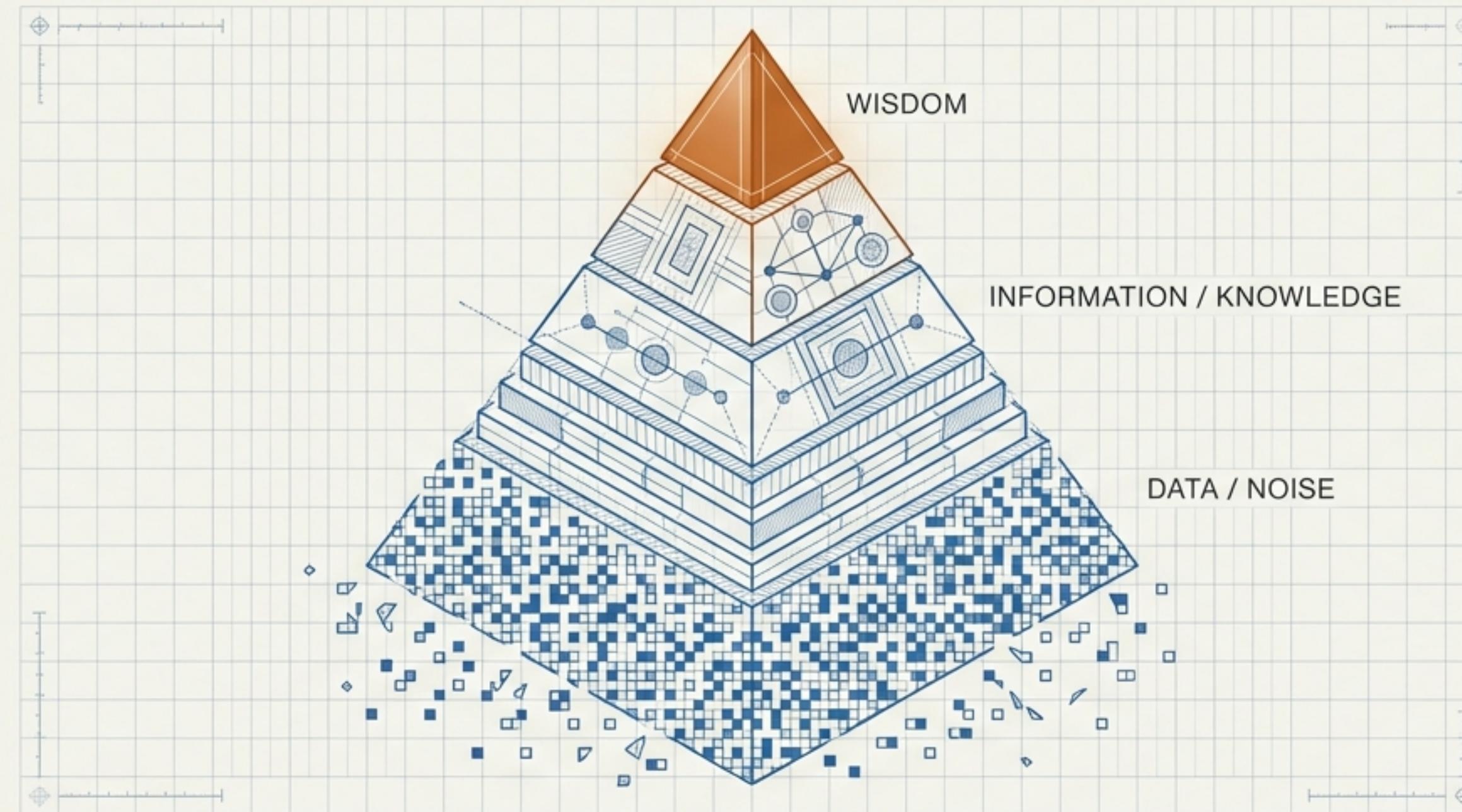


# FROM DATA TO WISDOM

THE ARCHITECTURE OF MACHINE LEARNING



Decoding the ecosystem of Intelligence, Knowledge, and Algorithmic Learning

# INTELLIGENCE IS THE CAPABILITY. LEARNING IS THE ENGINE.

## INTELLIGENCE



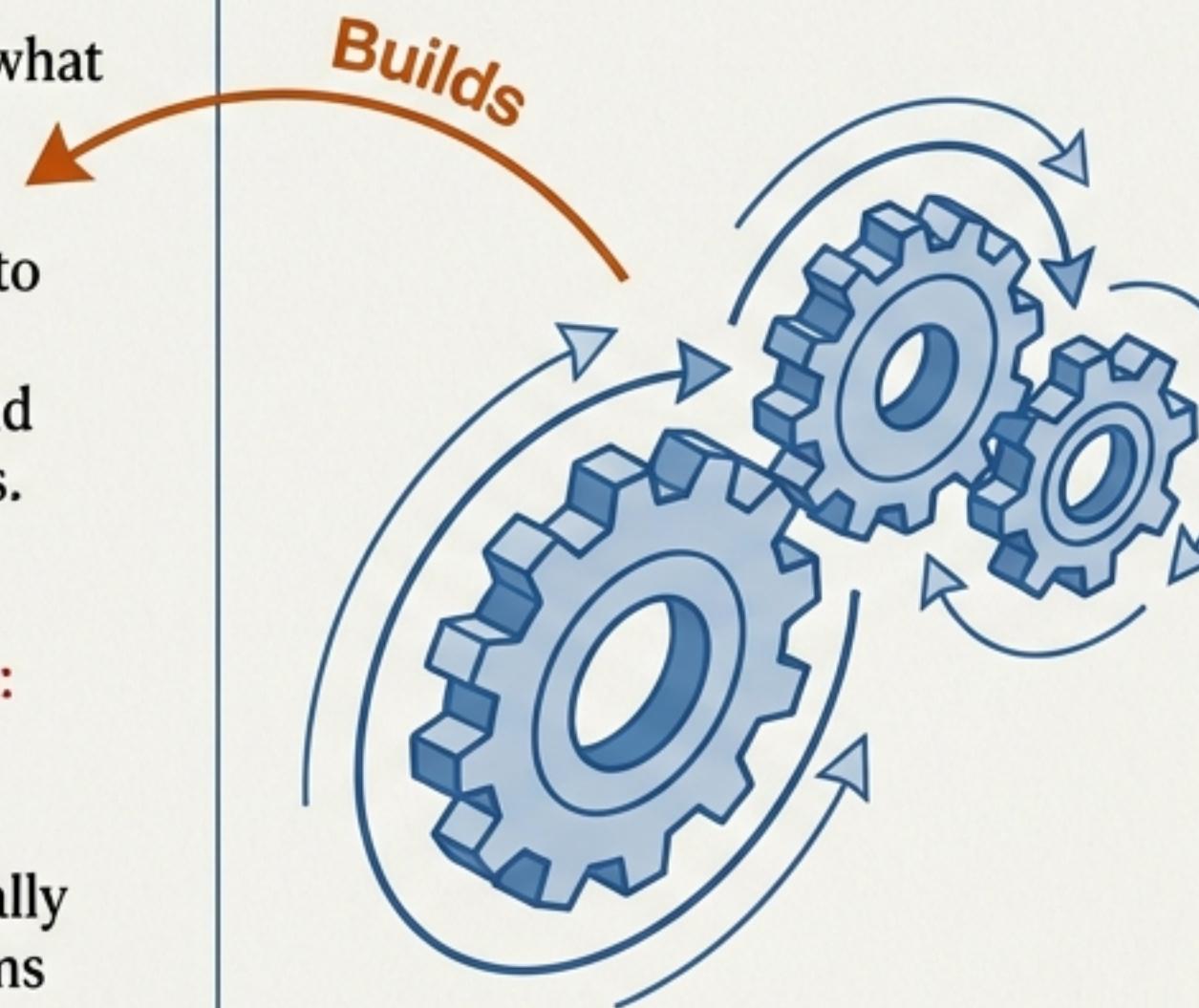
**The Goal:**  
“How you use what you know.”

The capability to think, learn, understand, and make decisions.

### Key Characteristics:

- Learn from experience
- Reason logically
- Solve problems
- Adapt to environments

## LEARNING



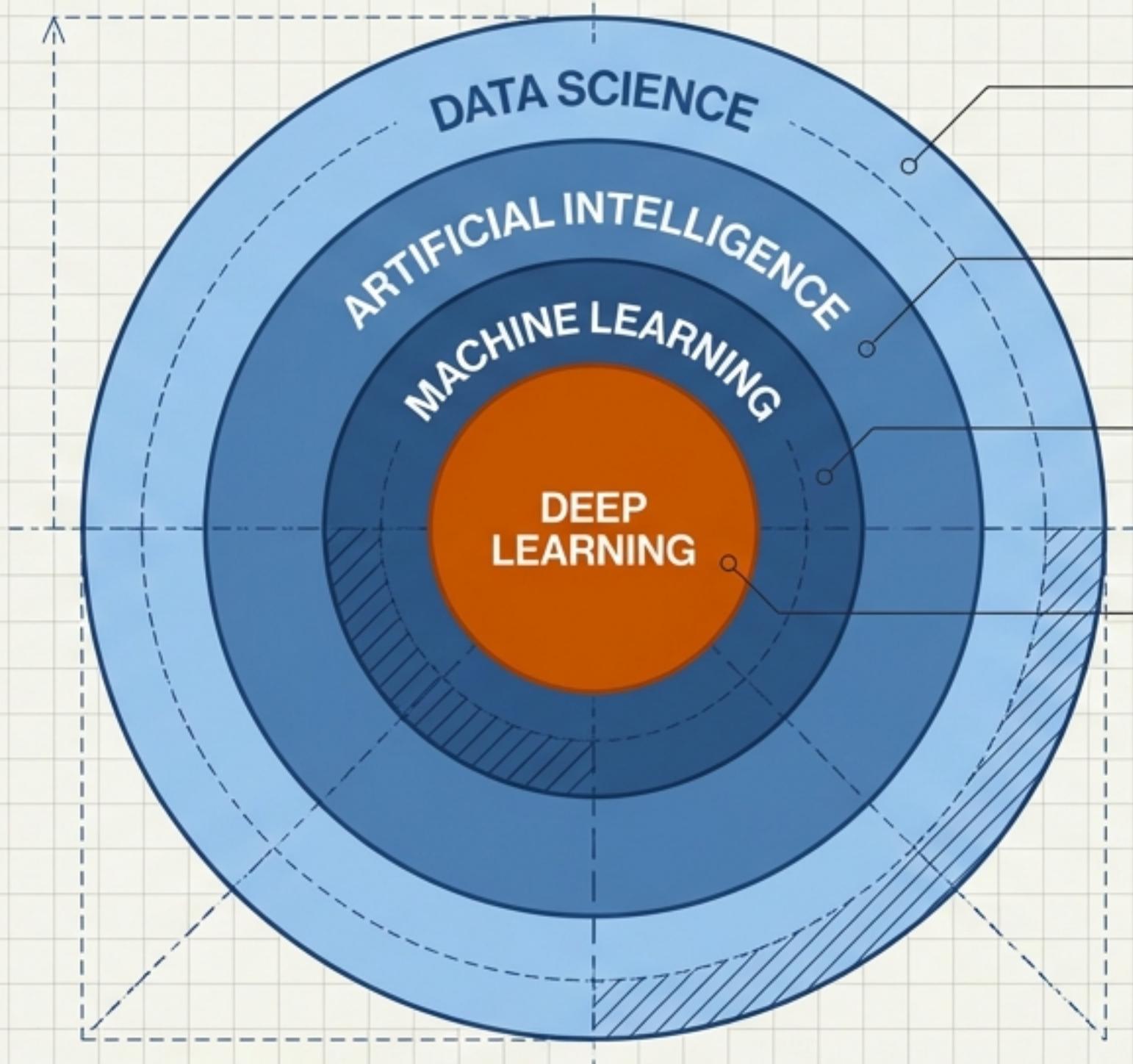
**The Process:**  
“Improving over time.”

The method of acquiring knowledge through experience.

### Comparison:

- Biological: Synaptic plasticity (strengthening connections).
- Machine: Mathematical optimization (reducing error).

# MAPPING THE ECOSYSTEM



**The Lifecycle**  
Collection, Cleaning,  
Visualization, & Analysis.

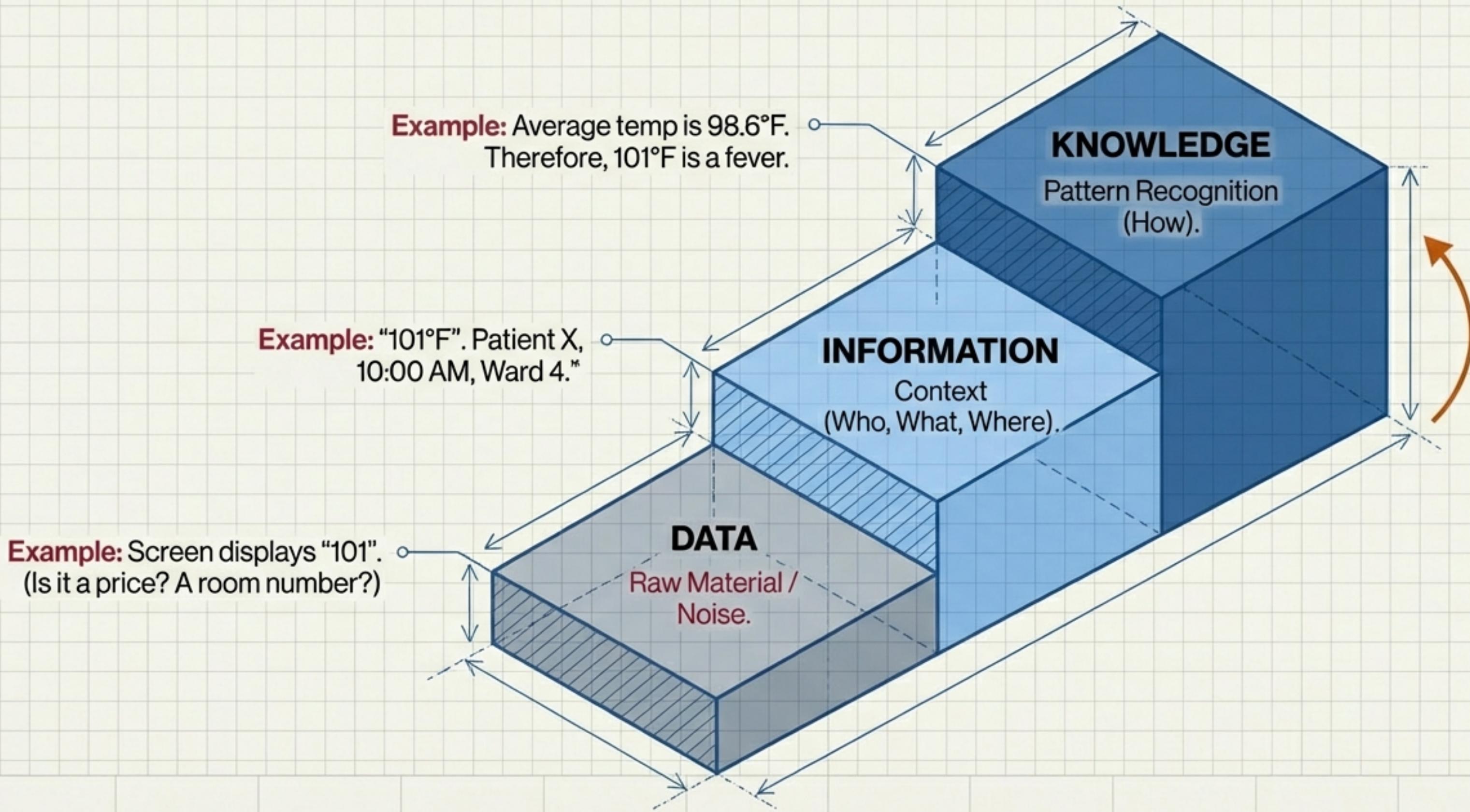
**The Goal**  
Creating intelligent machines  
(McCarthy, 1956).

**The Tool**  
Systems that learn from data  
without explicit rules (Samuel, 1959).

**The Technique**  
Multi-layer neural networks.

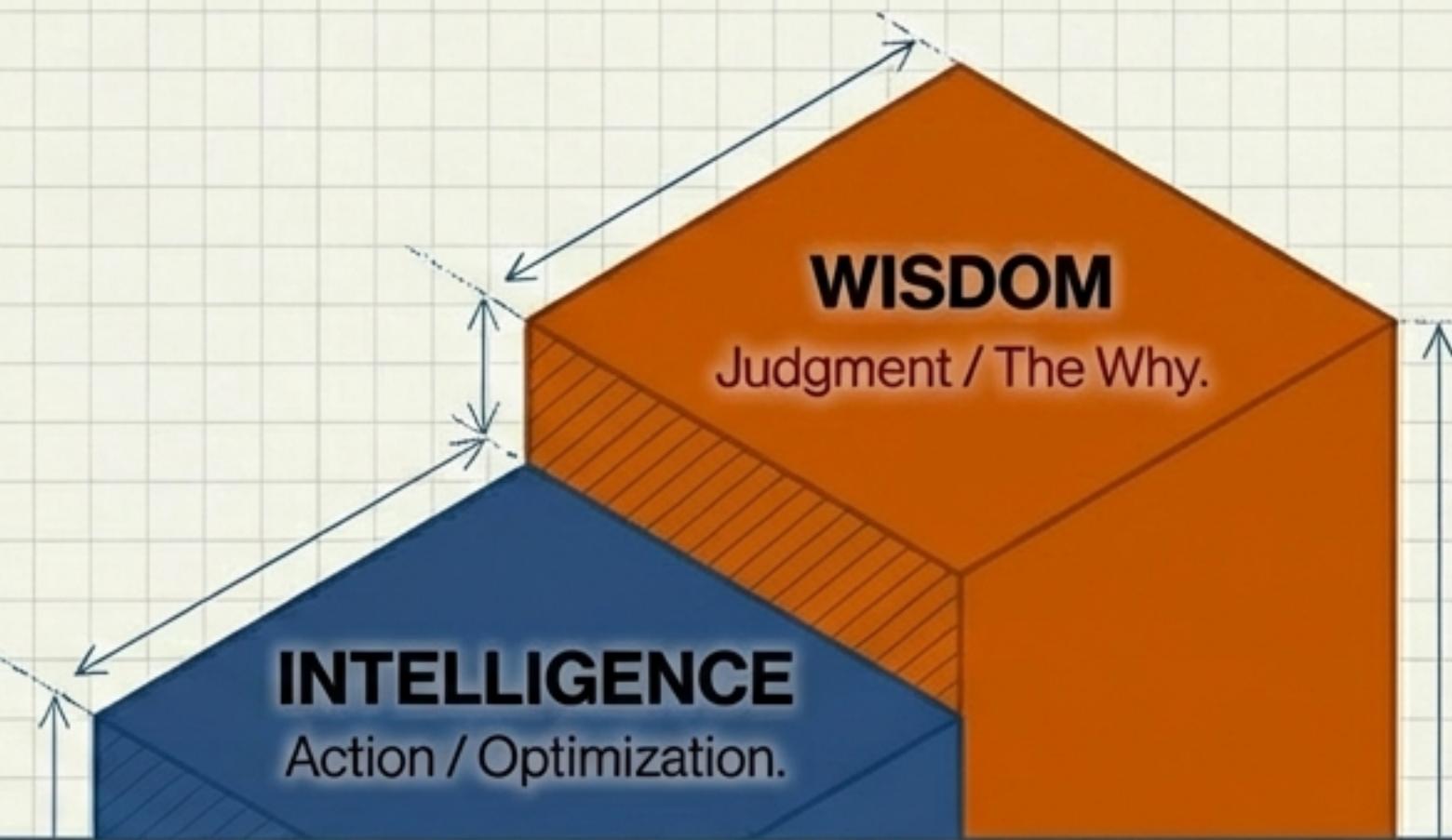
**Key Takeaway:** Data Science covers the entire lifecycle; Machine Learning is the specific tool used to build the predictive models.

# THE EVOLUTION OF UNDERSTANDING (DIKIW)



Learning is the engine that moves us up this curve. Stop learning, and you fall back to Data.

# FROM INTELLIGENCE TO WISDOM



	<b>The Medical Case</b>	<b>The Autonomous Car</b>
<b>INTELLIGENCE</b> (The Rule)	Administer paracetamol to lower fever.	Camera sees red pixel -> Recognizes Octagon -> Stops Car.
<b>WISDOM</b> (The Context)	Fever persists 3 days. Medicine failed. Check for underlying infection.	Road looks icy. Brake gently to avoid skidding.

Intelligence acts on the rule. Wisdom evaluates the context of the rule.

# THE VISIONARY AND THE BUILDER

ALAN TURING (1950)



**“Can machines think?”**

**Contribution:** The Turing Test.

**Philosophy:** Defined the ‘Mind’—mimicry so perfect it is indistinguishable from human.

ARTHUR SAMUEL (1959)



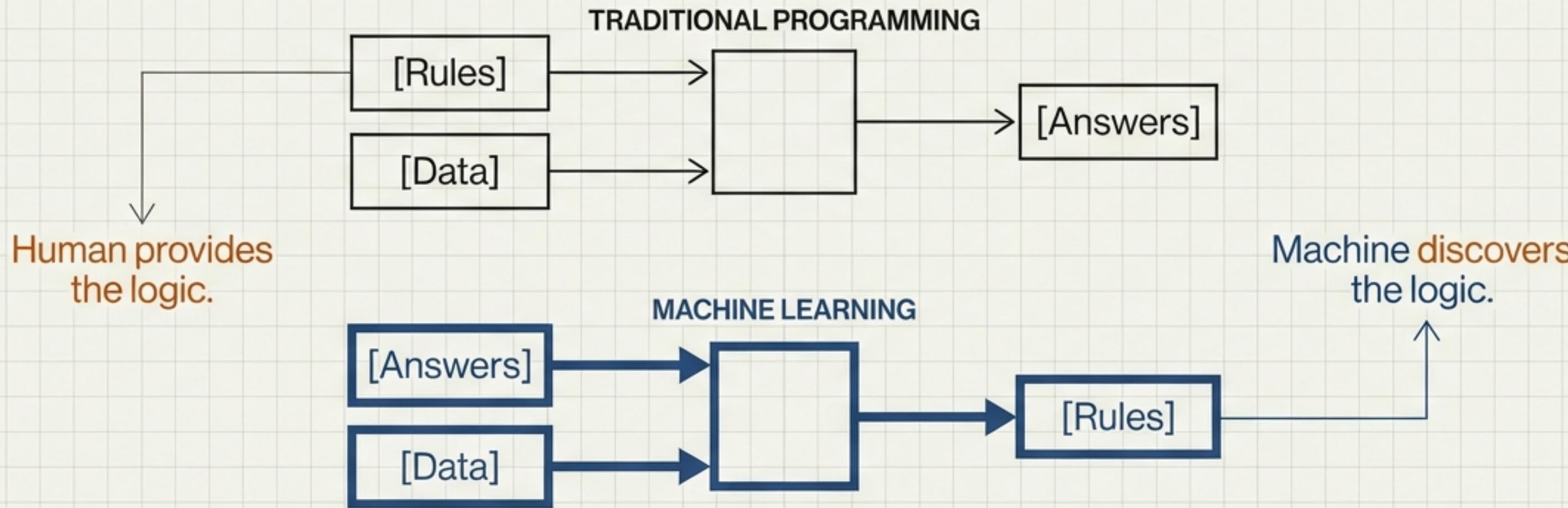
**“Can machines learn?”**

**Contribution:** The Checkers Program (Self-Learning).

**Execution:** Defined the ‘Method’—program played itself to discover winning strategies.

# THE LOGIC GAP

Traditional Programming vs. Machine Learning



**The Checklist:  
What is it?**



Arithmetic Processor  
(Neither)



Automation  
(Rule-based, No AI)



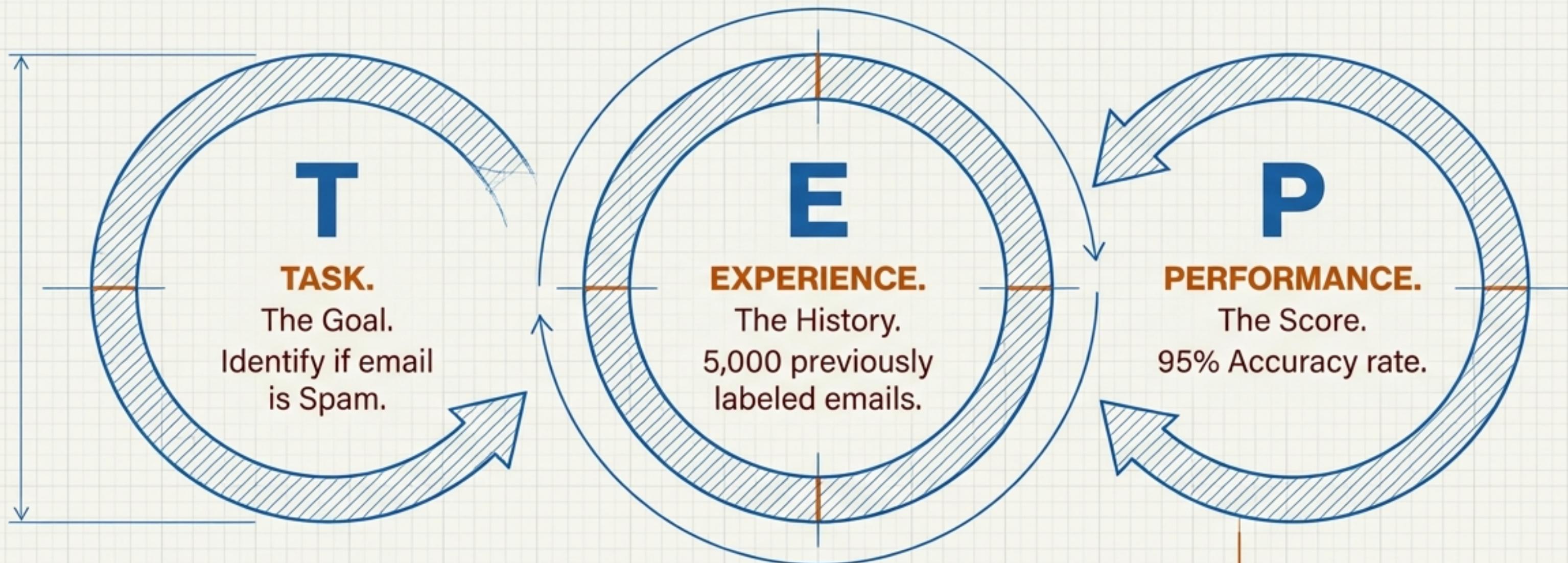
Video Game Enemy  
(Behavioral AI)



Amazon Recs  
(ML Predictive AI)

# THE RECIPE FOR LEARNING

Tom Mitchell's TEP Framework

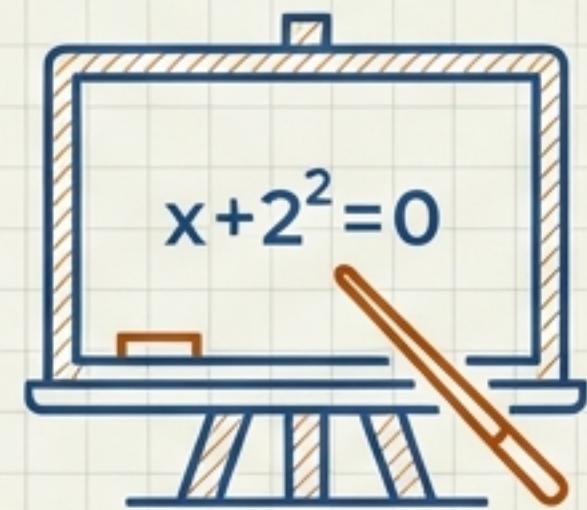


A computer learns if its **Performance (P)** on a **Task (T)** improves with **Experience (E)**.

**Critical:** If you cannot measure **P**, it is not Machine Learning.

# THE THREE PILLARS OF LEARNING

## SUPERVISED LEARNING



The Classroom

Uses Labeled Data  
(Input + Correct Answer).  
Goal: Map input to output.

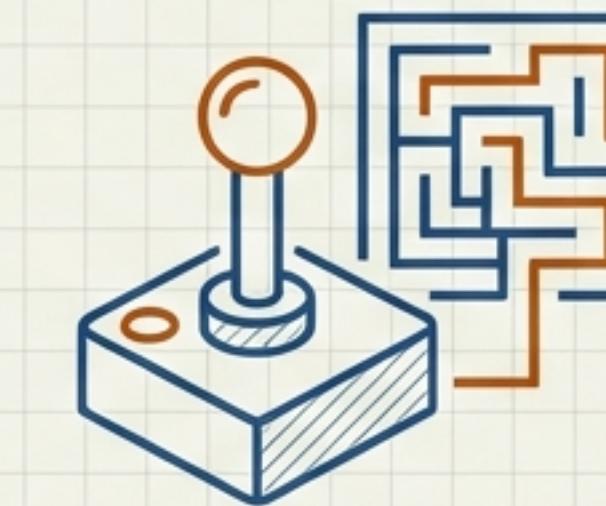
## UNSUPERVISED LEARNING



The Pattern Hunter

Uses Unlabeled Data.  
Goal: Find hidden structures or clusters.

## REINFORCEMENT LEARNING

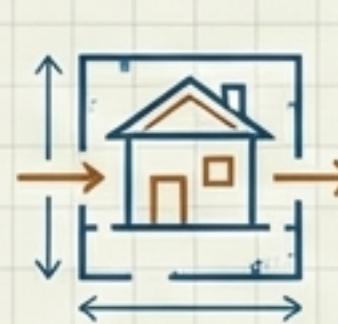


The Gamer

Trial and Error.  
Goal: Maximize a "reward" signal in an environment.

# ALGORITHMS IN THE WILD

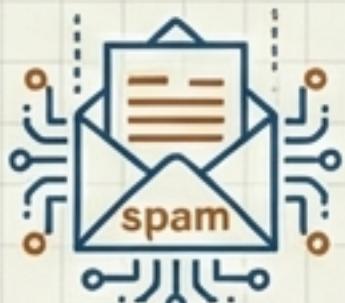
## SUPERVISED



**House Price Prediction** (Based on size/location)



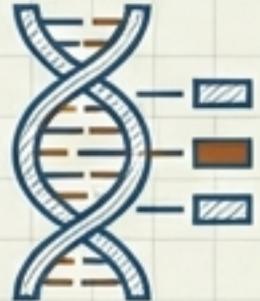
**Medical Diagnosis** (Labeled X-rays)



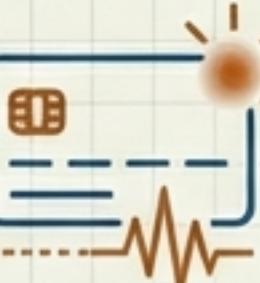
**Spam Detection** (Email filtering)



**Customer Segmentation** (Grouping shoppers)



**Genetics** (Grouping species by DNA)



**Anomaly Detection** (Credit card fraud spots)

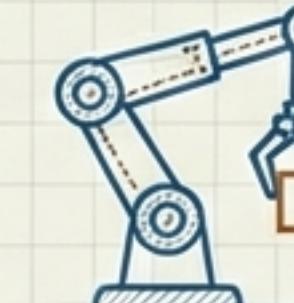


## UNSUPERVISED

**Self-Driving Cars** (Distance without crashing)

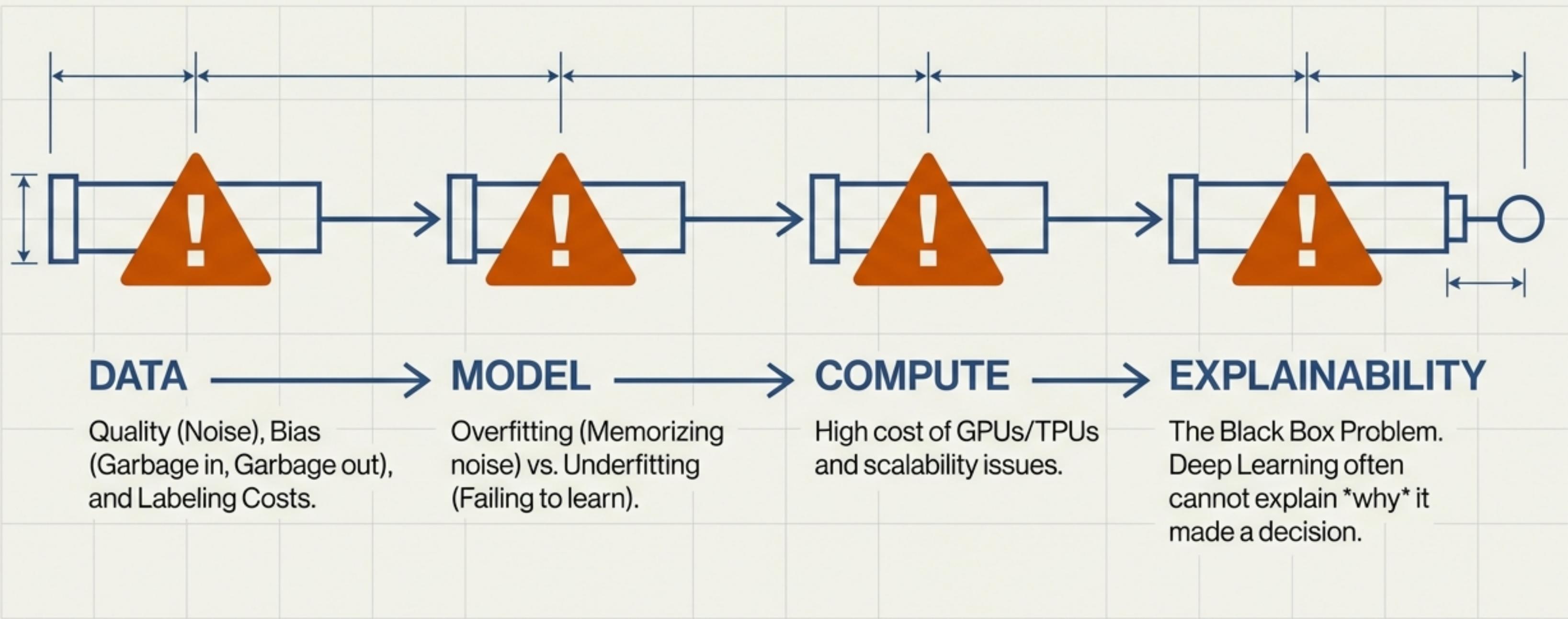


**Chess & Games** (Winning matches)



**Robot Arms** (Learning to grasp)

# THE FRICTION POINTS



# THE ETHICAL & SOCIAL WEIGHT

## BIAS & FAIRNESS

Models trained on historical data repeat historical prejudices (e.g., loan rejections, hiring bias).

## PRIVACY & LAW

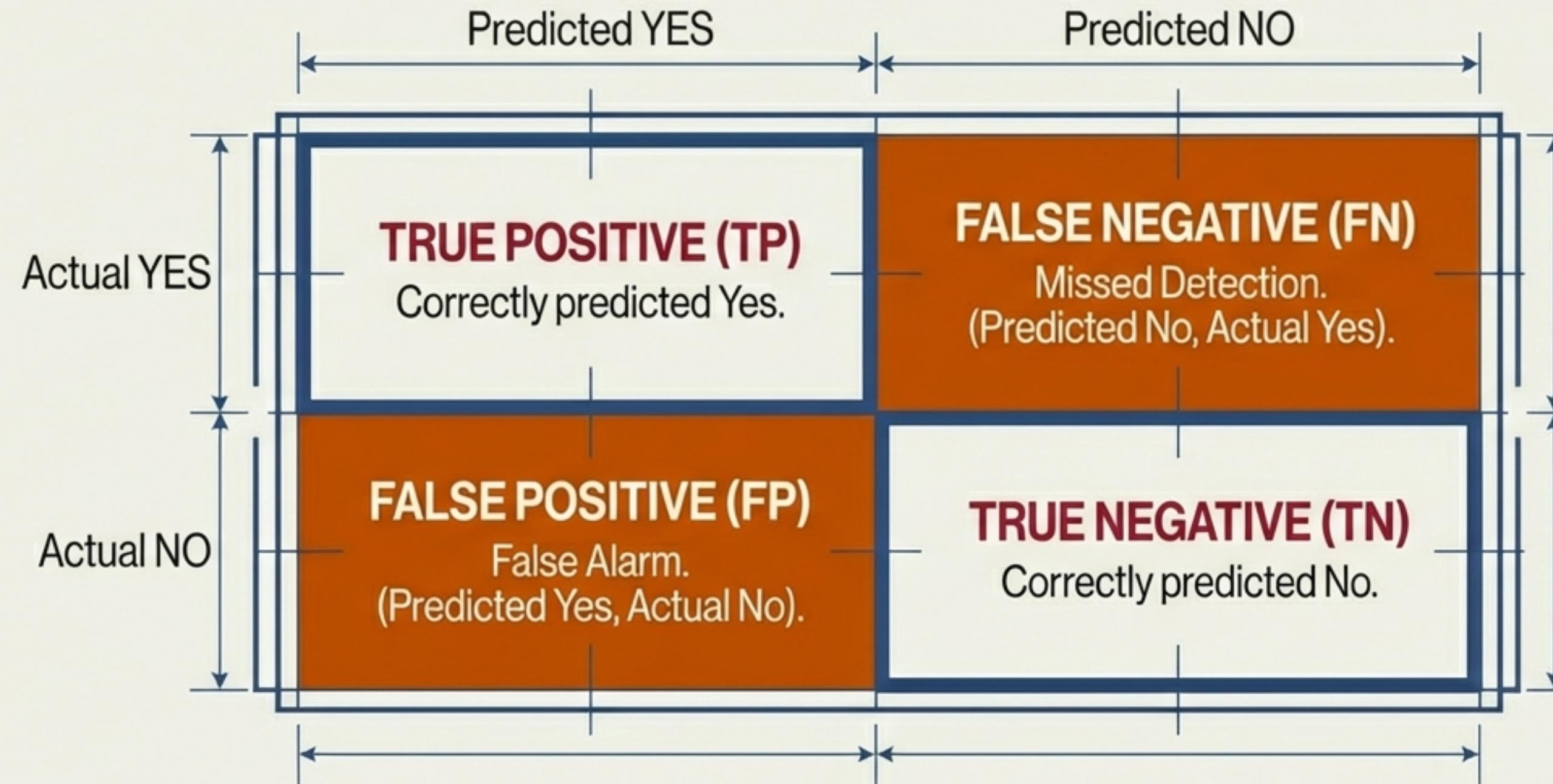
GDPR, the 'Right to be Forgotten,' and the dangers of unauthorized facial recognition.

## TRUST & MISUSE

Deepfakes eroding truth and over-reliance leading to skill atrophy.

**"If training data is biased, the model will produce biased results."**

# BEYOND ACCURACY: THE CONFUSION MATRIX

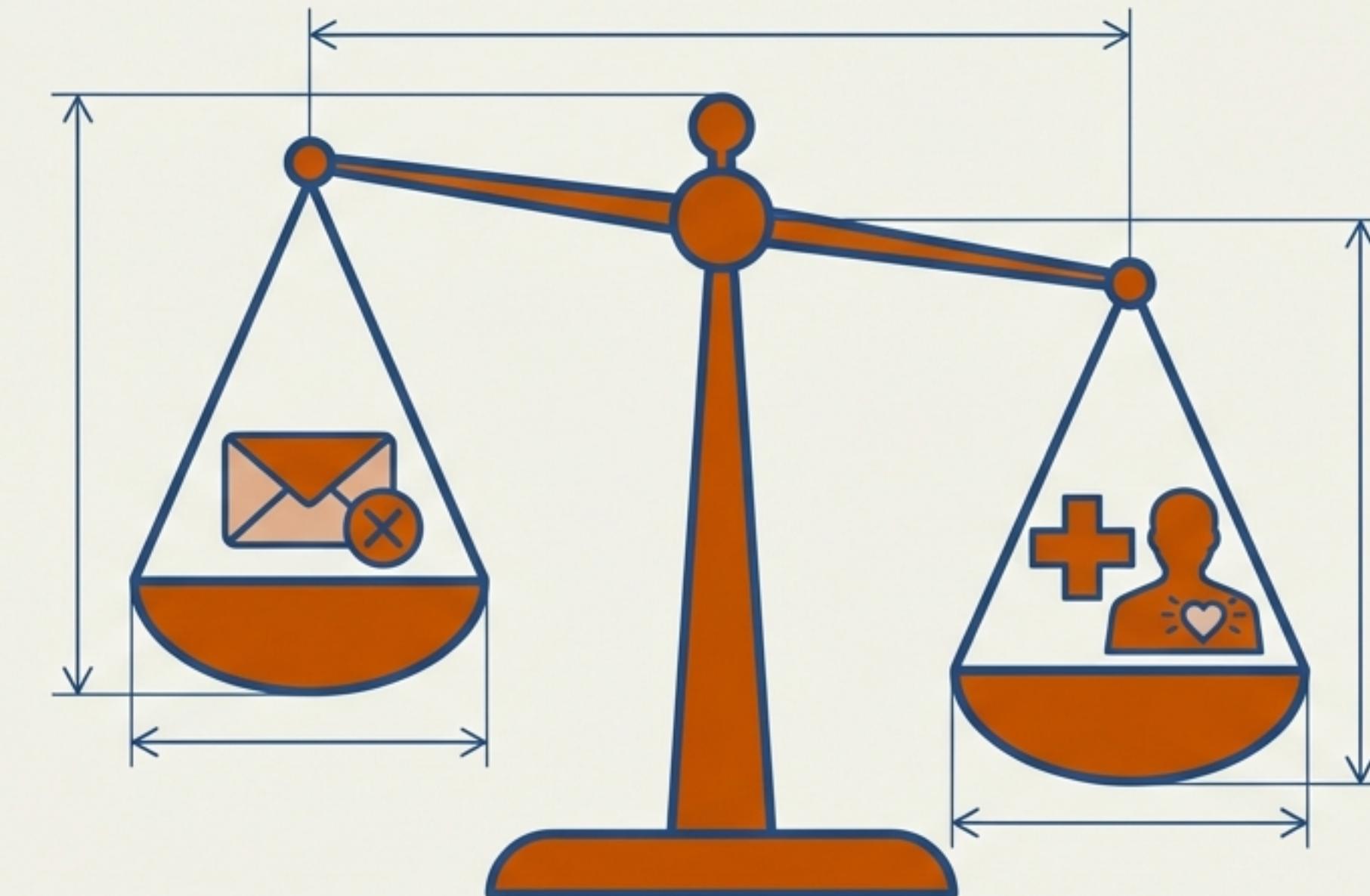


# THE COST OF BEING WRONG

**SCENARIO A:  
SPAM FILTER**

**False Positive  
is worse.**

An FP means a lost business email.  
An FN is just an annoyance.



**SCENARIO B:  
CANCER DIAGNOSIS**

**False Negative  
is worse.**

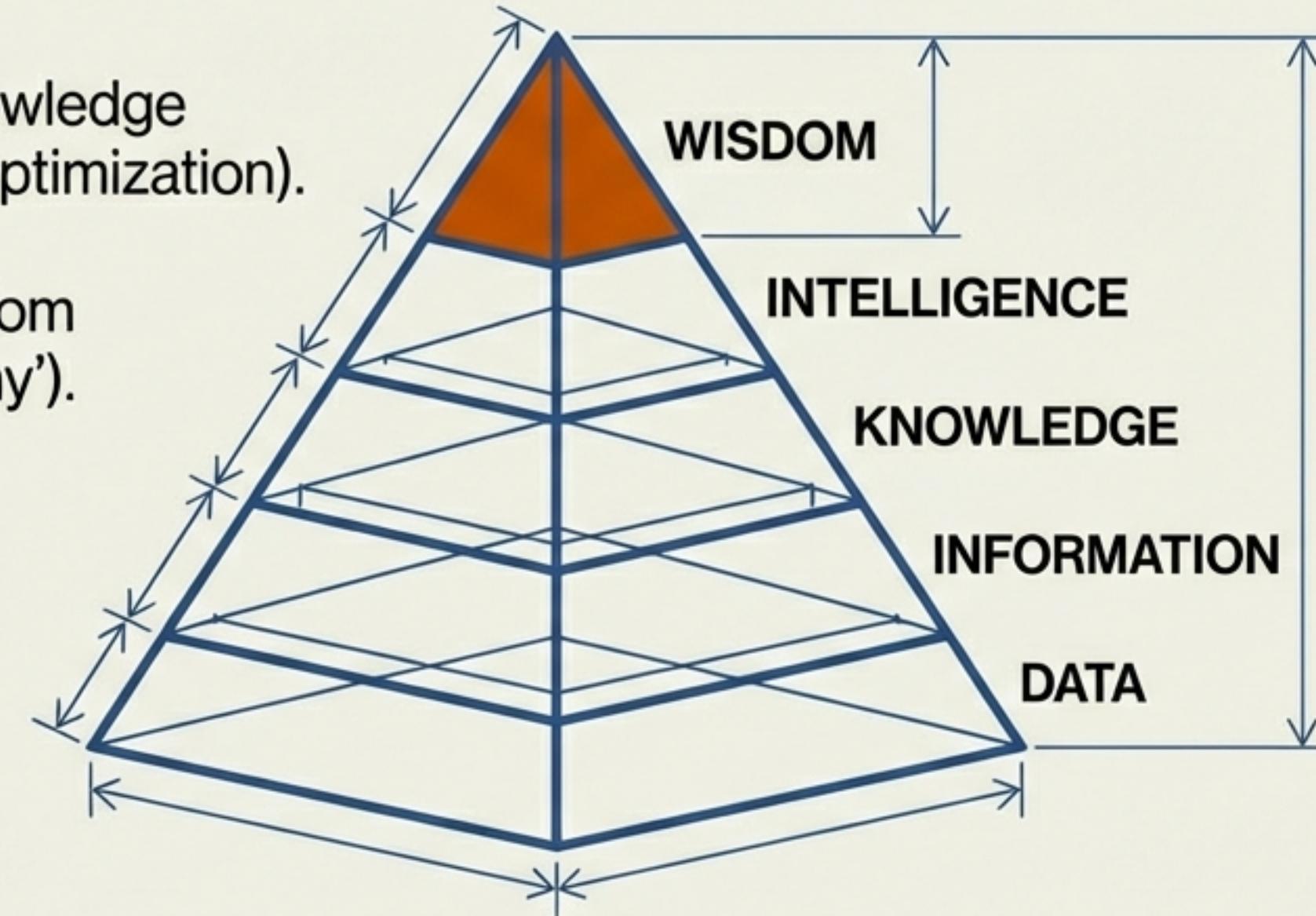
An FN means a missed disease/death.  
An FP causes stress but is correctable.

**Context determines which error is acceptable.  
You must tune the model based on the risk.**

# THE WISDOM GAP

**MACHINES:** Excellent at Knowledge (Patterns) and Intelligence (Optimization).

**HUMANS:** Essential for Wisdom (Context, Ethics, and The 'Why').



Intelligence is the ability to acquire knowledge. Wisdom is knowing how to use it responsibly. Learn the tools, but master the context.