Machine Learning Algorithms

Demystifying the Core of Artificial Intelligence

CBSE Class 11 AI Unit 6

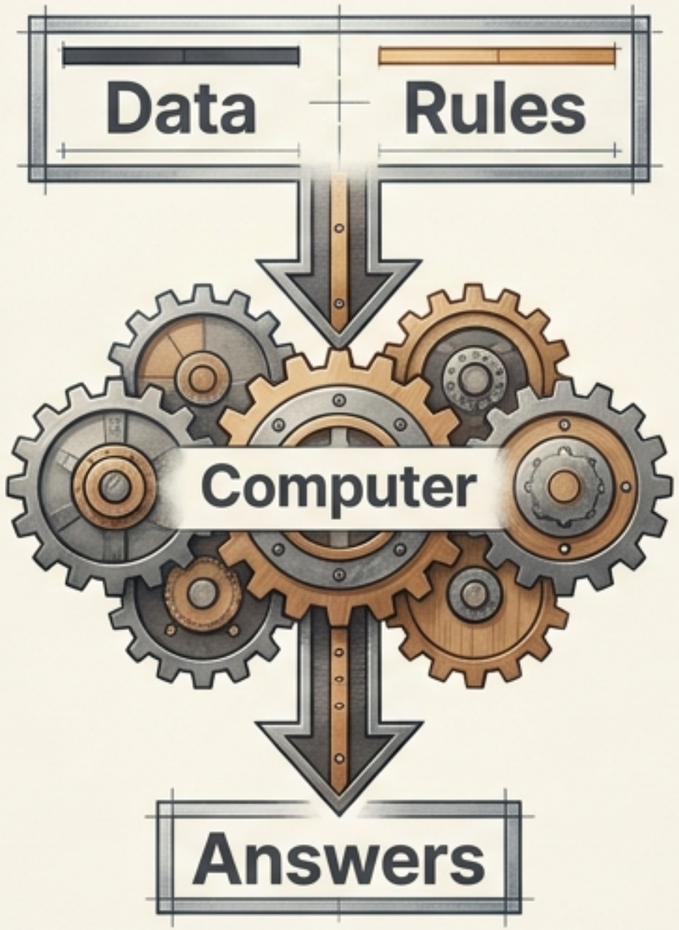
By Akansha Aggarwal



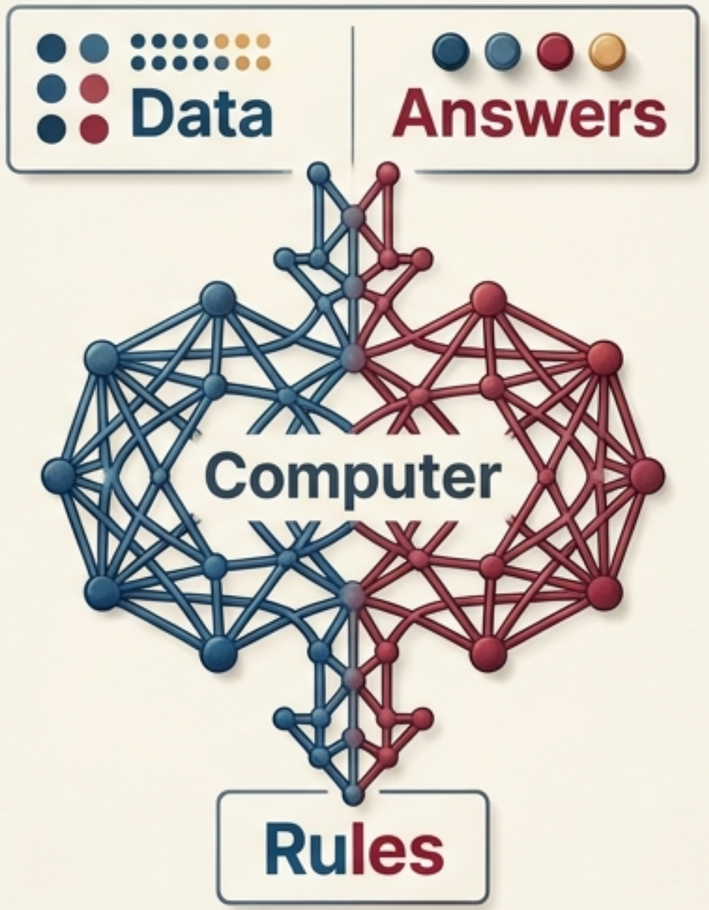
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The Paradigm Shift: Learning from Experience

Machine Learning empowers systems to learn from data without being explicitly programmed. Instead of writing rigid rules, we provide the computer with data and outcomes, allowing it to optimize its own performance over time.



Traditional Programming



Machine Learning

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The Machine Learning Universe Universe

Machine Learning

Supervised Learning



The Guided Learner
Requires a Teacher

Unsupervised Learning



The Independent Explorer
Finds Hidden Patterns

Reinforcement Learning

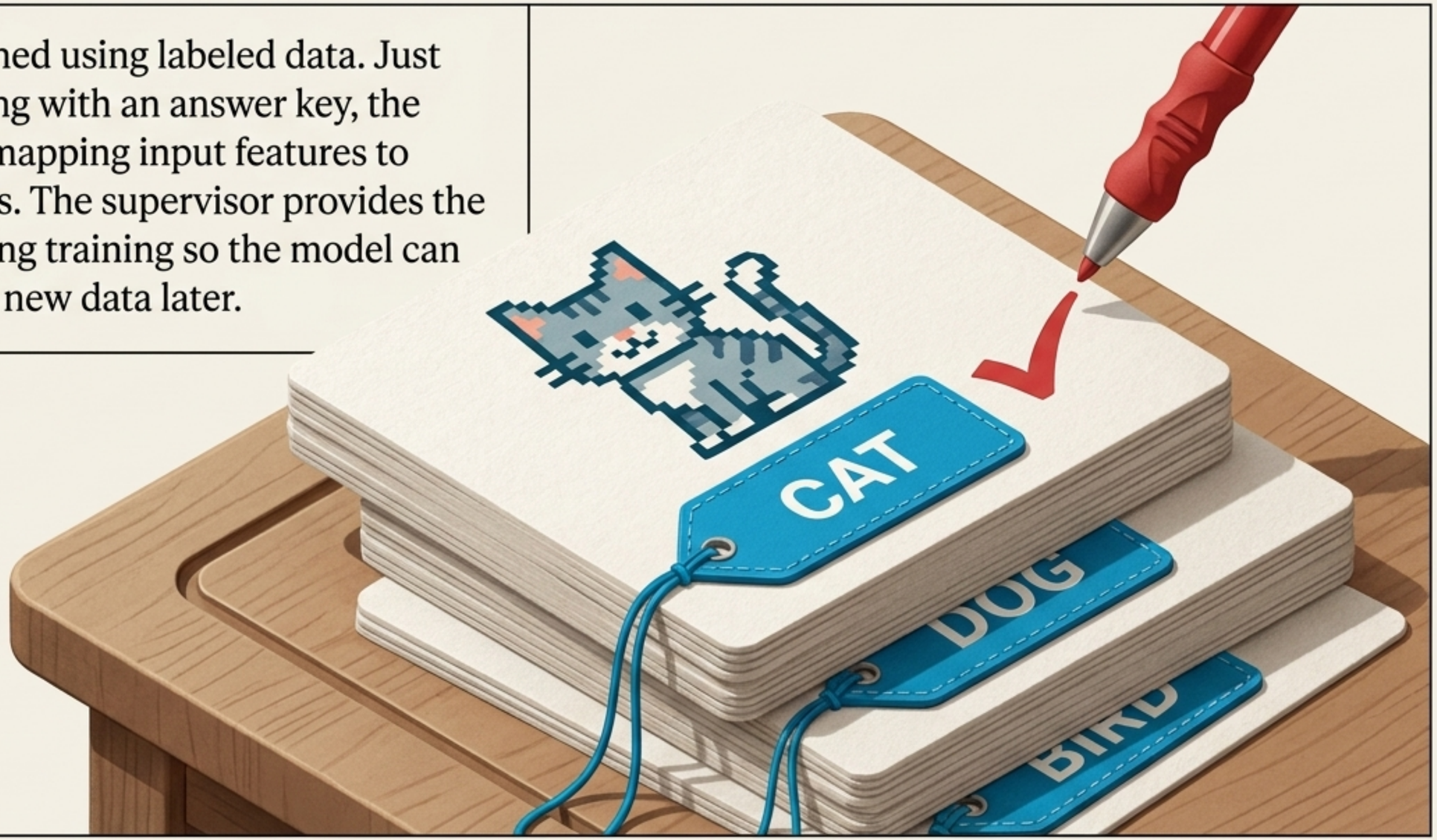


The Trial-and-Error Agent
Learns from Feedback

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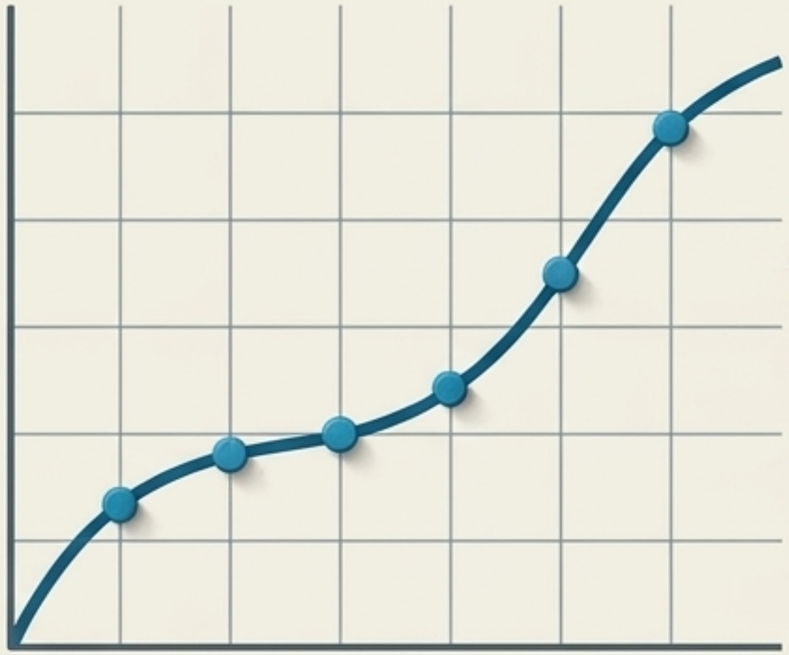
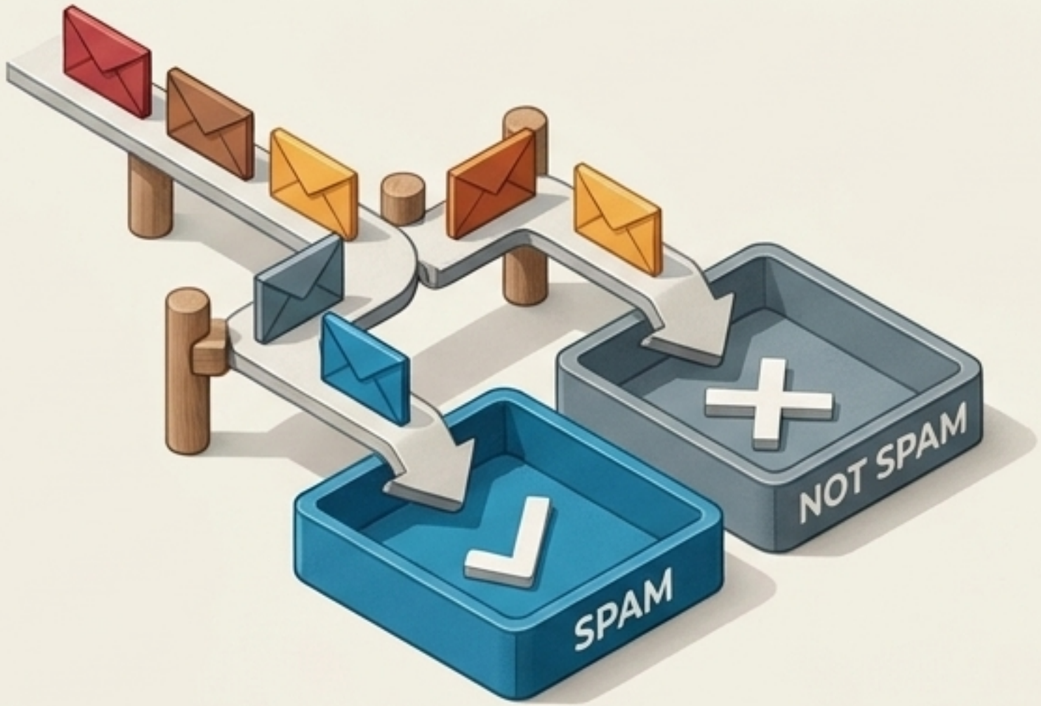
Supervised Learning: The Teacher Model

The algorithm is trained using labeled data. Just like a student studying with an answer key, the algorithm learns by mapping input features to known target outputs. The supervisor provides the correct answers during training so the model can make predictions on new data later.



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Two Paths of Supervision: Regression vs. Classification

Regression	Classification
Predicts continuous numerical values. • (e.g., Temperature, Sales Forecast, Height).  	Predicts discrete categorical labels. • (e.g., Spam vs. Not Spam, Pass vs. Fail). 

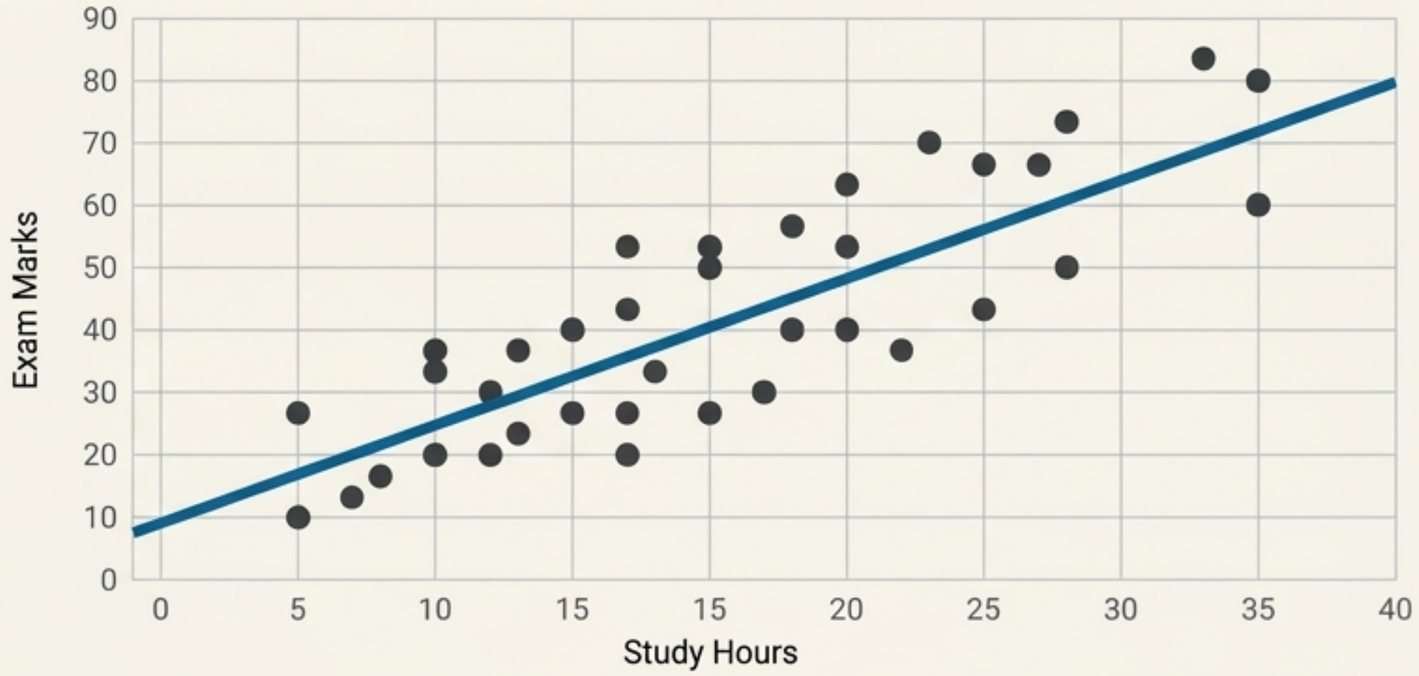
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Simple Linear Regression: Finding the Line

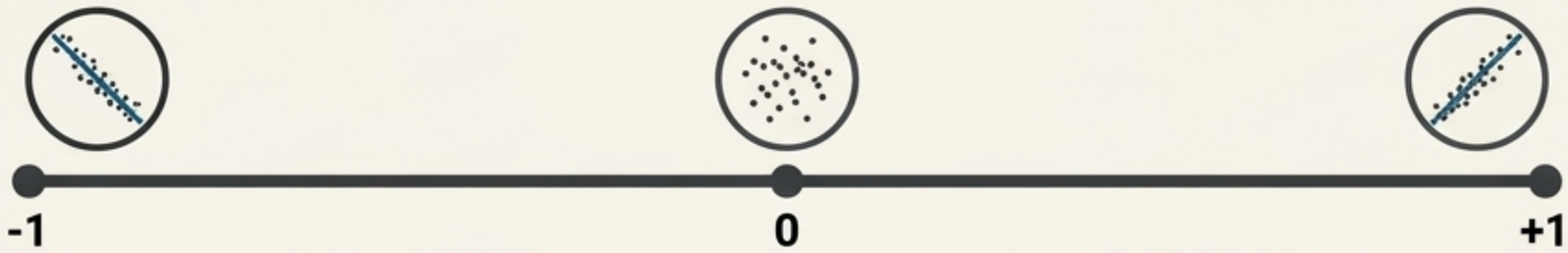
Regression algorithms predict continuous outputs by discovering the Line of Best Fit through historical data.

Correlation is Key

The algorithm relies on measuring how strongly two variables are connected, visualized by the Pearson correlation coefficient.



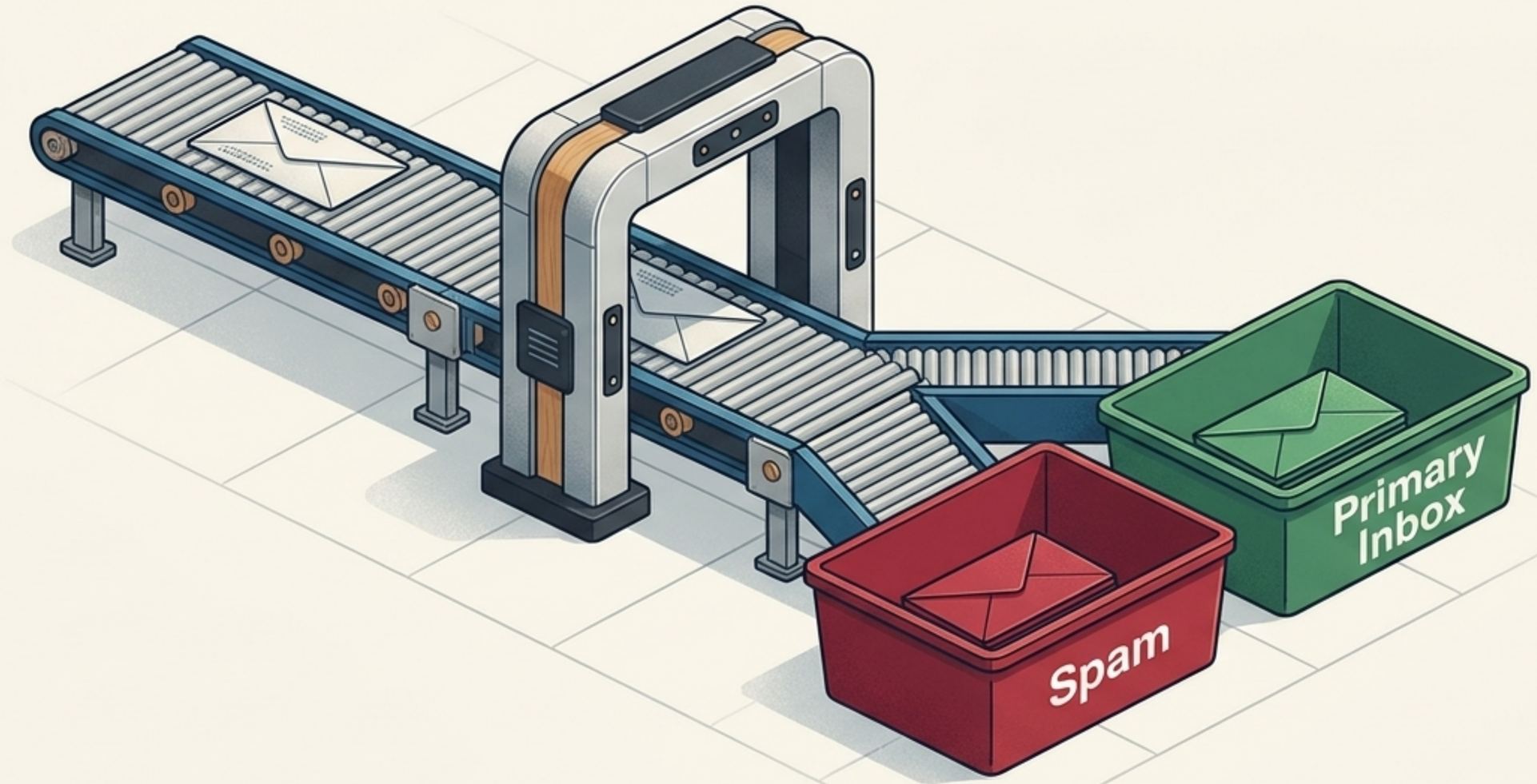
Pearson's Correlation Spectrum



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Classification: Sorting the Discrete

Classification algorithms predict distinct, categorical target variables rather than continuous numbers. Real-world uses include Spam Detection, Sentiment Analysis, and Image Tagging.

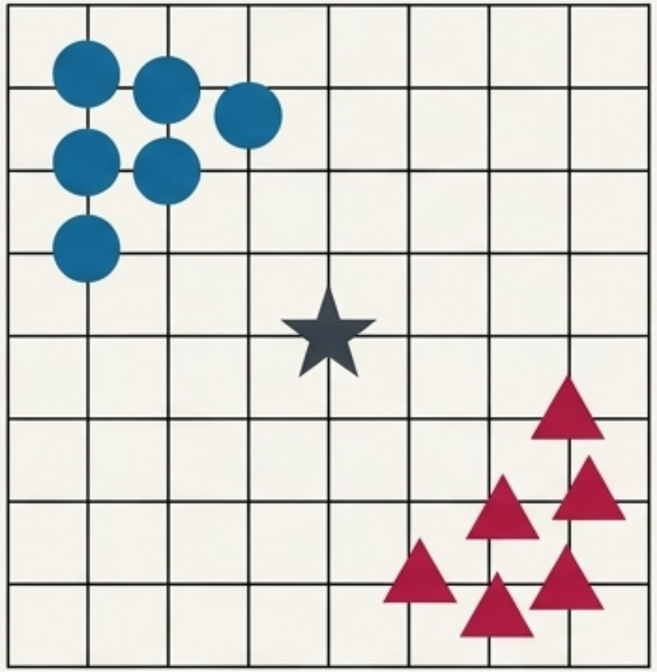


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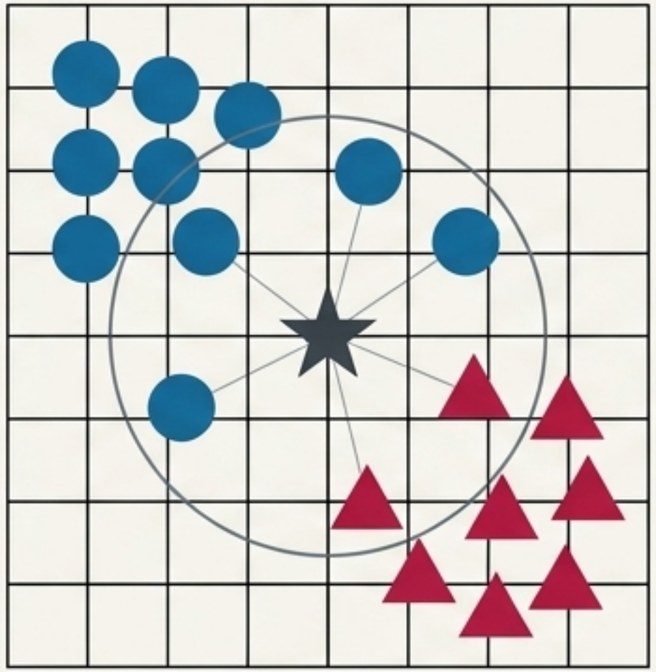
The K-Nearest Neighbors (KNN) Algorithm

Tell me who your friends are, and I will tell you who you are.

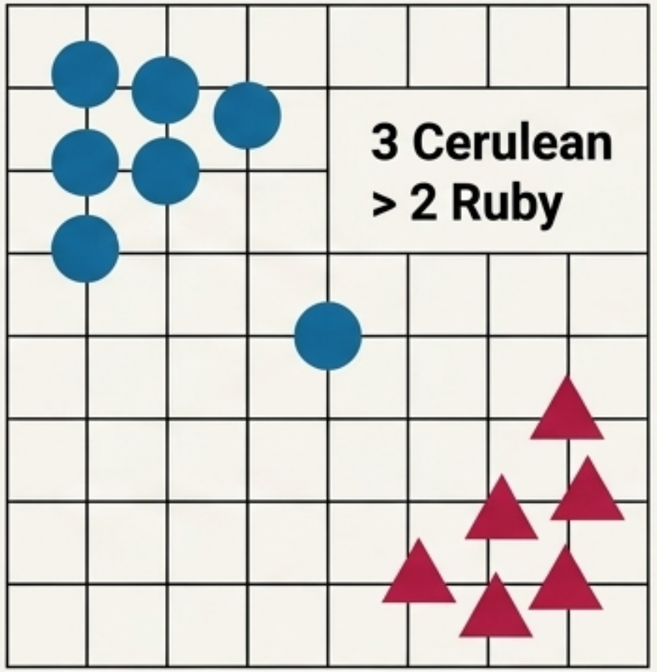
1. Receive new data point.



2. Find the ‘K’ closest points.



3. Classify via majority vote.



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Unsupervised Learning: The Explorer Model

The algorithm is given unlabeled data. With no teacher and no pre-assigned answers, the algorithm must act as an independent explorer to find inherent structures, hidden patterns, or natural groupings entirely on its own.



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Clustering: The K-Means Algorithm

K-Means automatically groups similar data points together into 'K' distinct clusters based on their features. Real-world uses include Customer Market Segmentation and Anomaly Detection.

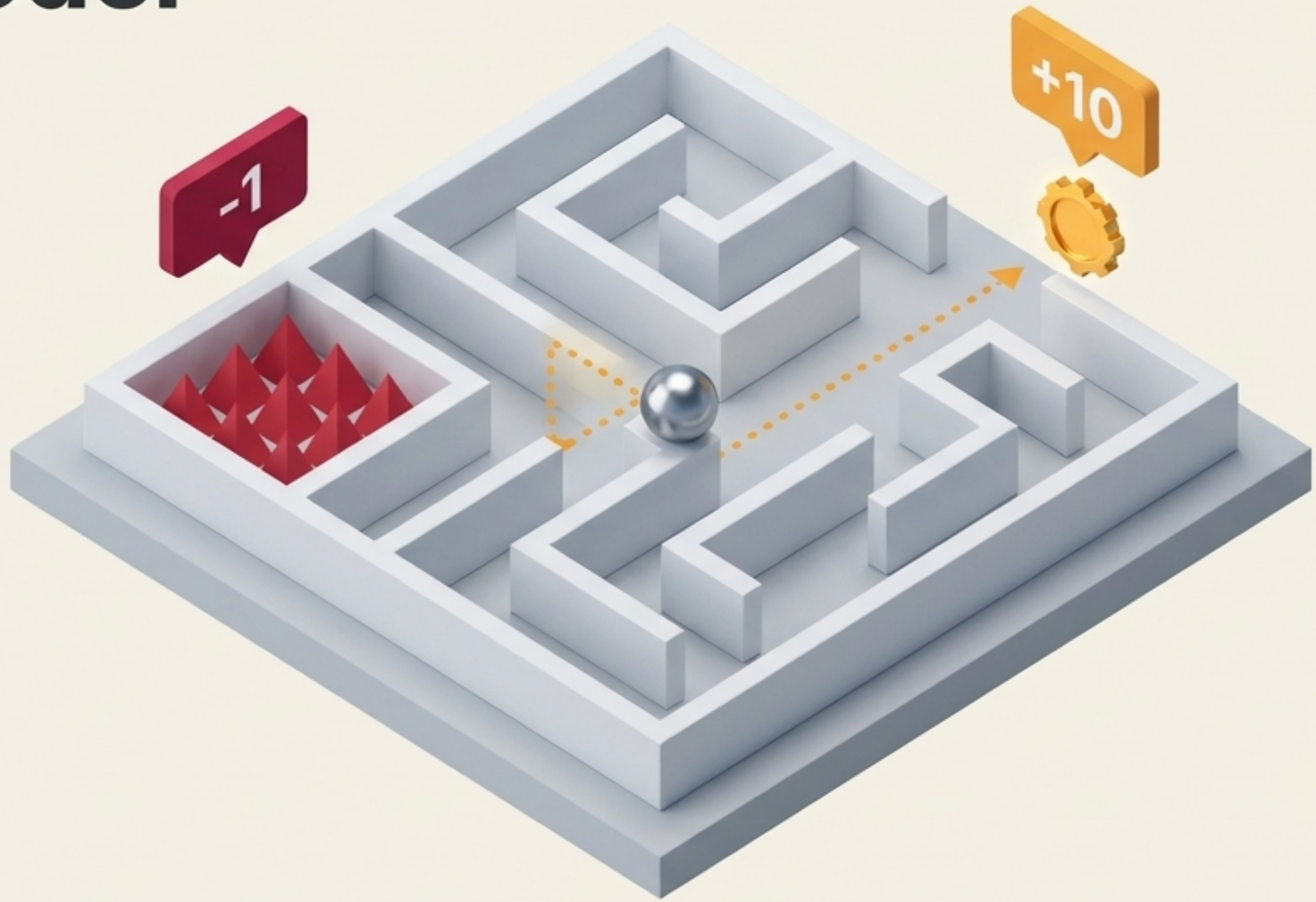
1. Raw Data → **2. Initialization** → **3. Clustered**



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Reinforcement Learning: The Reward Model

The Agent learns optimal behavior in an interactive environment entirely through trial and error. There is no specific data given upfront. The algorithm maximizes rewards for good actions and minimizes penalties for bad ones to eventually solve the environment.



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The Machine Learning Diagnostic Matrix

	Supervised	Unsupervised	Reinforcement
Data Type	Labeled Data	Unlabeled Data	No Predefined Data (Environment)
Approach	Guided Teacher	Independent Explorer	Trial & Error Agent
Goal	Predict outcomes	Discover inherent structure	Maximize cumulative reward
Key Algorithms	Linear Regression, KNN	K-Means	Q-Learning

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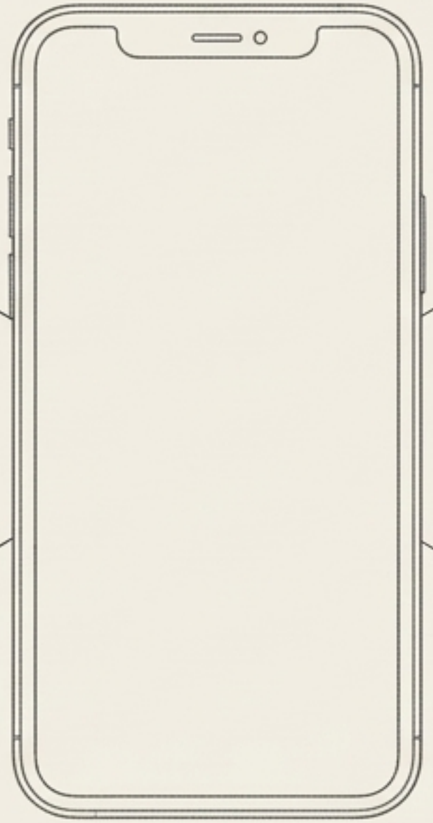
The Algorithms In Your Pocket

Weather App

Supervised (Regression) -> Forecasting tomorrow's temperature.

Spam Filter & FaceID

Supervised (Classification) -> Routing junk mail & unlocking your screen.



Streaming Ads

Unsupervised (Clustering) -> Grouping your tastes with similar users for targeted recommendations.

Video Game AI

Reinforcement -> NPCs learning to adapt to your play style.

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The Practical Toolbelt

The Language



Data Wrangling

NumPy pandas

The Algorithms

scikit learn

Visualization

matplotlib

Fundamentals

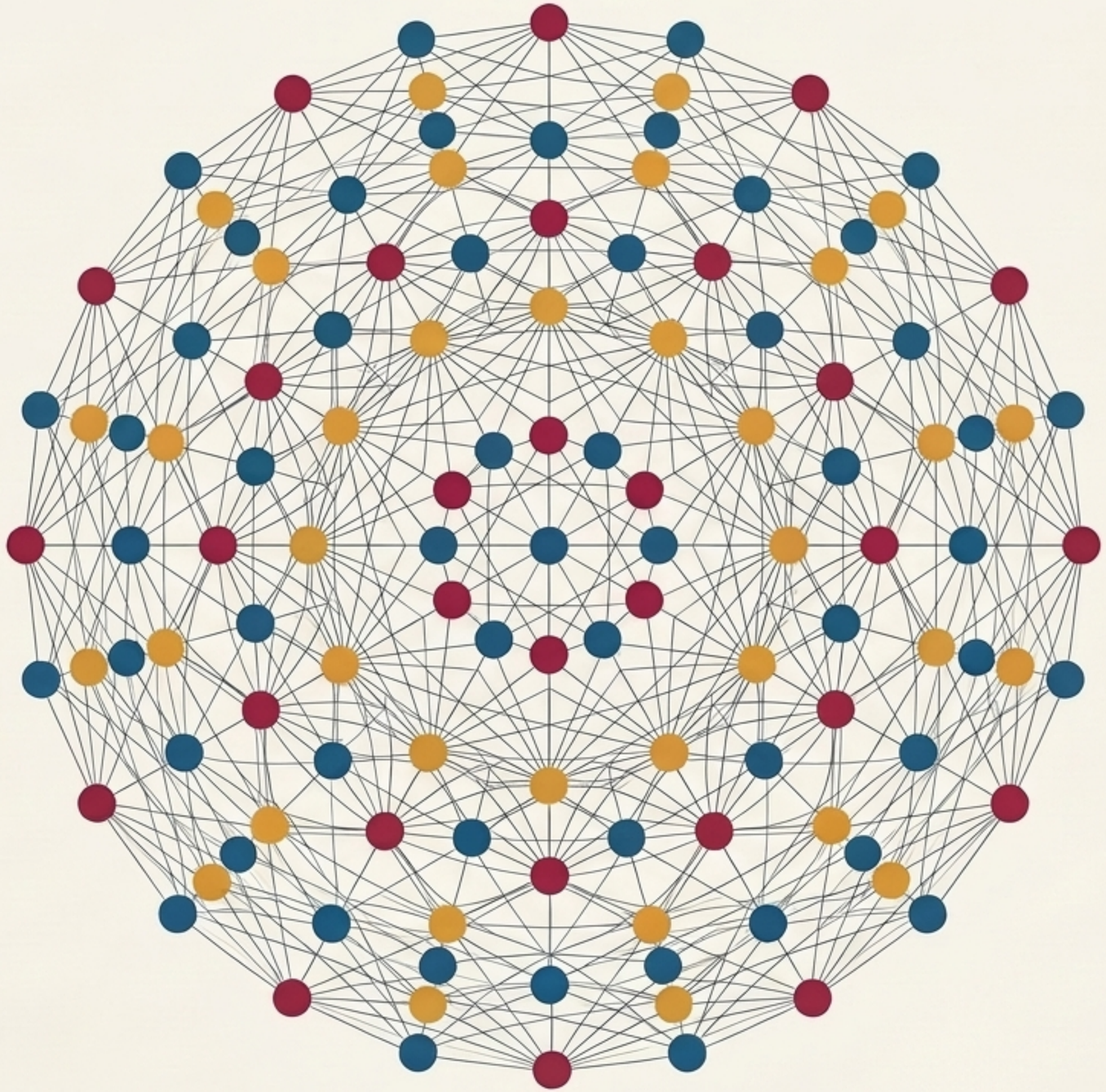


(Crucial for manual calculation of Linear Regression and Pearson Correlation Coefficient)

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Order from Chaos

Data is everywhere, but it is only raw material. Machine learning algorithms provide the architecture to turn that chaos into insight, predictions, and automated intelligence.



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