The Memory Bottleneck: GPU comparison

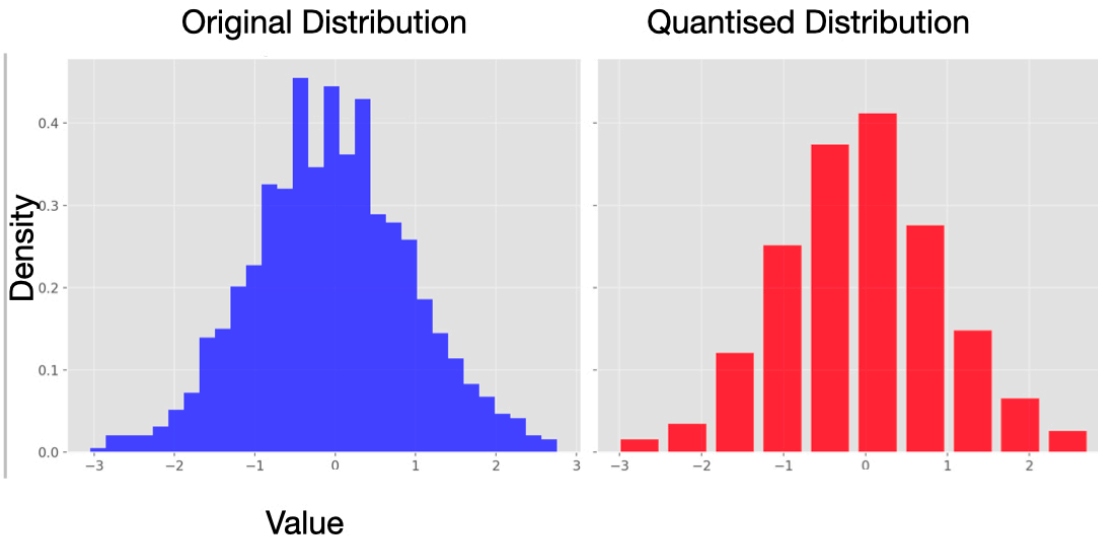
GPU	Tier	$ / hr (AWS)	VRAM (GiB)
H100	Enterprise	12.29	80
A100	Enterprise	5.12	80
V100	Enterprise	3.90	32
A10G	Enterprise	2.03	24
T4	Enterprise	0.98	16
RTX 4080	Consumer	N/A	16

Problem - Loading Params

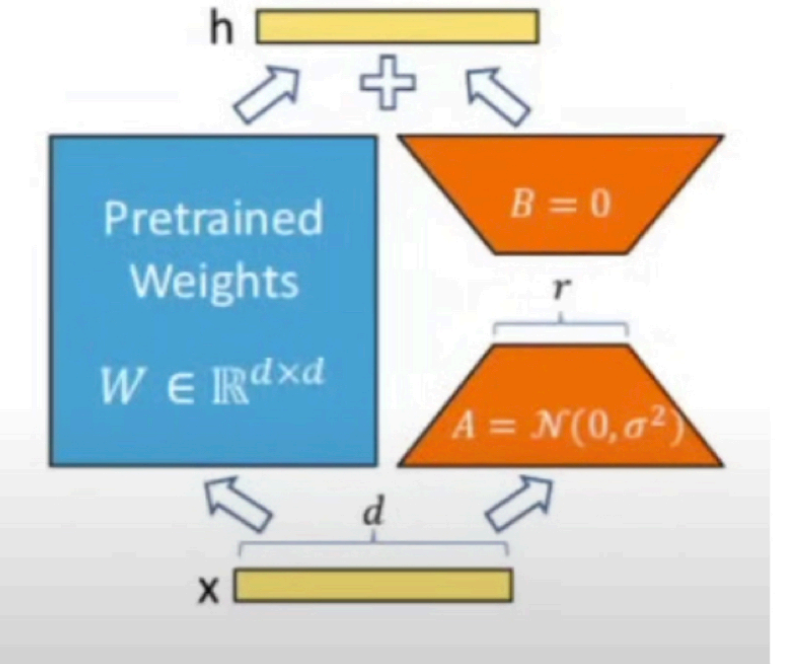
Solution - Half Precision



- Problem - Loading Params
  Solution - Half Precision
- Problem - Loading Gradients
  Solution - Quantization



- Problem - Loading Params
  Solution - Half Precision
- Problem - Loading Gradients
  Solution - Quantization
- Problem - Loading Optimizer States
  Solution - LoRA, QLora



Lora Paper