



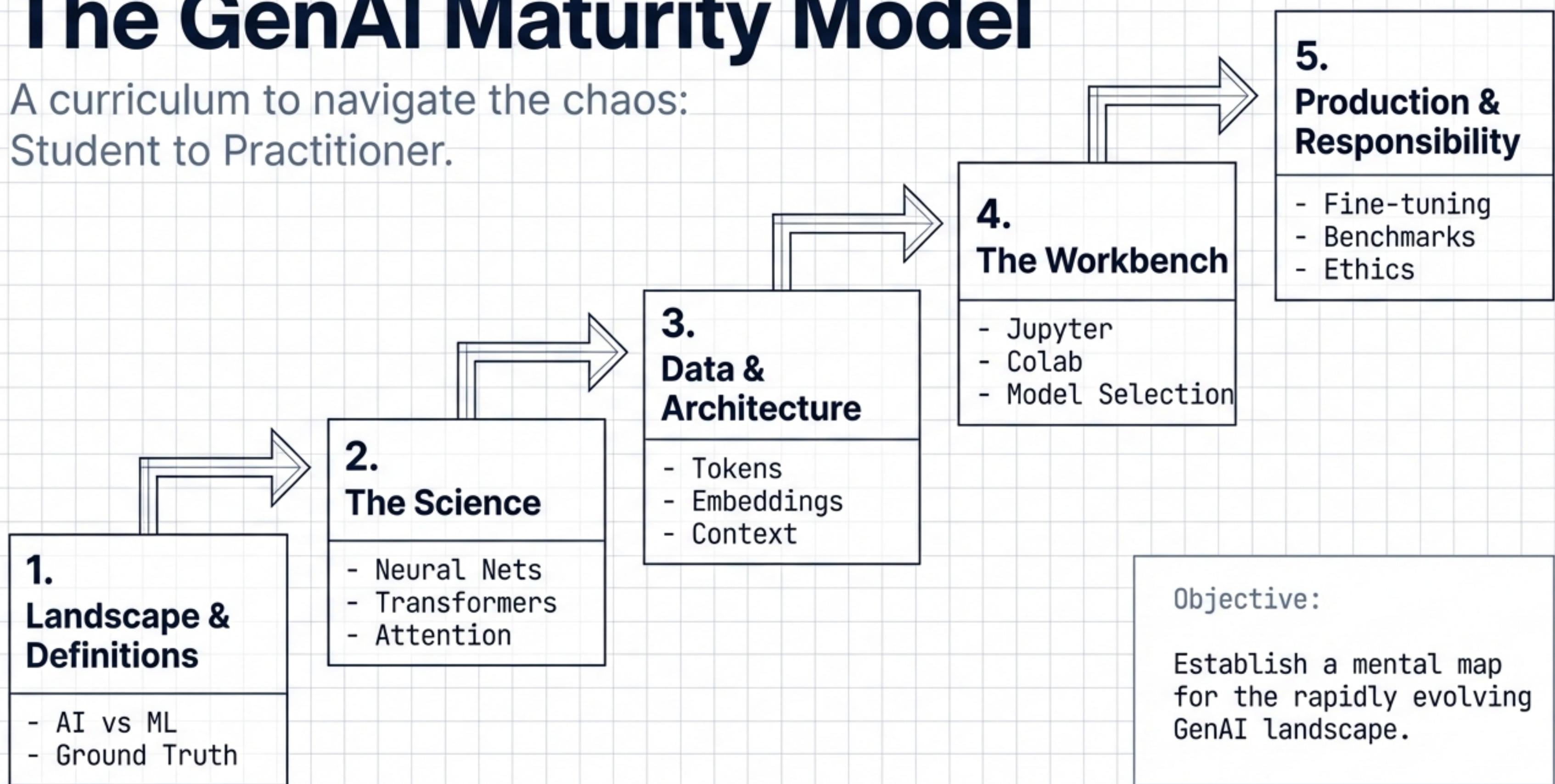
# GenAI Essentials: From Concept to Code

A comprehensive technical roadmap based on  
the ExamPro GenAI Maturity Model.

Course Code: EXP-GENI-001  
Instructors: Andrew Brown & Rola  
Target: Developers & Engineers

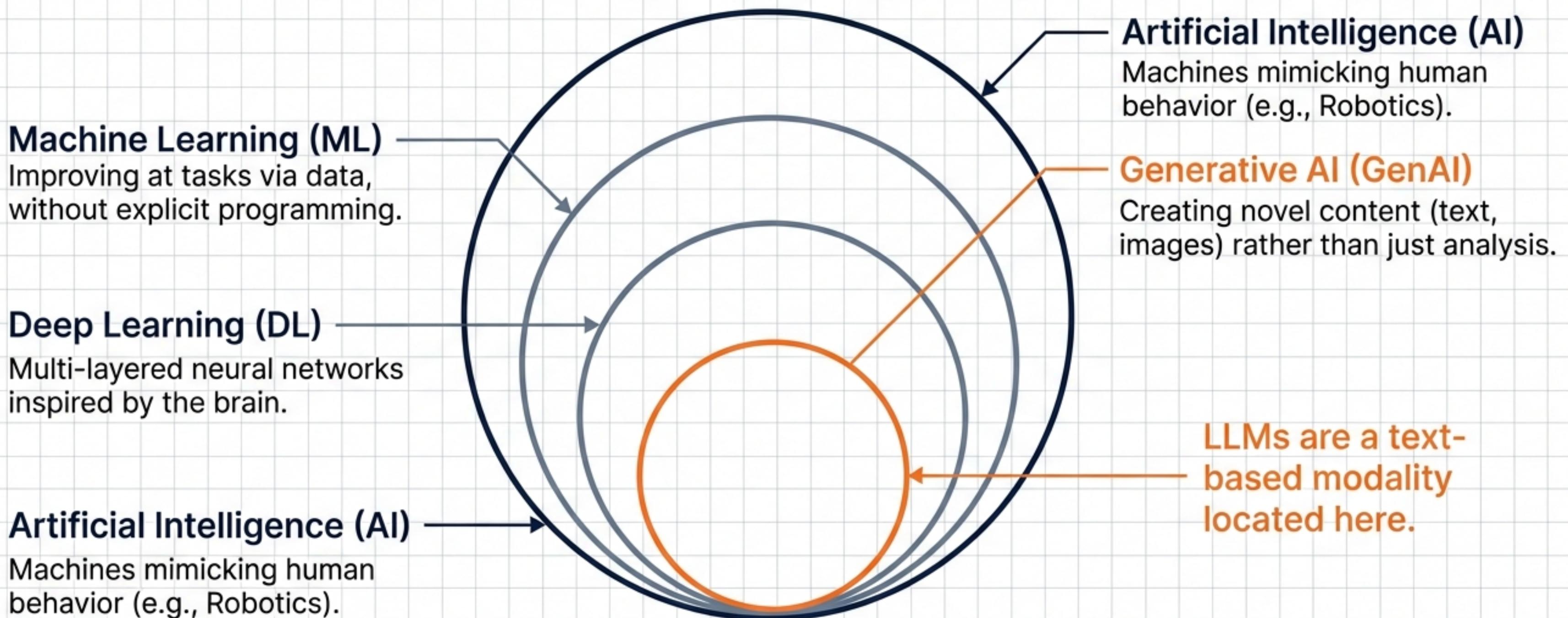
# The GenAI Maturity Model

A curriculum to navigate the chaos:  
Student to Practitioner.



# Defining the Hierarchy

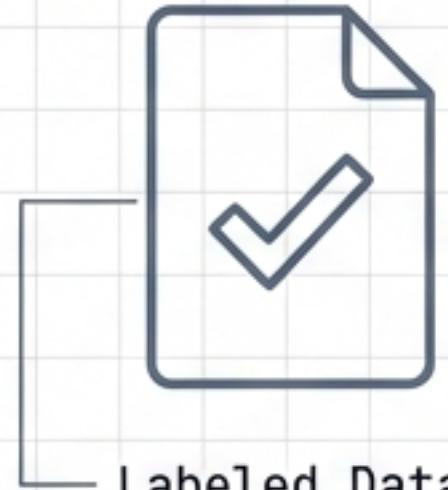
The 'Russian Doll' relationship of AI disciplines.



# Machine Learning Paradigms

Three ways machines learn from data.

## Supervised Learning

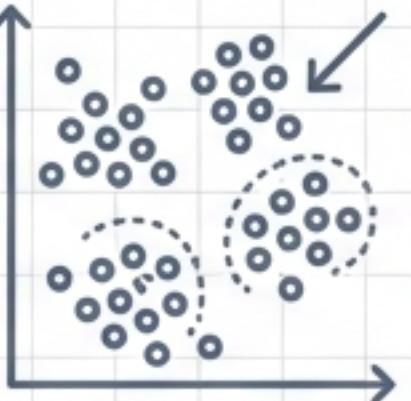


Labeled Data

Mechanism: "Show me how."  
Uses Ground Truth (Labeled Data).

**Key Concept:** Task-Driven (Classification, Regression).

## Unsupervised Learning

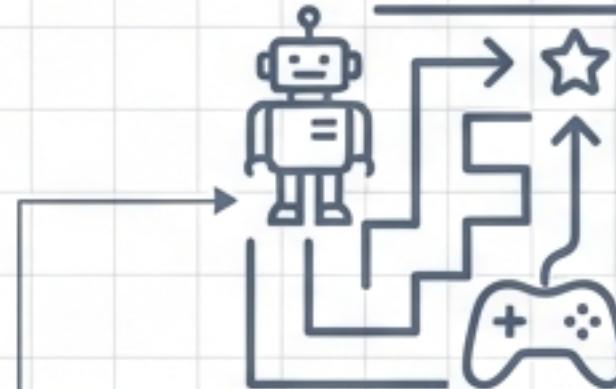


Pattern Finding

Mechanism: "Find the patterns."  
Uses Unlabeled Data.

**Key Concept:** Data-Driven (Clustering, Segmentation).

## Reinforcement Learning



Agent/Environment/Reward

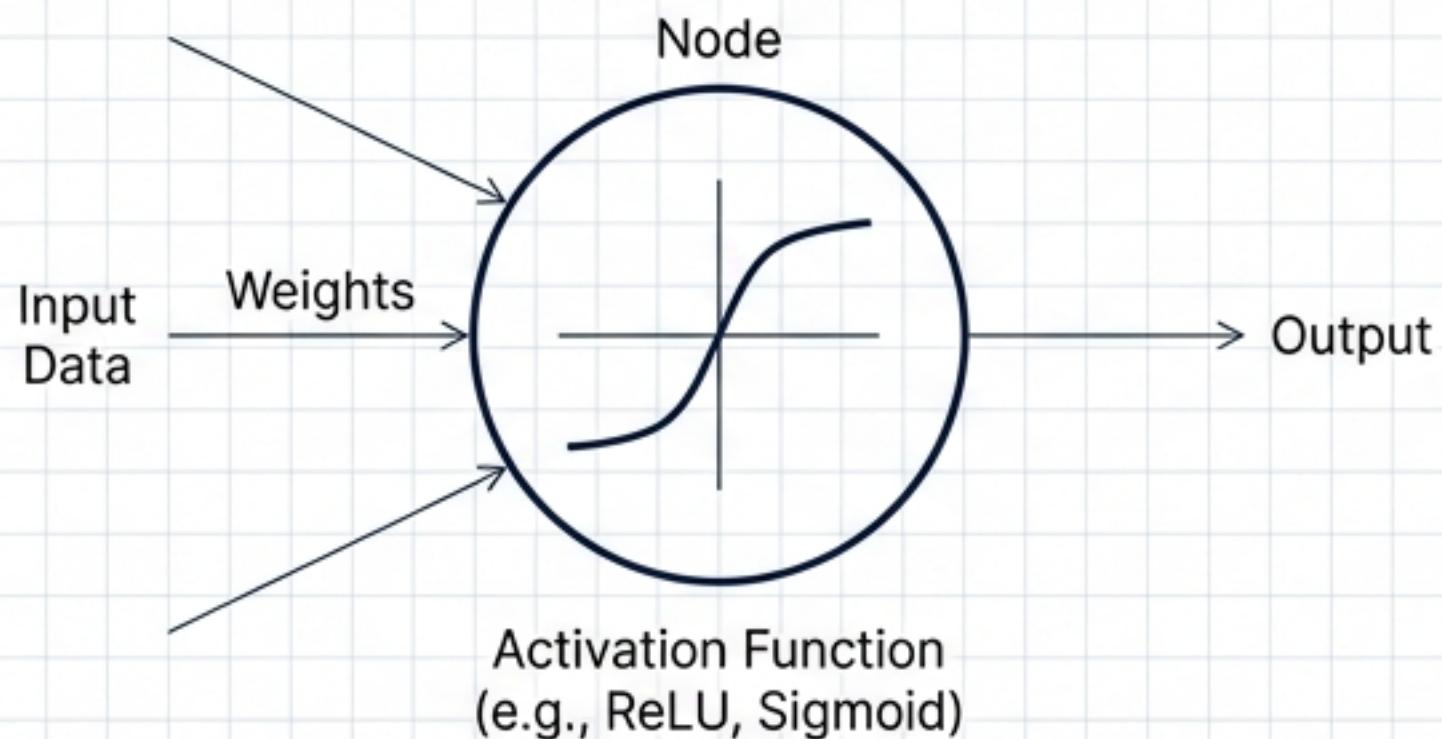
Mechanism: "Trial & Error."  
Agent learns via Rewards/Punishment.

**Key Concept:** Decision-Driven (Game AI, Robotics).

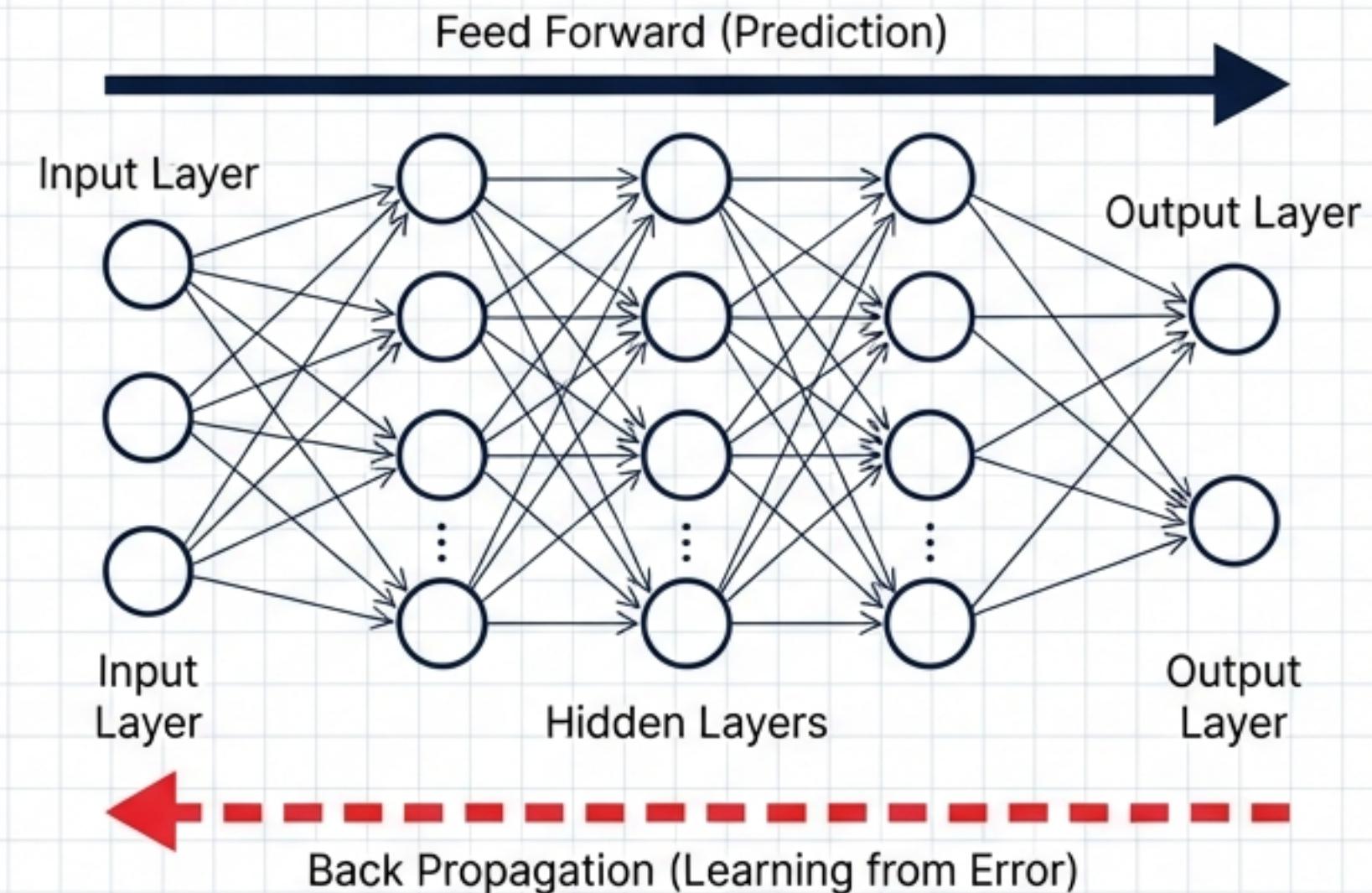
# Deep Learning: The Neural Network

Stripping away the hype to show the math.

## The Single Neuron (Perceptron)

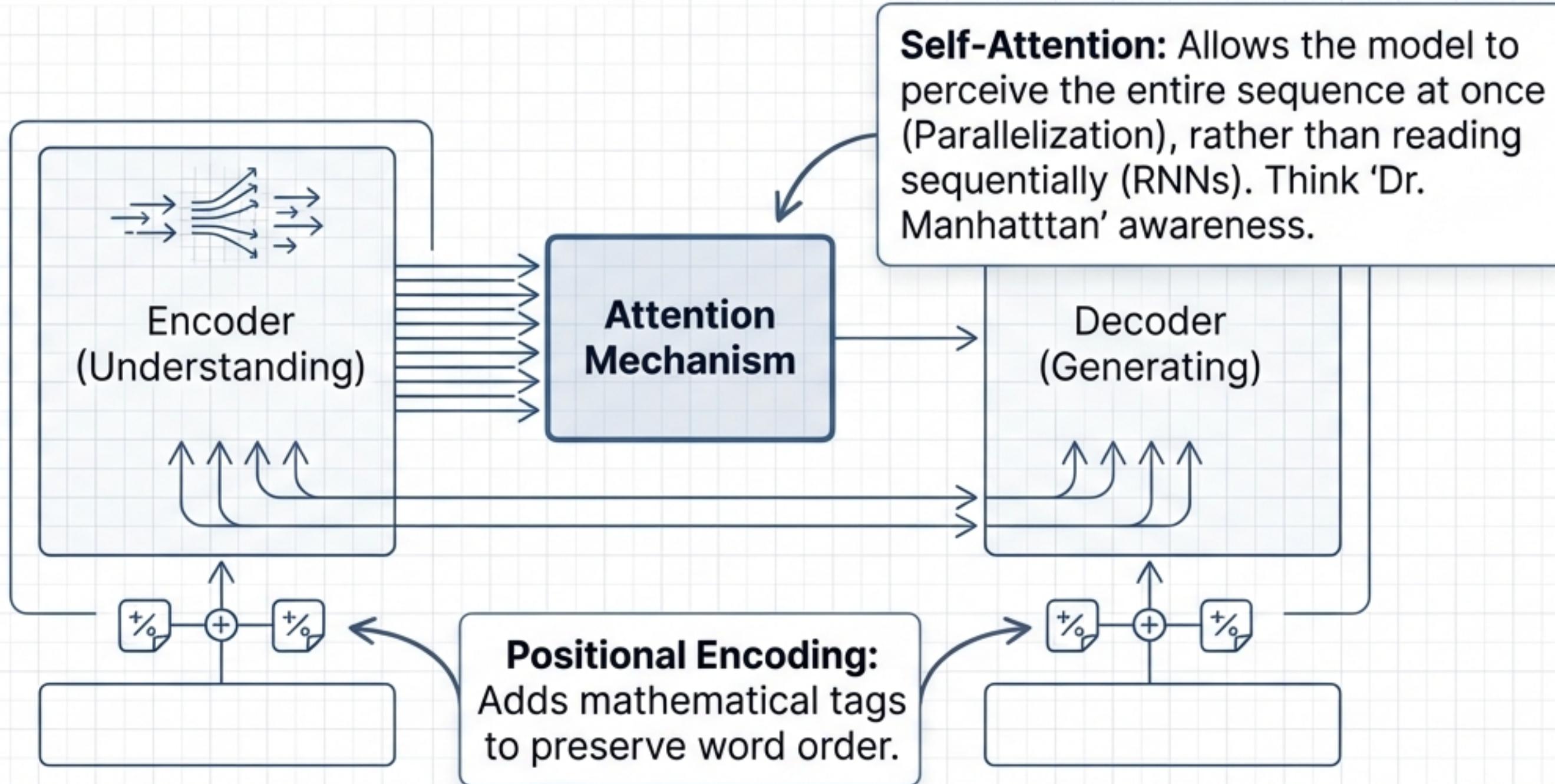


## Multi-Layer Perceptron (MLP)



# The Transformer Architecture (2017)

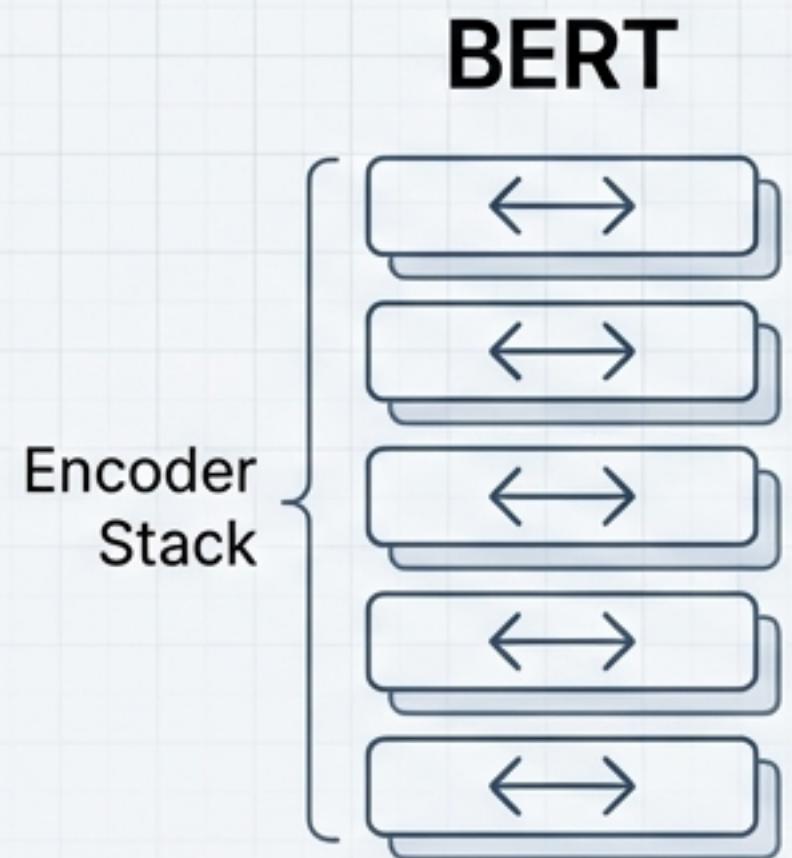
Attention Is All You Need.



This architecture enabled the scaling of massive LLMs.

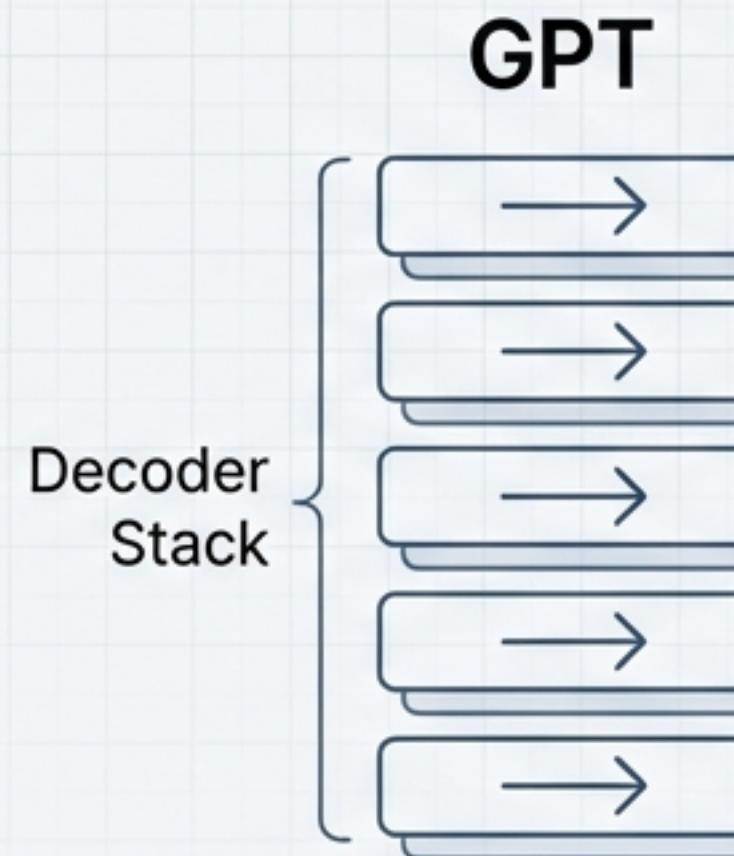
# Model Families: BERT vs. GPT

Encoder-only vs. Decoder-only architectures.



Bidirectional Encoder Representations  
from Transformers.  
The Reader / Analyst.

Best For: Classification,  
Sentiment Analysis, NER.

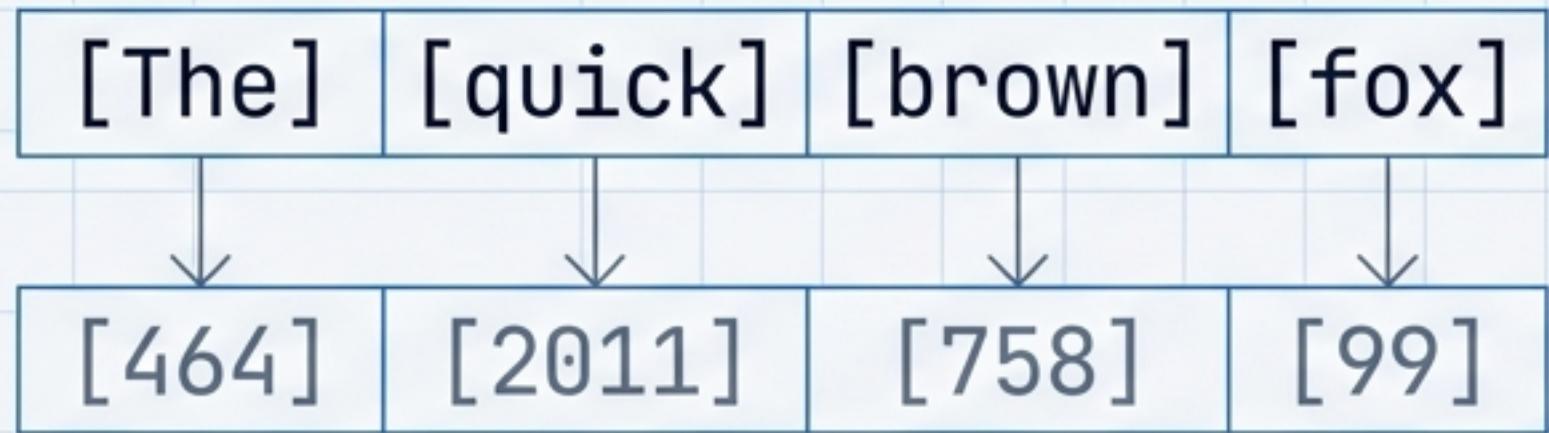


Generative Pre-trained Transformer.  
The Writer / Creator.

Best For: Text Generation, Chat,  
Autoregressive Prediction.

# The Language of AI: Tokens

How text becomes math.



Tokens ≠ Words. (Approx 0.75 words/token).

Algorithms: BPE (GPT), WordPiece (BERT).

## Key Constraints

Context Window

The model's short-term memory  
(Input + Output capacity).

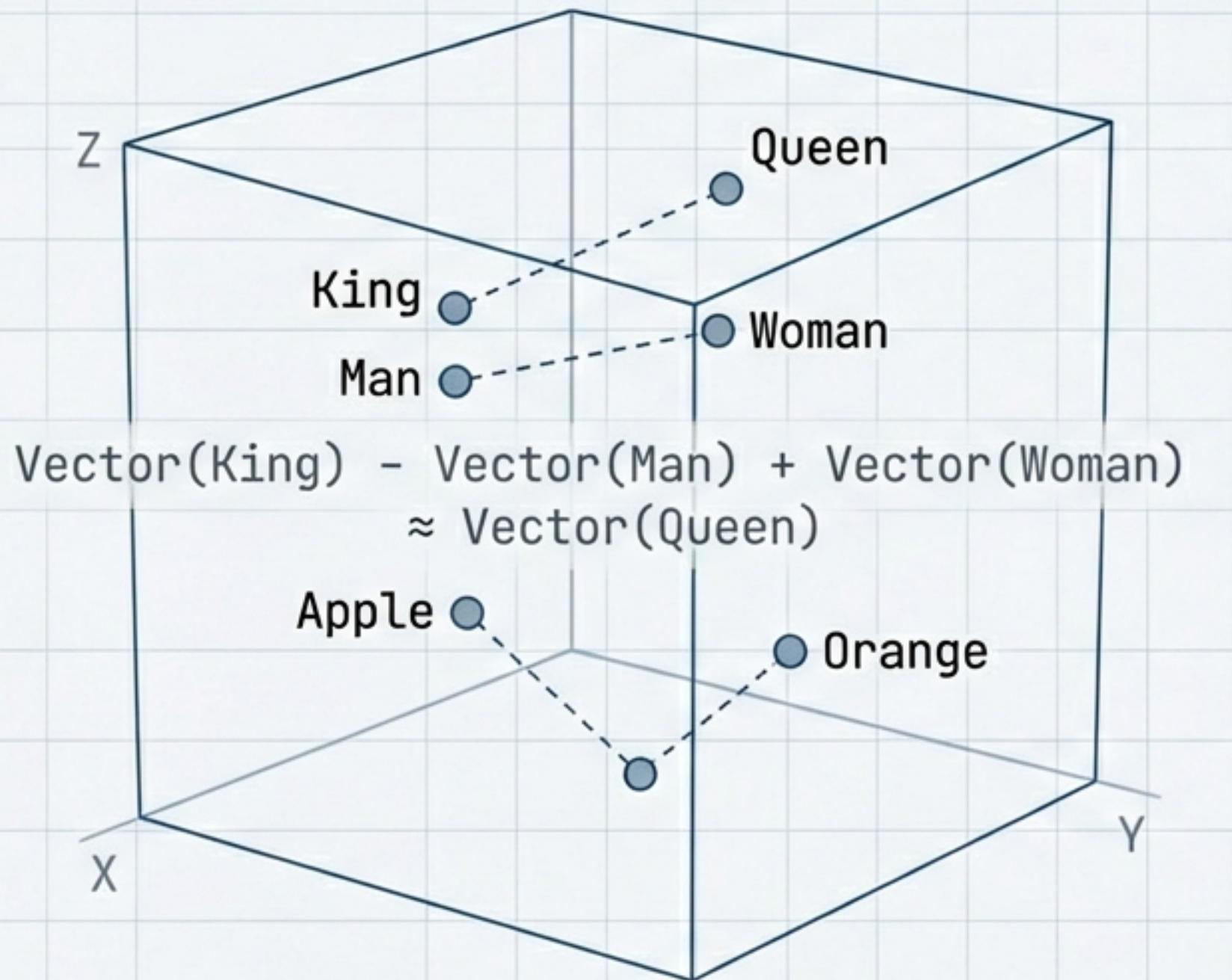
Compute Cost

Memory scales linearly. Attention  
compute scales quadratically.

Vocabulary: The fixed dictionary of 30k-100k unique tokens the model knows.

# Embeddings & Vector Spaces

Measuring the meaning of words.



- **Embeddings:** Converting tokens into dense vectors (lists of numbers) to represent semantic meaning.
- **Vector Space:** A multi-dimensional map where distance equals similarity.
- **Application:** Powering Semantic Search and RAG (Retrieval Augmented Generation).

# Decoding the ‘Large’ in LLM

Parameters, scaling laws, and efficiency.

## Definitions

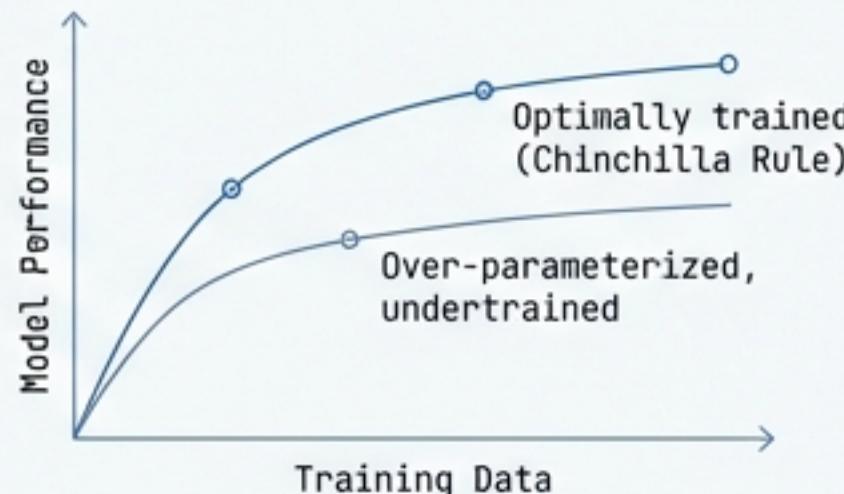
### Parameters

Internal variables (weights) learned during training. (e.g., **GPT-4 has trillions**).

### Foundation Model

A general-purpose base model trained on vast internet-scale data.

## Rola's Insight: The Chinchilla Paper



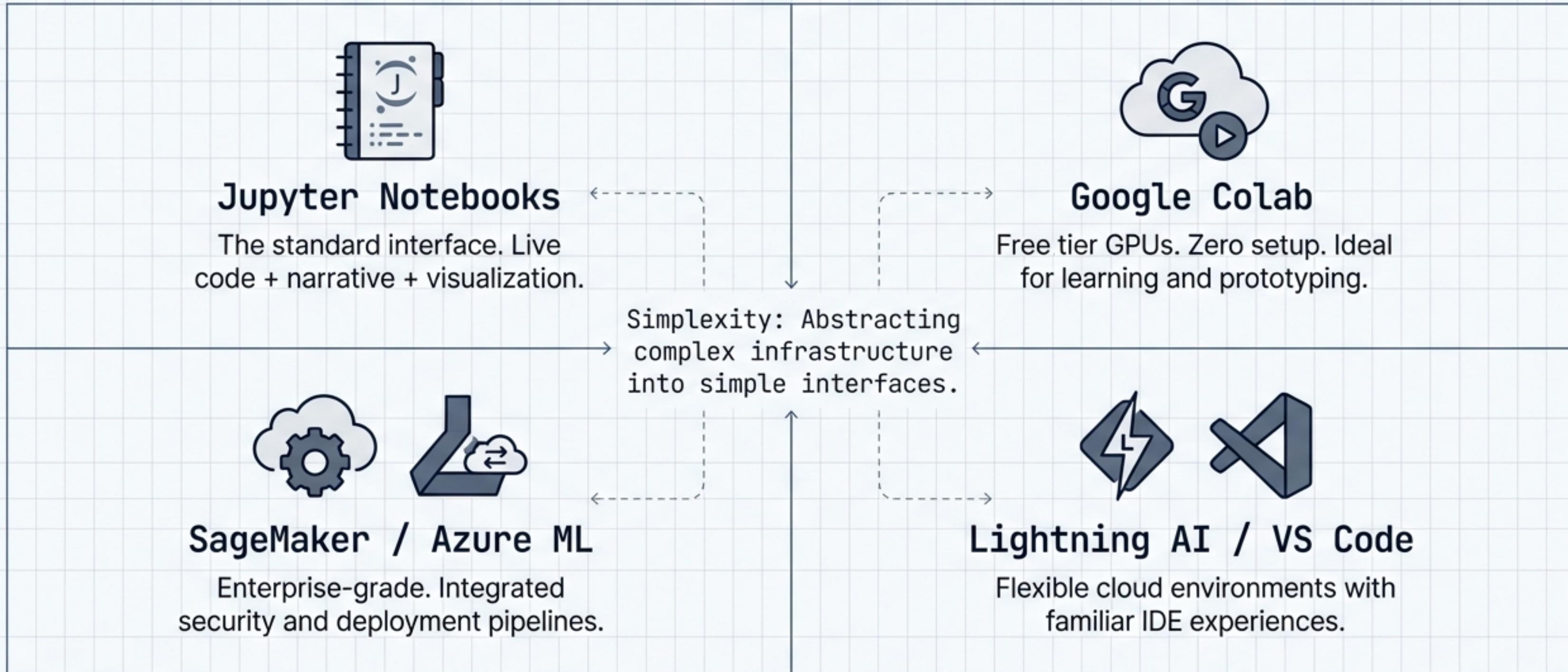
**Discovery:** Many models are over-parameterized and undertrained.

**The Chinchilla Rule:** Optimal training requires ~20x training tokens per parameter.

**Takeaway:** Smaller, better-trained models often beat larger, under-trained ones.

# The Developer's Workbench

Environments for building GenAI workloads.

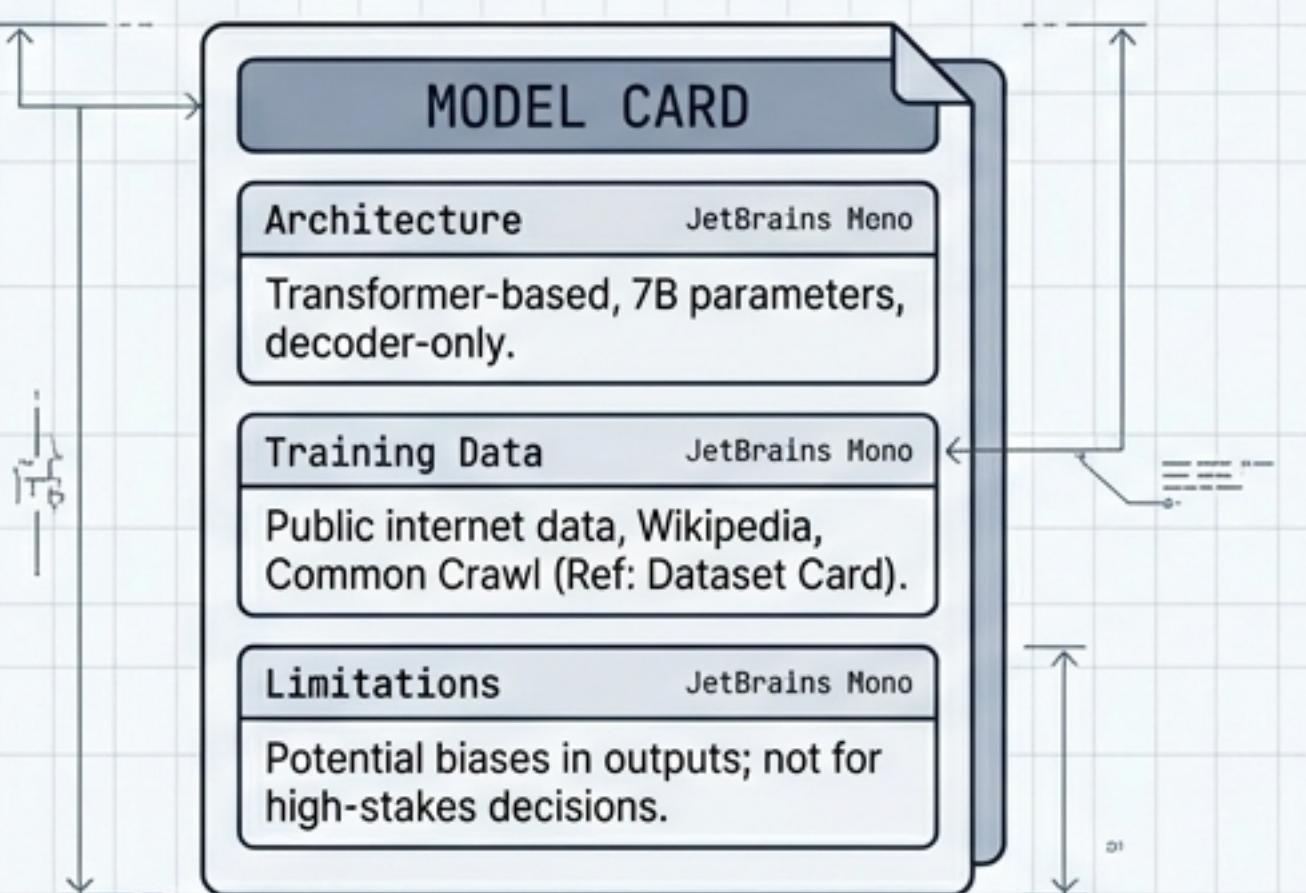


# The Model Marketplace

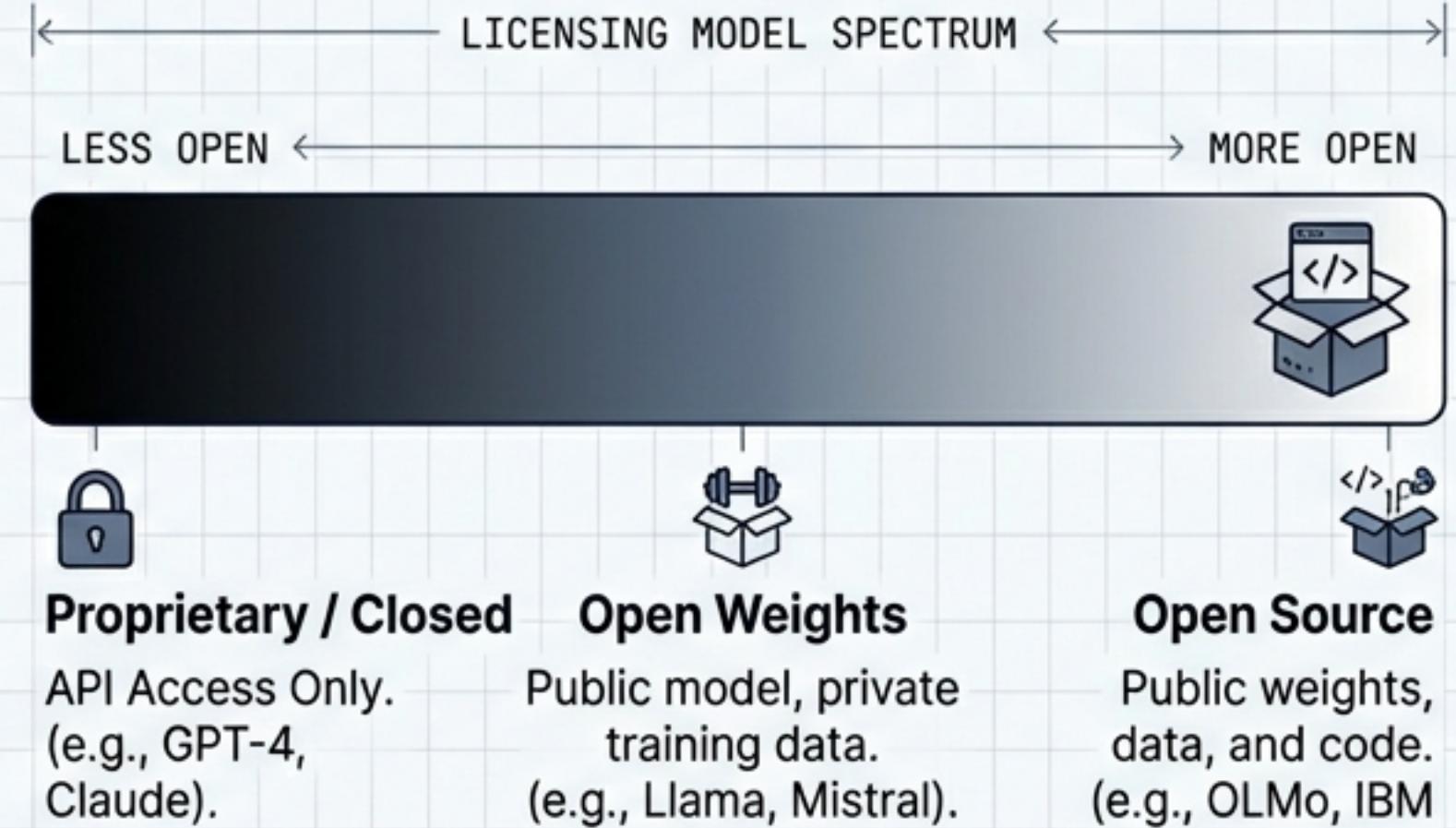
Navigating Hugging Face and licensing models.

## The Hub: Hugging Face

The 'GitHub of AI'. Repository for models, datasets, and demos.

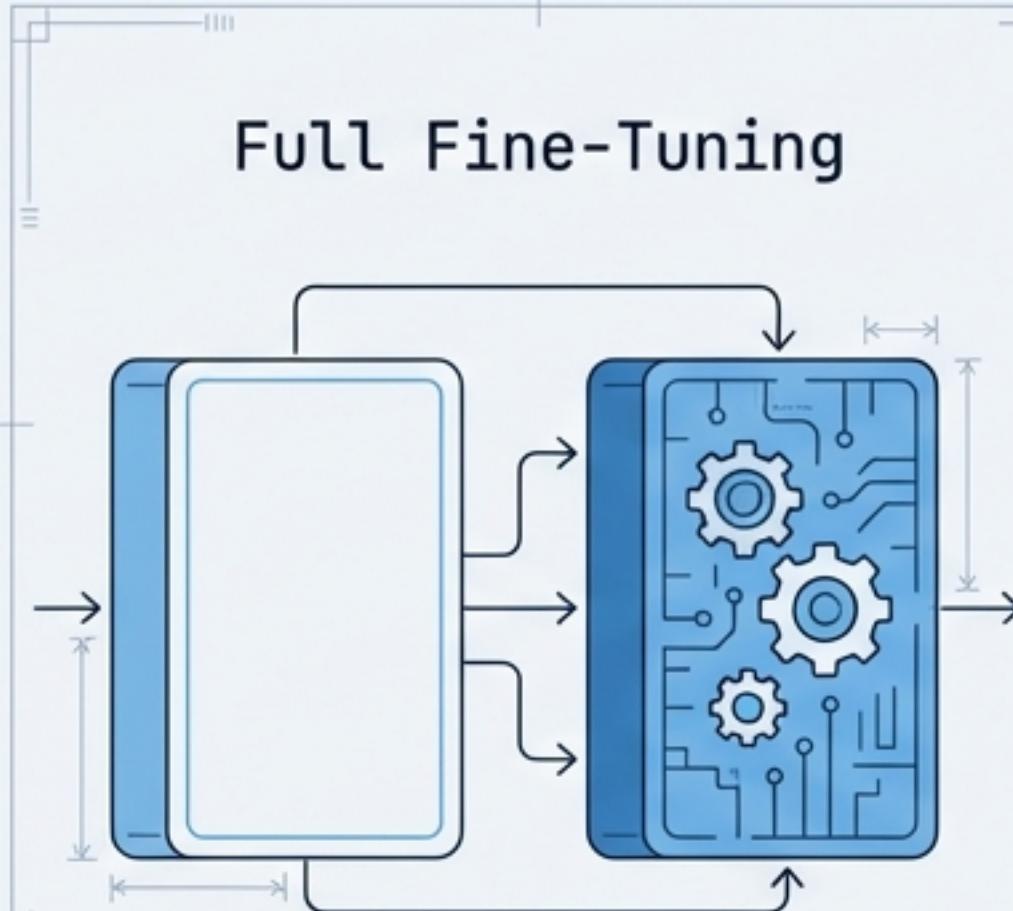


## The Licensing Spectrum



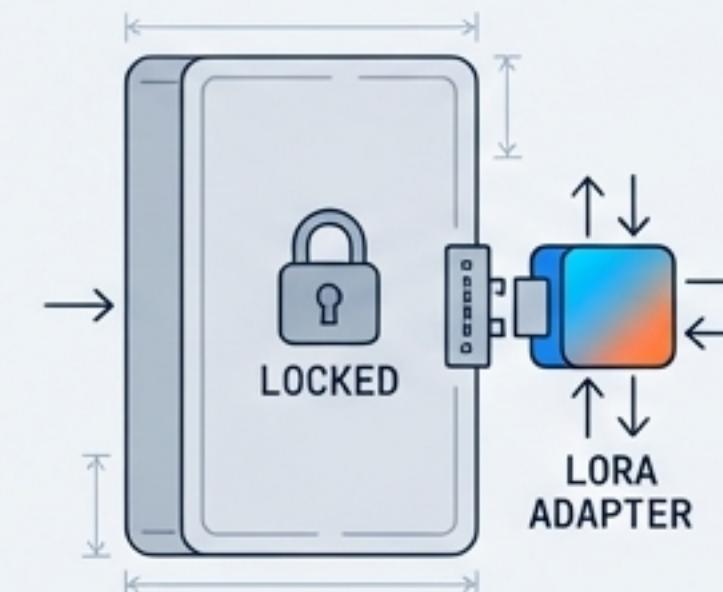
# Fine-Tuning & Optimization

Moving beyond the base model.



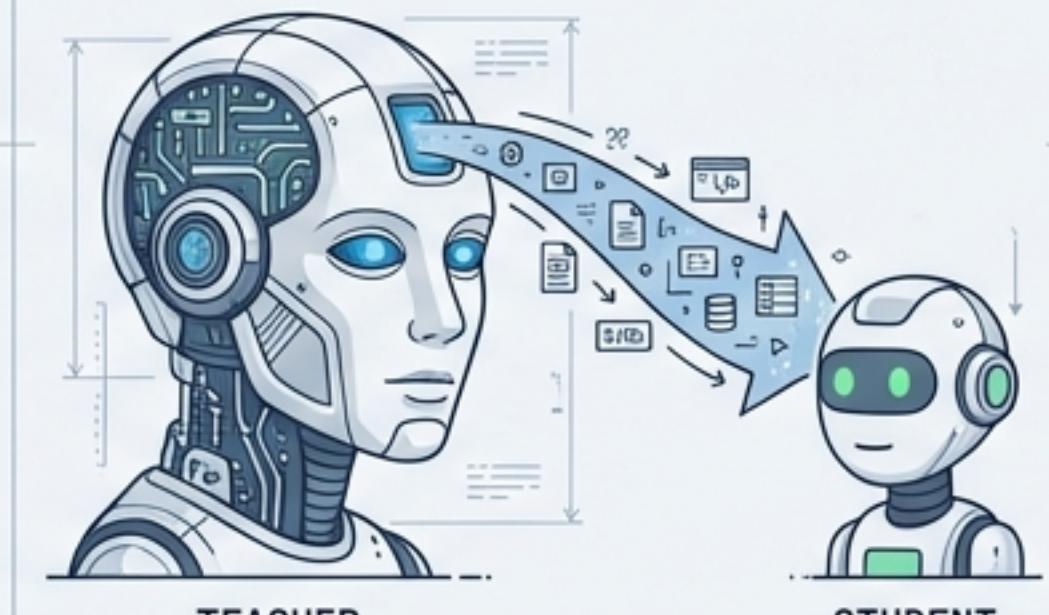
Retraining all parameters.  
Expensive & slow.

PEFT / LoRA  
(Low-Rank Adaptation)



Updates only a small subset  
of parameters.  
Cheap, fast, low VRAM.

Distillation



Training a small model to  
mimic a massive one.  
High performance, low latency.

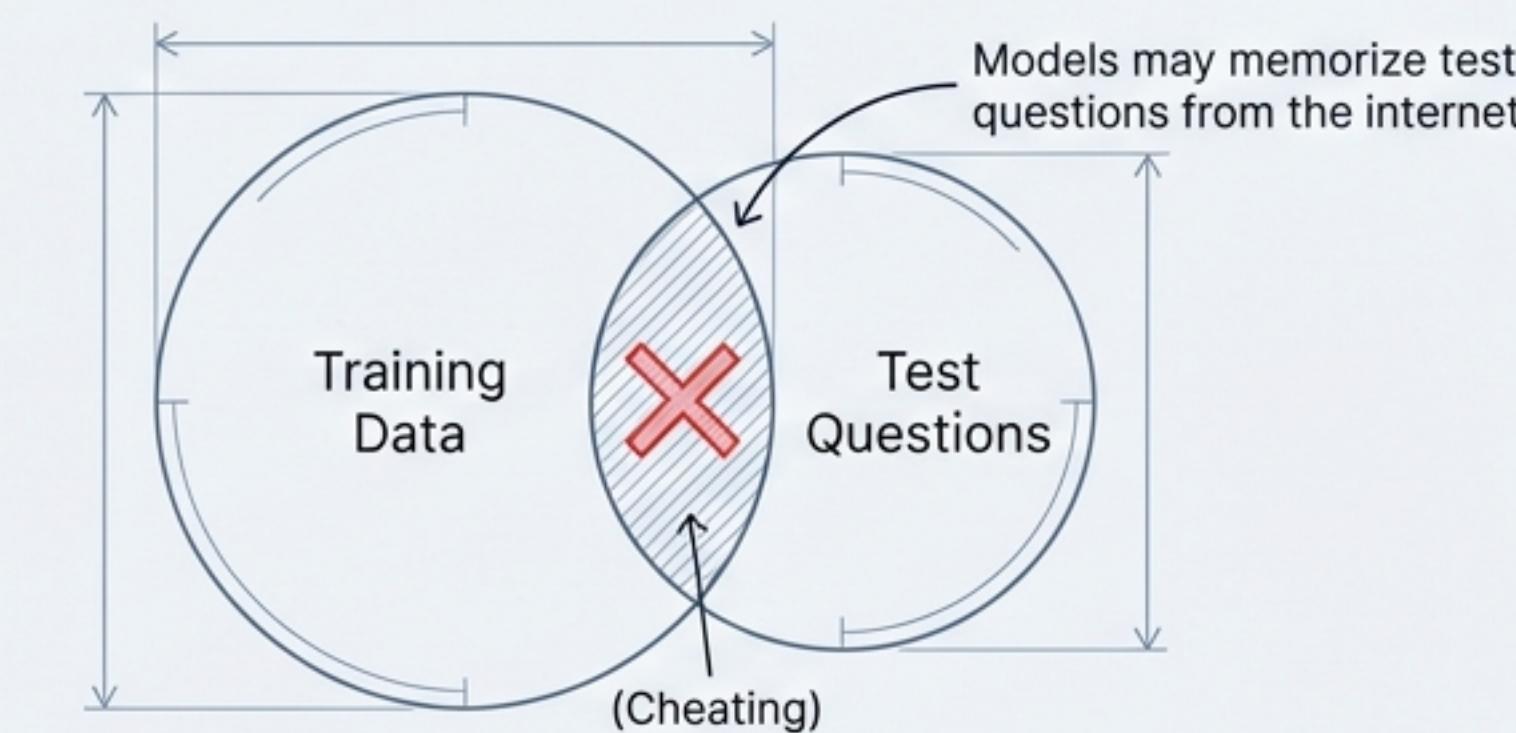
# Evaluation & Benchmarks

The challenge of measuring intelligence.

## The “SATs” of AI



## The Contamination Problem



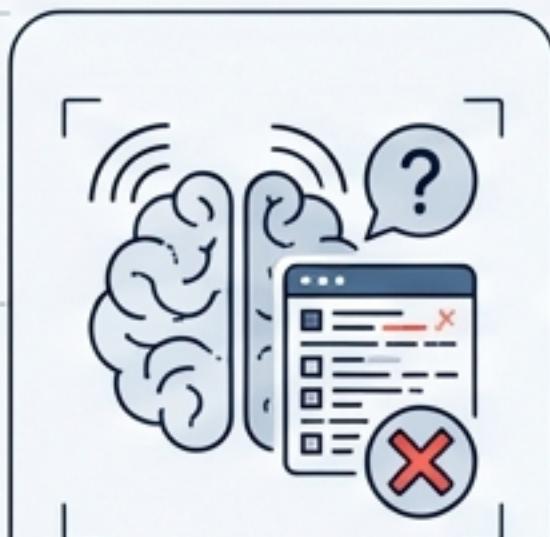
## Solution:



# Responsible AI & Next Steps

Navigating the 'Black Box'.

## WARNING



### Hallucination

Confidence ≠ Correctness.



### Bias

Amplifying training data prejudices.

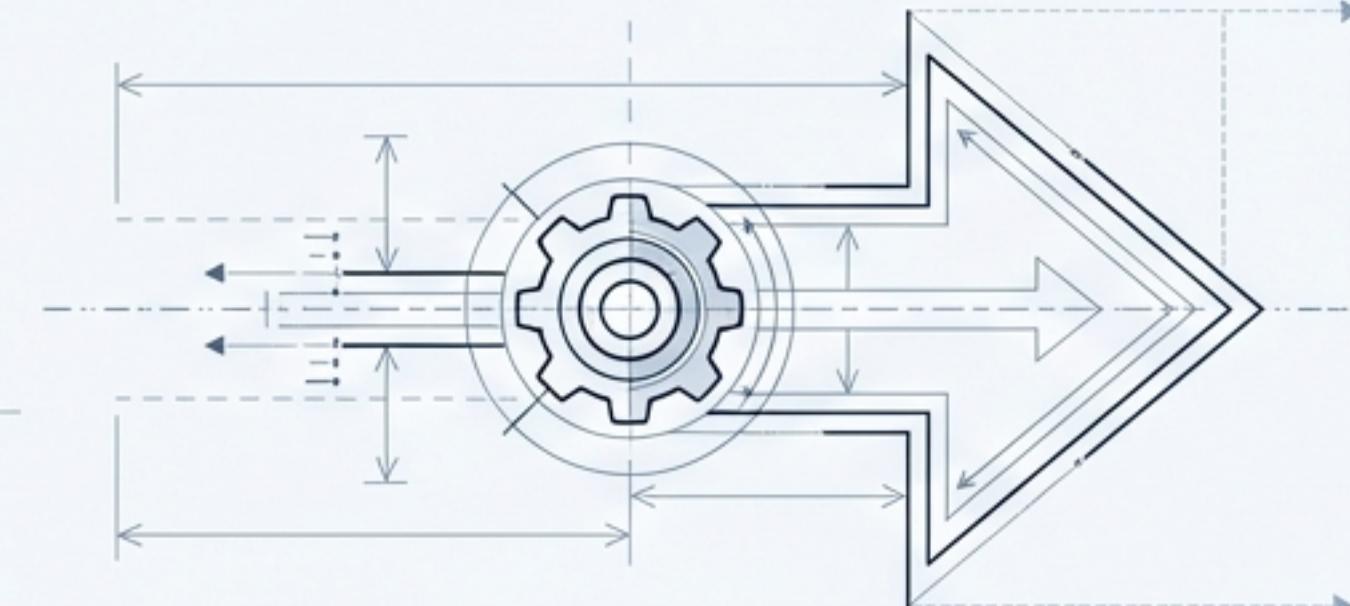


### Privacy

Risk of PII leakage.



## Conclusion / Call to Action



**The path forward is practical application.  
Move from "prompting"  
to "engineering" by  
building real projects.**