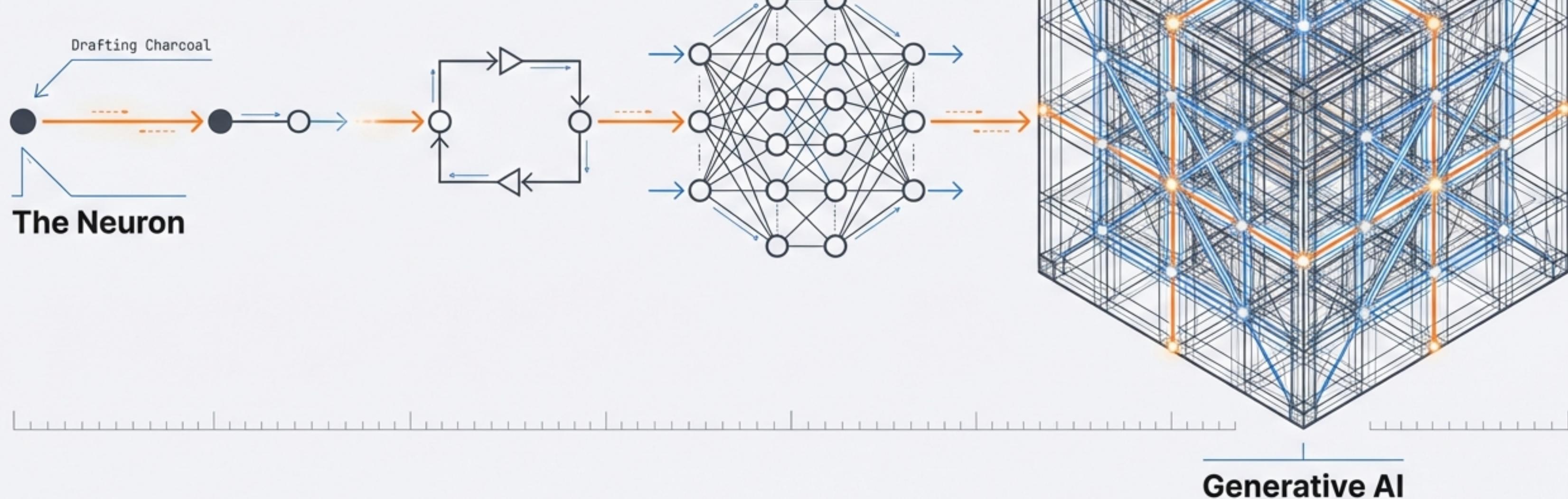
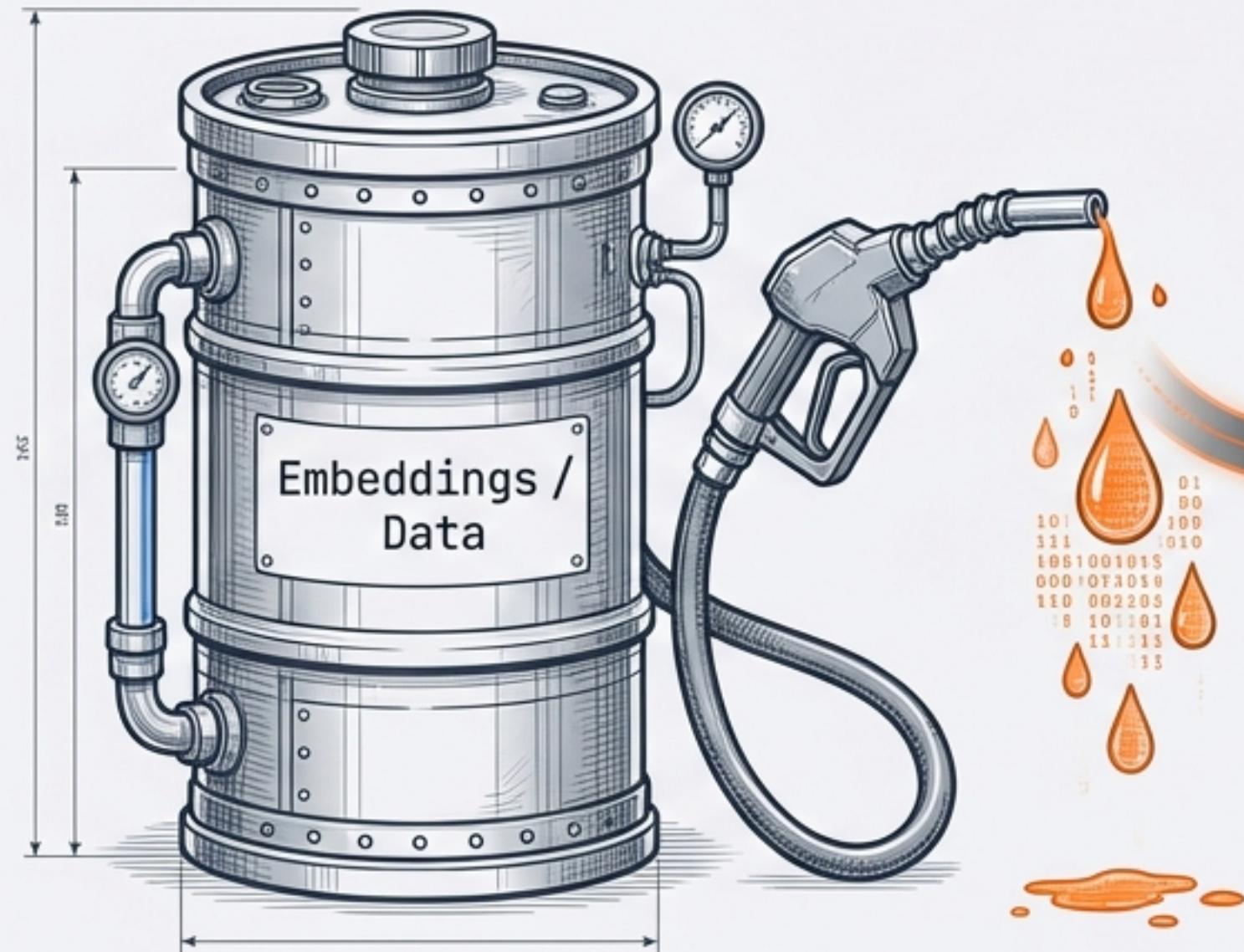


# The Evolution of the Engine

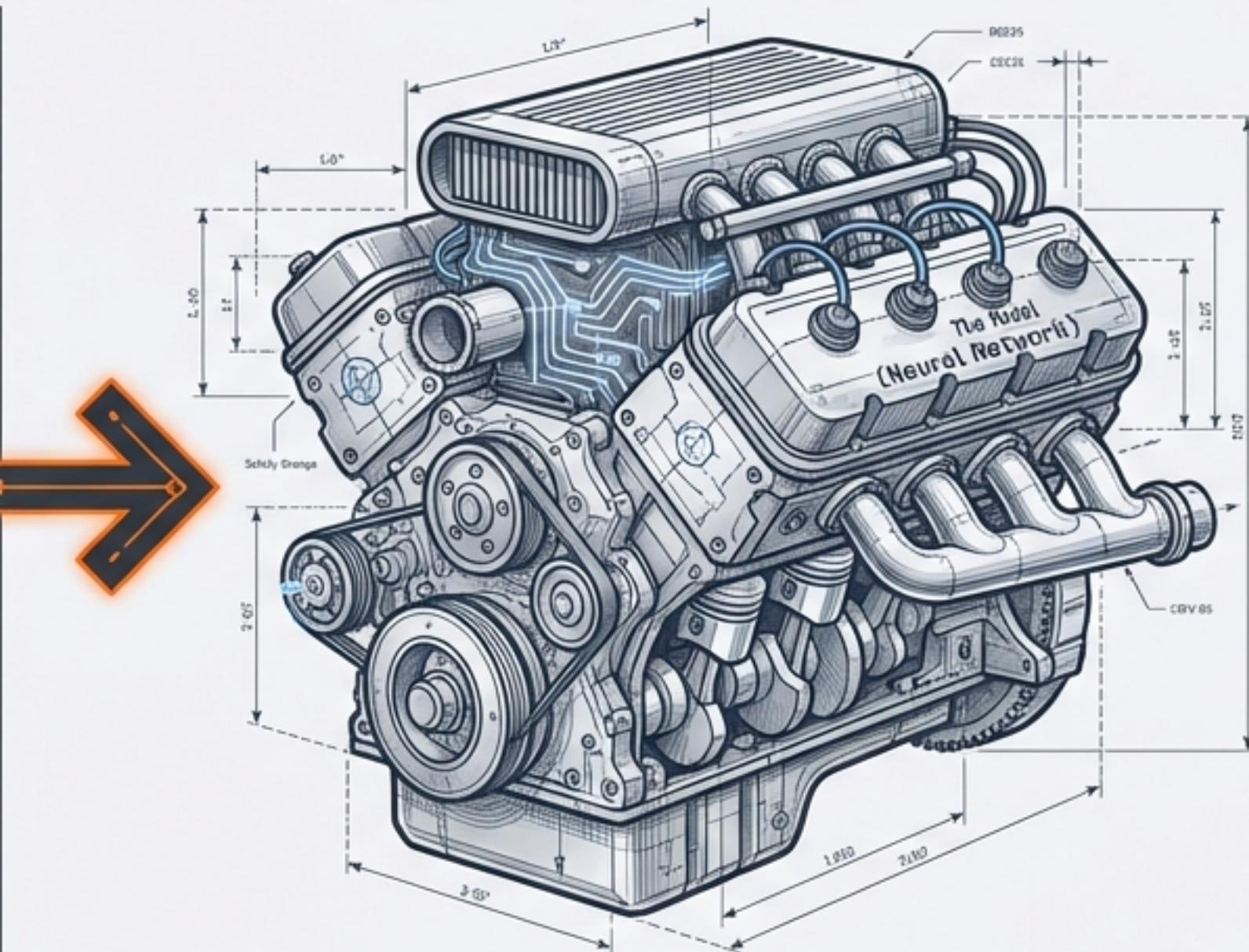
From Simple Neurons to Generative AI: A step-by-step guide to how machines learned to think.



# You have the Fuel. Now meet the Engine.

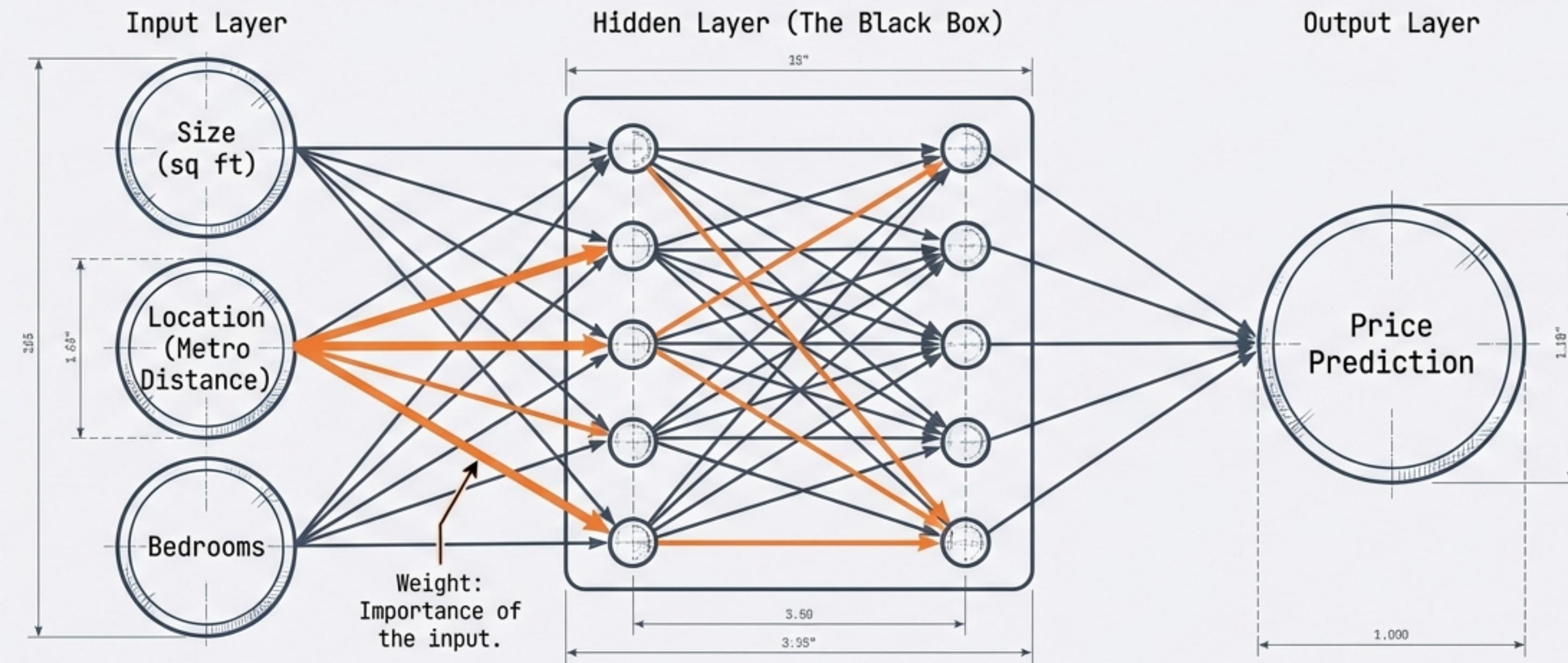


**The Fuel:** Embeddings turn words into numbers the machine understands.



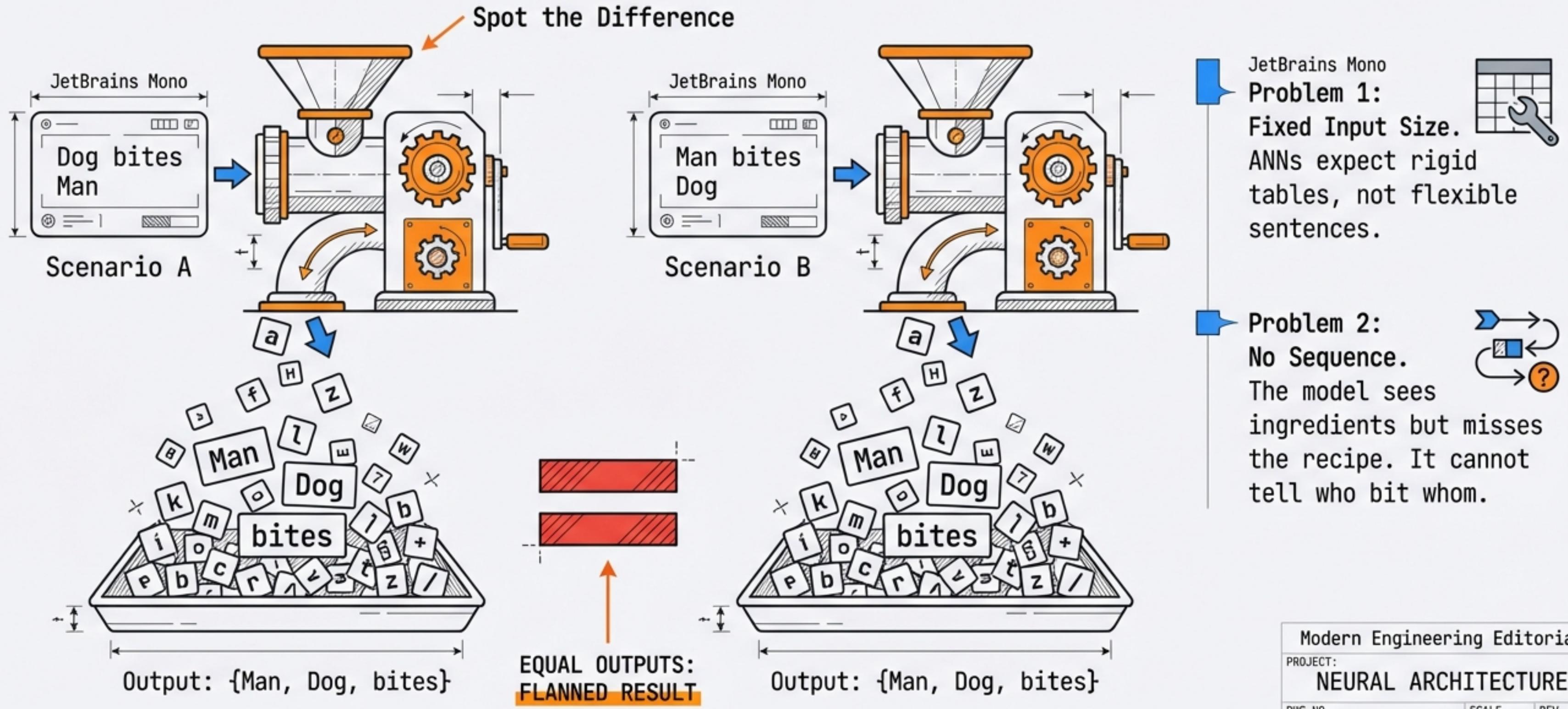
**The Engine:** The architecture that processes the fuel. To understand ChatGPT, we must first understand the simpler engines that came before it.

# Level 1: The Artificial Neural Network (ANN)



ANNs mimic the brain's decision-making process for fixed data tables.

# The Flaw: The “Bag of Words” Problem



Modern Engineering Editorial

PROJECT:  
NEURAL ARCHITECTURE

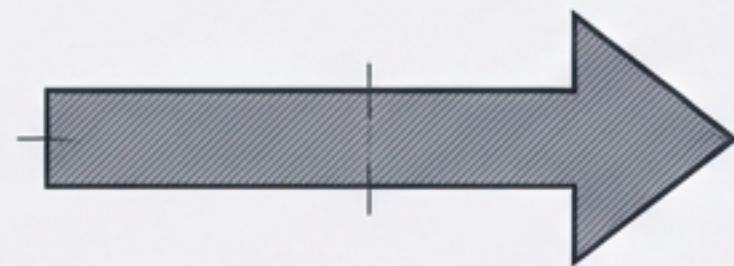
DWG NO.      SCALE      REV

AI-ENG-02      1:1      A

NotebookLM

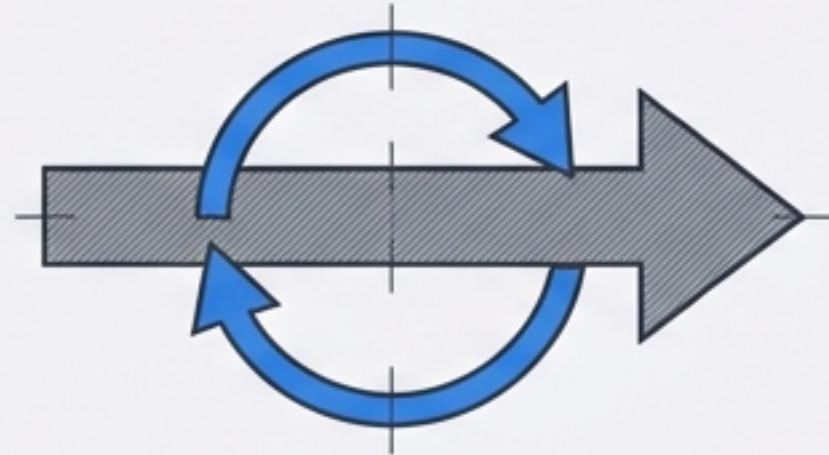
# Level 2: The Recurrent Neural Network (RNN)

(ANN)

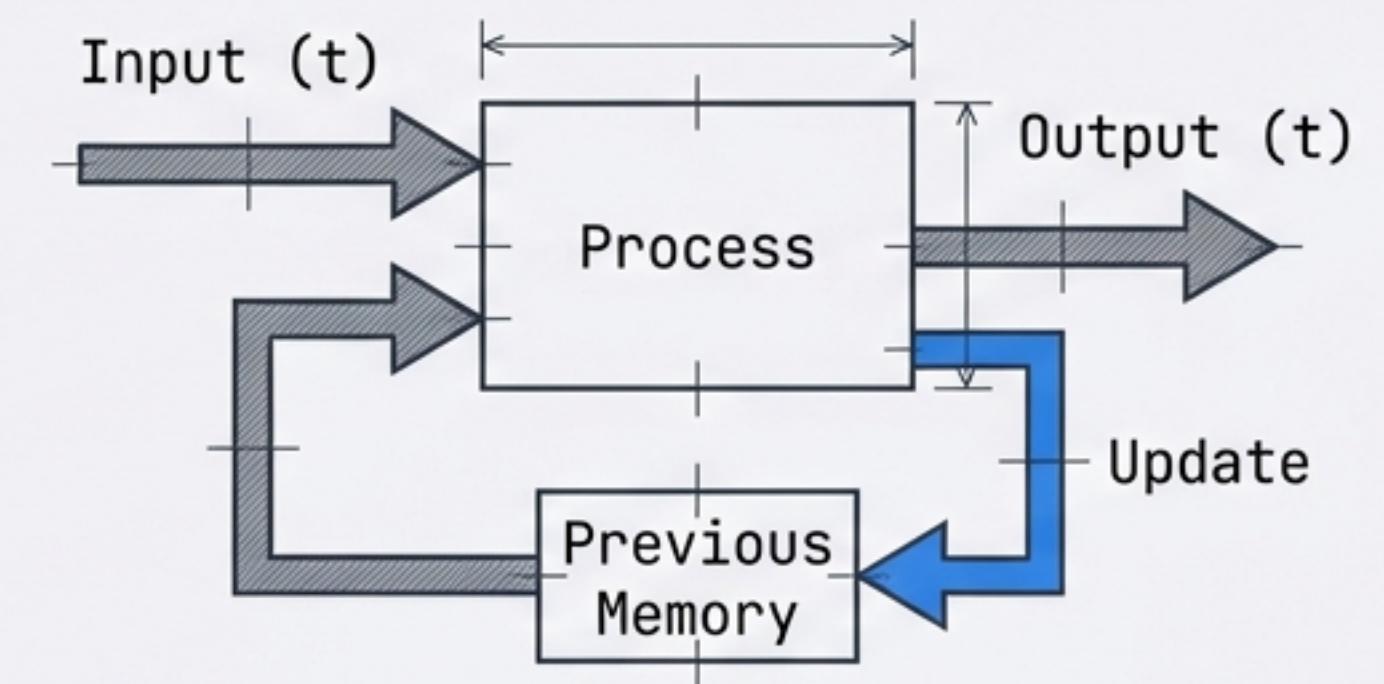


Feed Forward Only

(RNN)

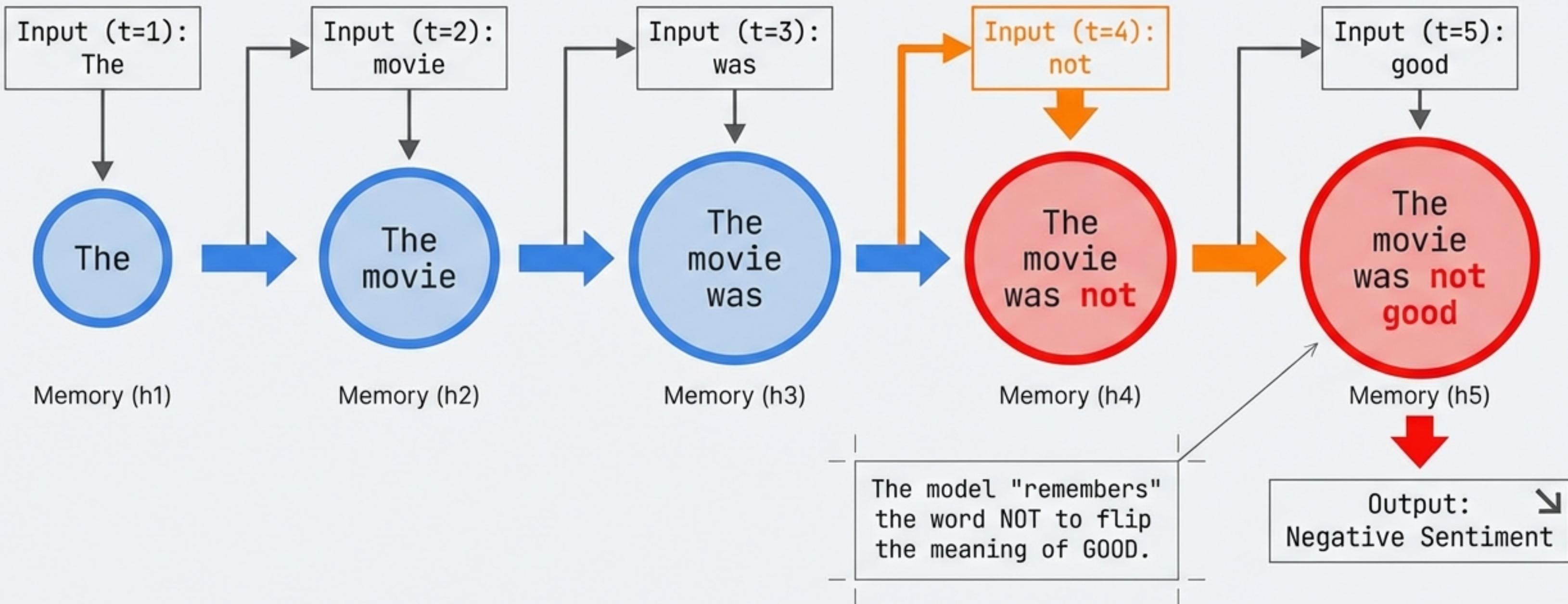


The Feedback Loop



The Fix: Adding Memory. The RNN processes the current word while remembering the "ghost" of the previous word.

# RNN in Action: Catching the Negation

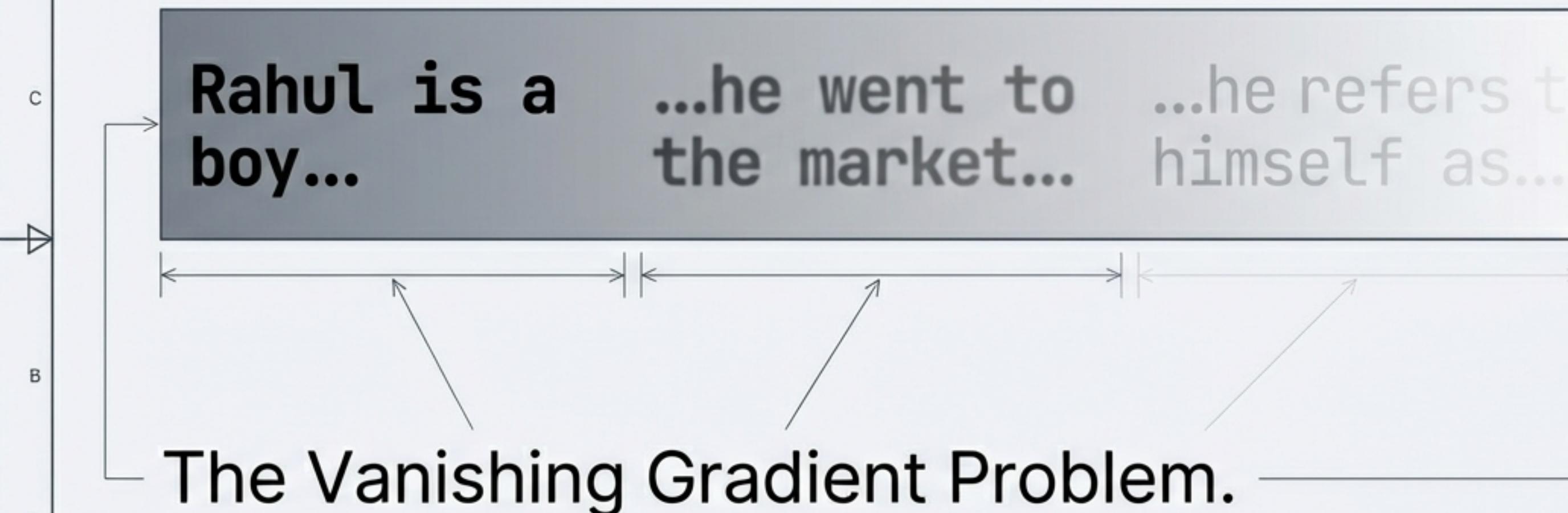


Modern Engineering Editorial.

PROJECT: NEURAL ARCHITECTURE

DWG NO. AI-ENG-04 SCALE: 1:1 REV: A

# The Flaw: The Goldfish Memory

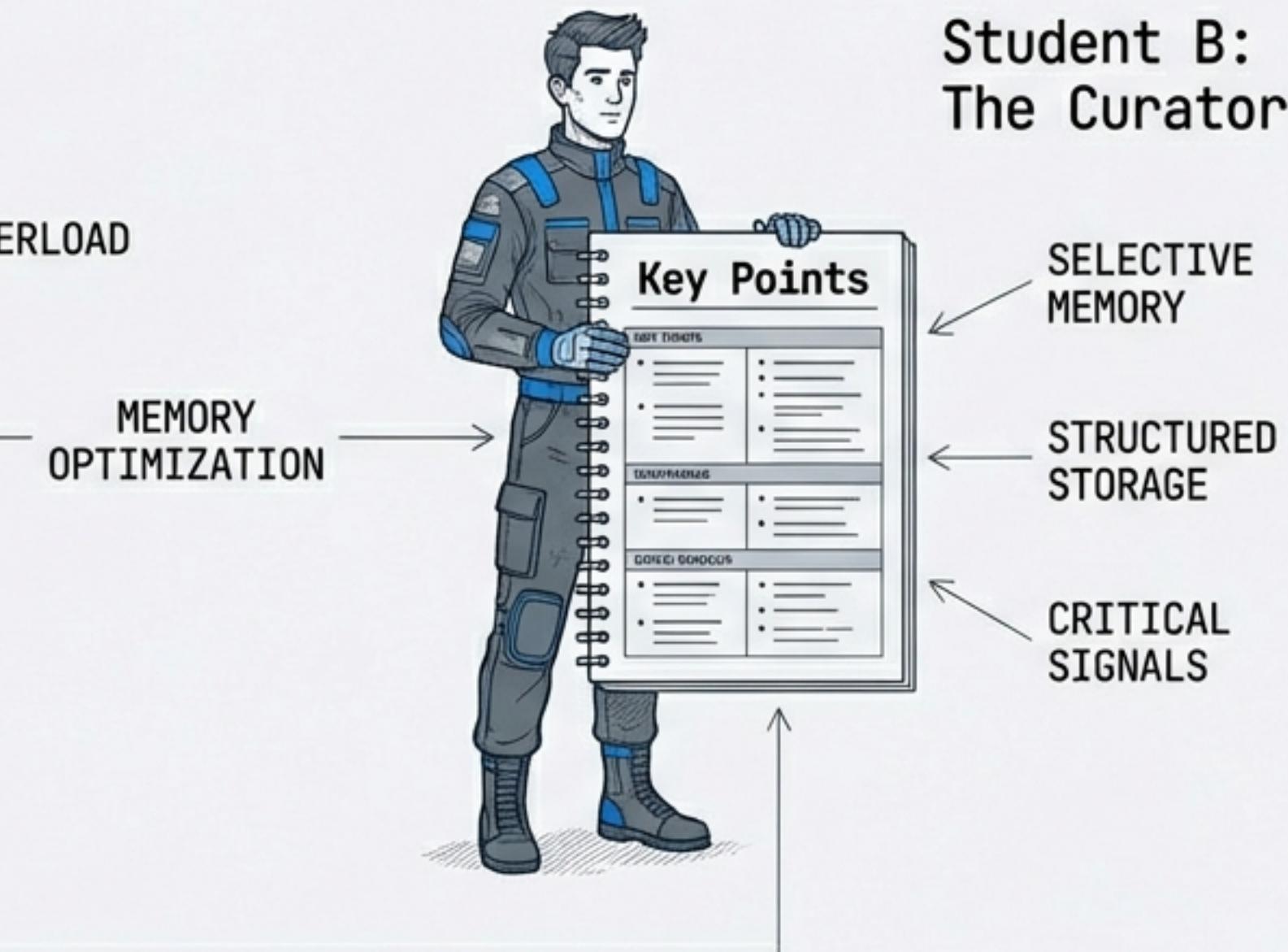
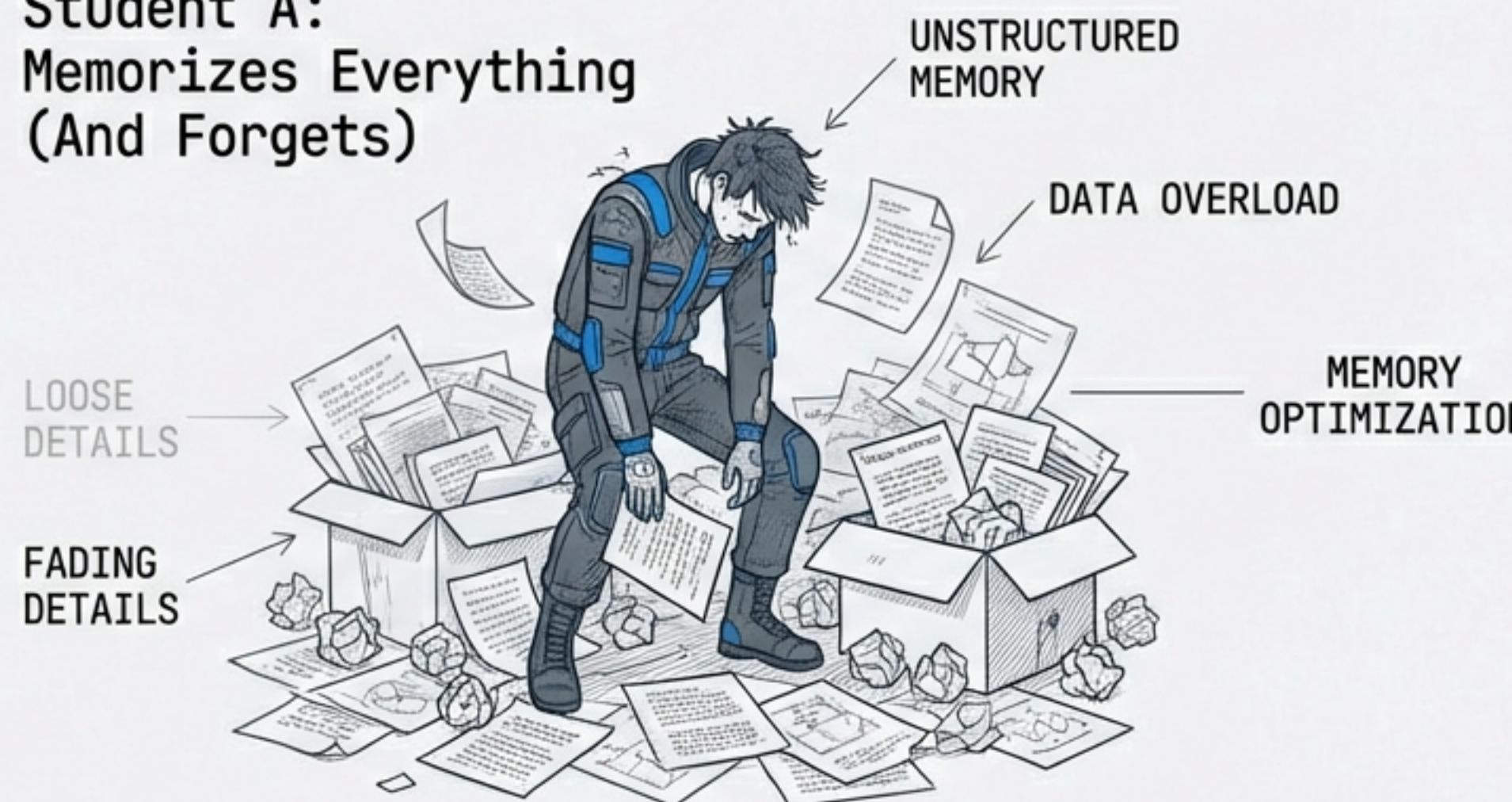


## The Vanishing Gradient Problem.

RNNs have severe short-term memory. By the time it reaches the end of a paragraph, the signal from the beginning has faded away.

# Level 3: Long Short-Term Memory (LSTM)

Student A:  
Memorizes Everything  
(And Forgets)

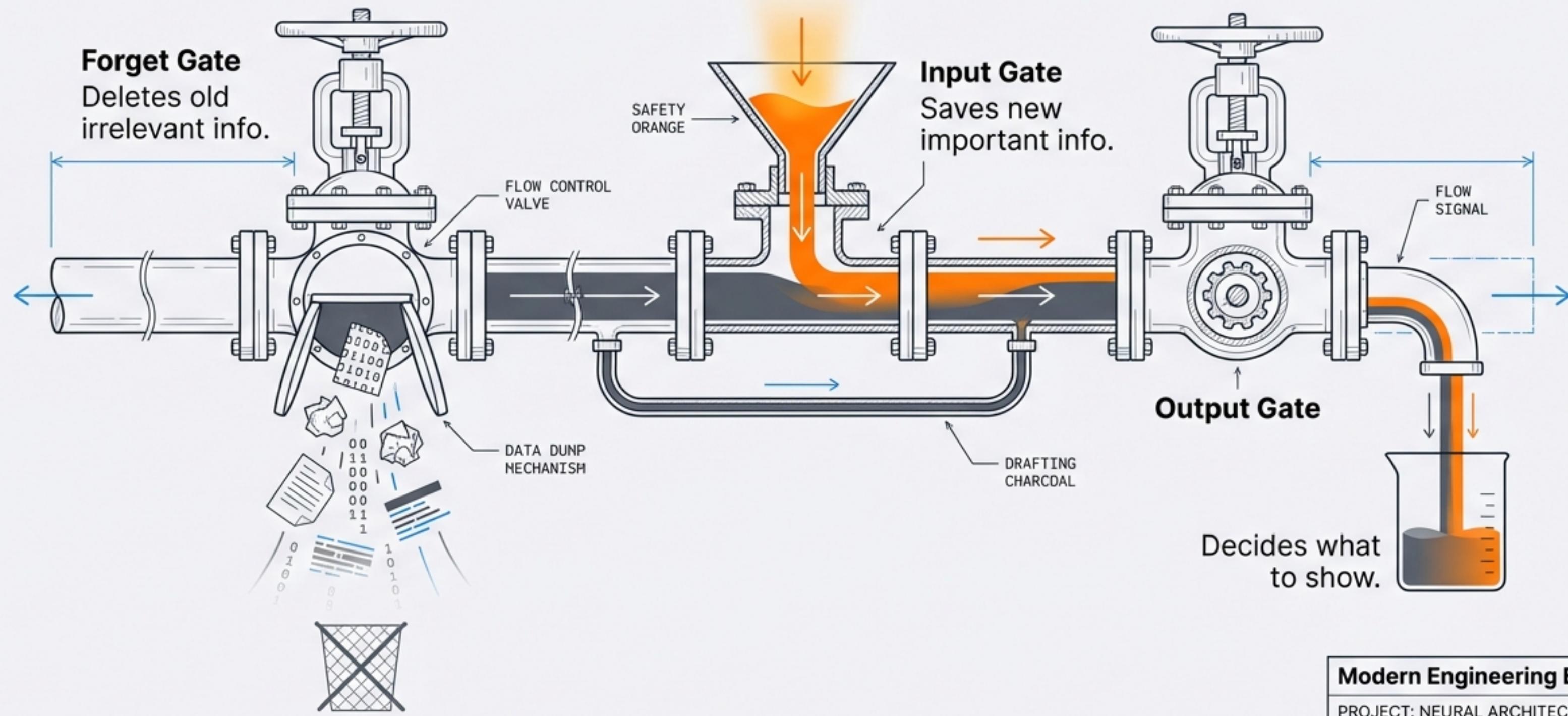


## The Fix: The Notebook.

Instead of trying to remember everything, the LSTM learns what to write down and what to ignore.

Modern Engineering Editorial.		
PROJECT: NEURAL ARCHITECTURE		
DOC ID: AI-ENG-06	SCALE: 1:1	REV: A

# Inside the LSTM: The Three Gates

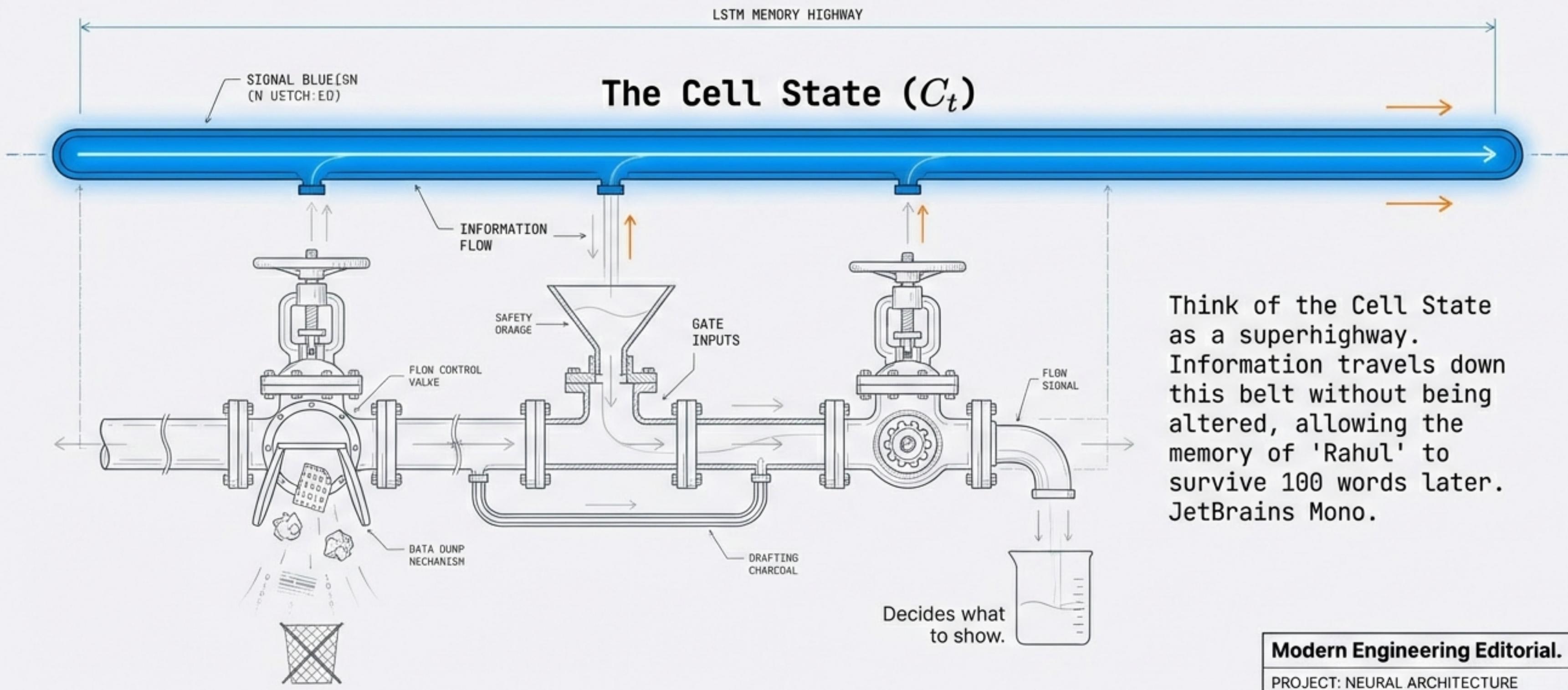


Modern Engineering Editorial.

PROJECT: NEURAL ARCHITECTURE

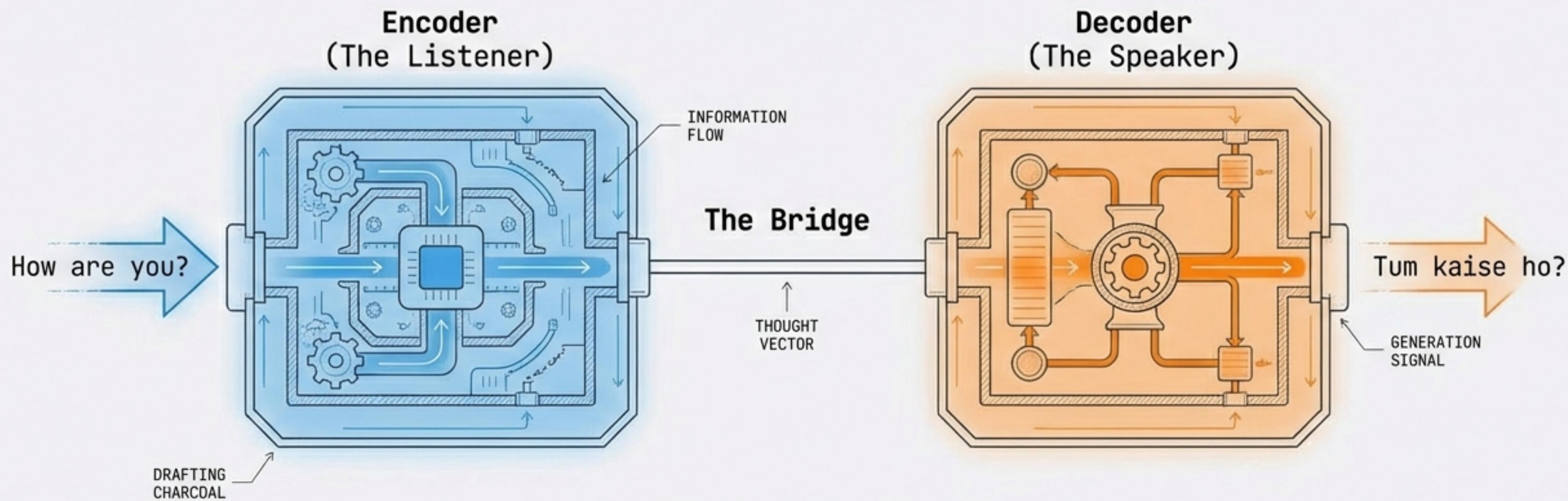
DWG NO. AI-ENG-07 | SCALE: 1:1 | REV. A

# The Secret Sauce: The Conveyor Belt



# Level 4: The Encoder-Decoder (Seq2Seq)

The Application: Machine Translation.



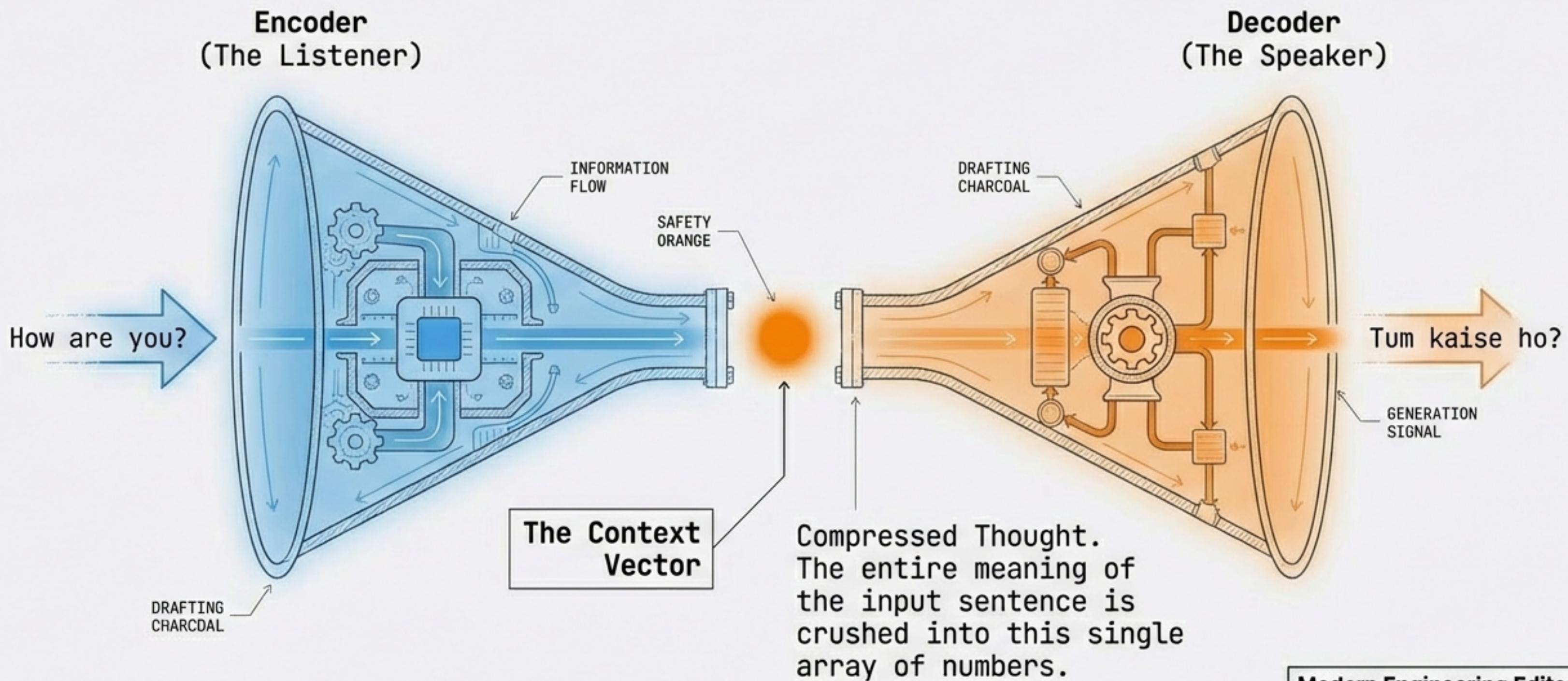
We chain two LSTMs together.  
One listens to English,  
passes the thought,  
and the other speaks Hindi.

Modern Engineering Editorial.

PROJECT: NEURAL ARCHITECTURE

DWG NO. AI-ENG-09 | SCALE: 1:1 | REV. A

# The Process: Crushing the Thought

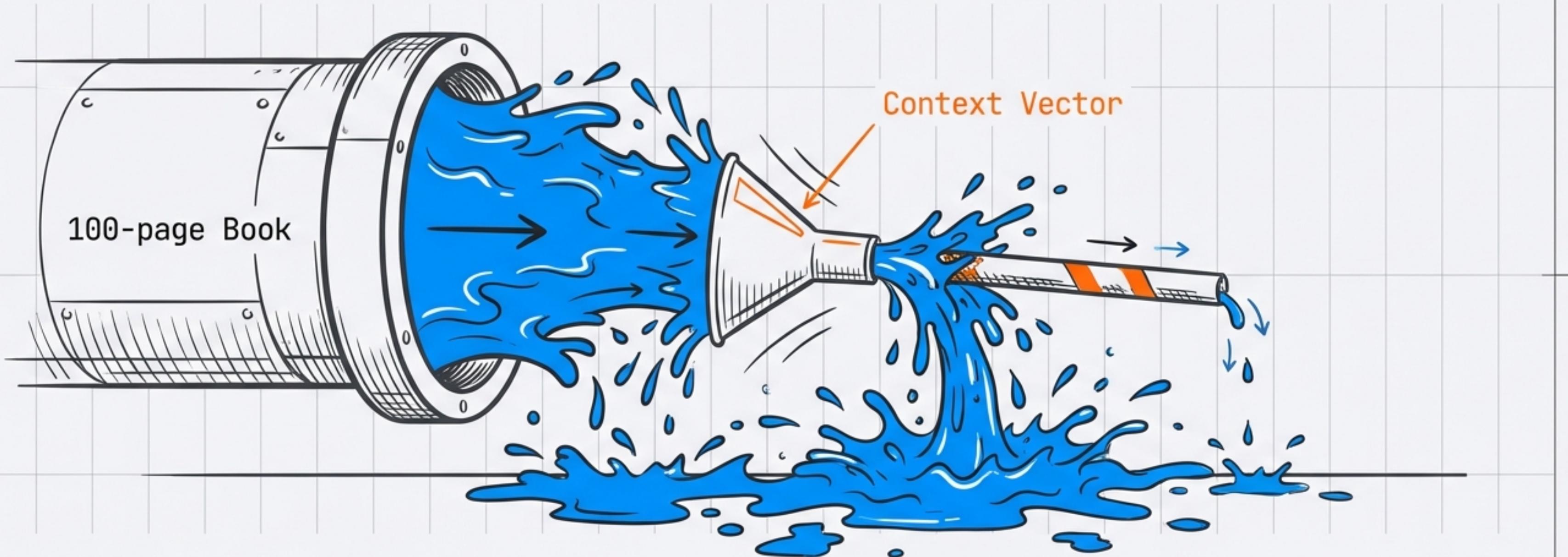


Modern Engineering Editorial.

PROJECT: NEURAL ARCHITECTURE

DWG NO. AI-ENG-10 | SCALE: 1:1 | REV. A

# The Flaw: The Information Bottleneck



Imagine summarizing a whole book into one sentence. Details are lost. The Encoder cannot squeeze all the nuance of a long sequence into a single vector.

**Modern  
Engineering  
Editorial.**

Modern Engineering Editorial.

PROJECT:  
NEURAL ARCHITECTURE

DMG NO.: AI-ENG-11      SCALE: 1:1      REV. A

# The Solution: Looking Back

**Input Sequence**

How  
are  
you  
today?

**Output Sequence**

Tum  
kaise  
ho  
aaj?

**Attention Mechanism**

We allow the Decoder to 'look back' at the entire source material. This simple shift birthed the Transformer (ChatGPT).

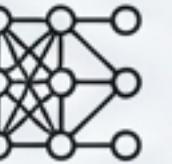
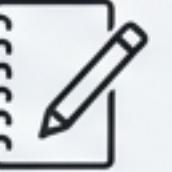
**Modern  
Engineering  
Editorial.**

Modern Engineering Editorial.

PROJECT:  
NEURAL ARCHITECTURE

DNG NO.: AI-ENG-12      SCALE: 1:2      REV. A

# The Evolutionary Cheatsheet

Era	Model	Strength	The Fatal Flaw	
1	ANN		Fixed Numbers	No Sequence (Bag of Words)
2	RNN		Sequences	Goldfish Memory
3	LSTM		Long Memory	Slow (Sequential)
4	Seq2Seq		Translation	Bottleneck
5	Transformers		Everything	None of the above

Modern Engineering Editorial.

PROJECT: NEURAL ARCHITECTURE

DWG NO. AI-EN6-13 | SCALE: 1:1 | REV. A

Autodesk Revit | SketchUp | Inventor | SolidC. L1 | F