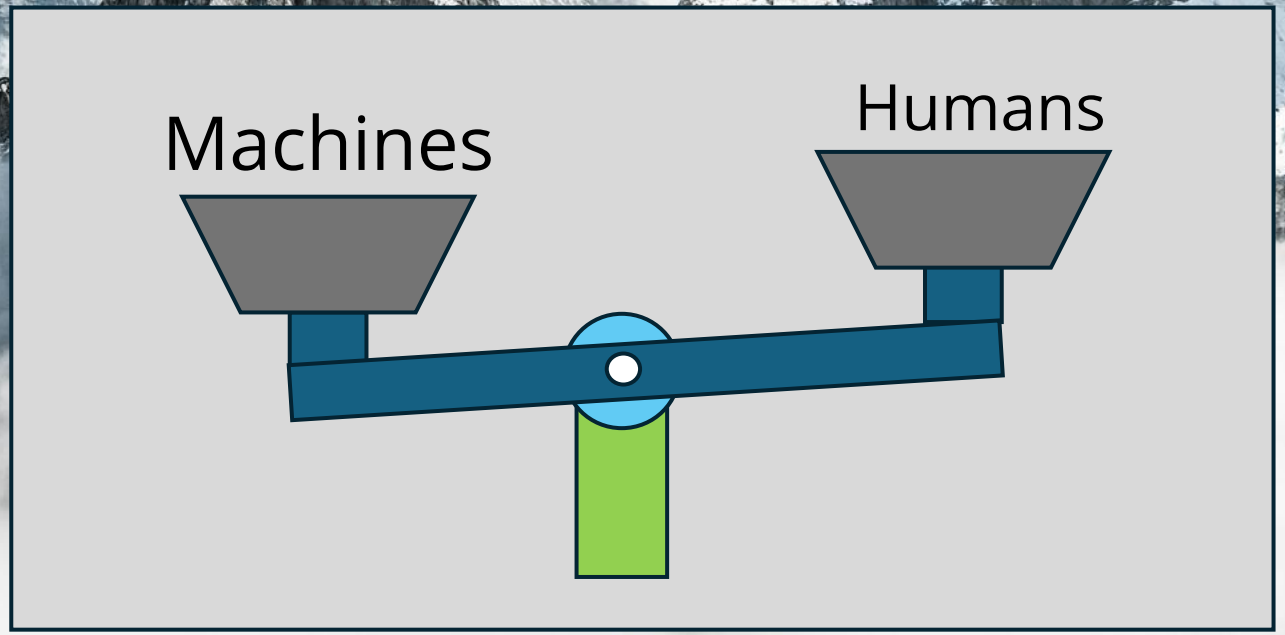
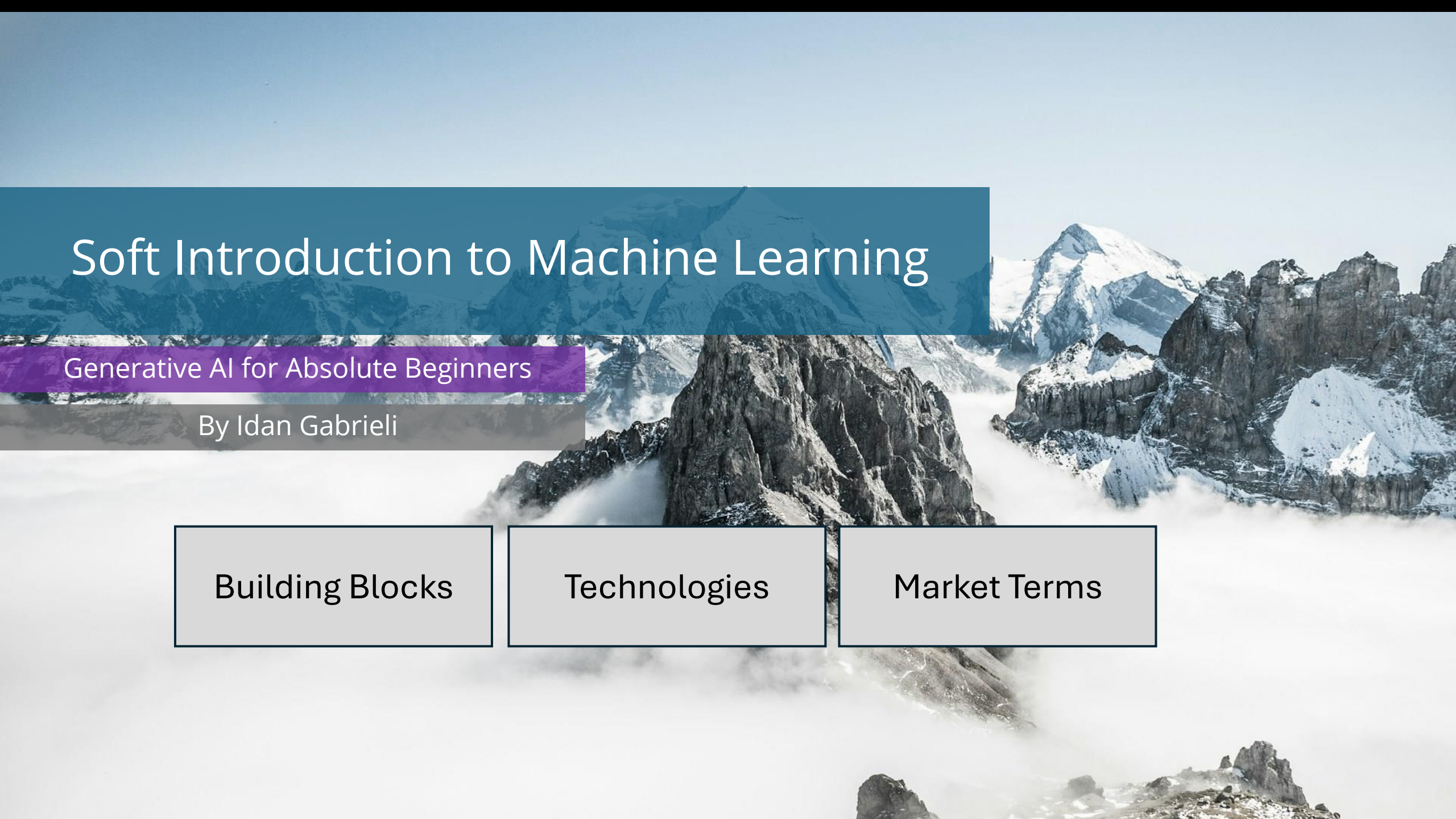
Soft Introduction to Machine Learning

Generative AI for Absolute Beginners

By Idan Gabrieli





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Building Blocks

Technologies

Market Terms

The ML Box (I/O)

The Box Analogy

INPUT → ML-Solution → OUTPUT

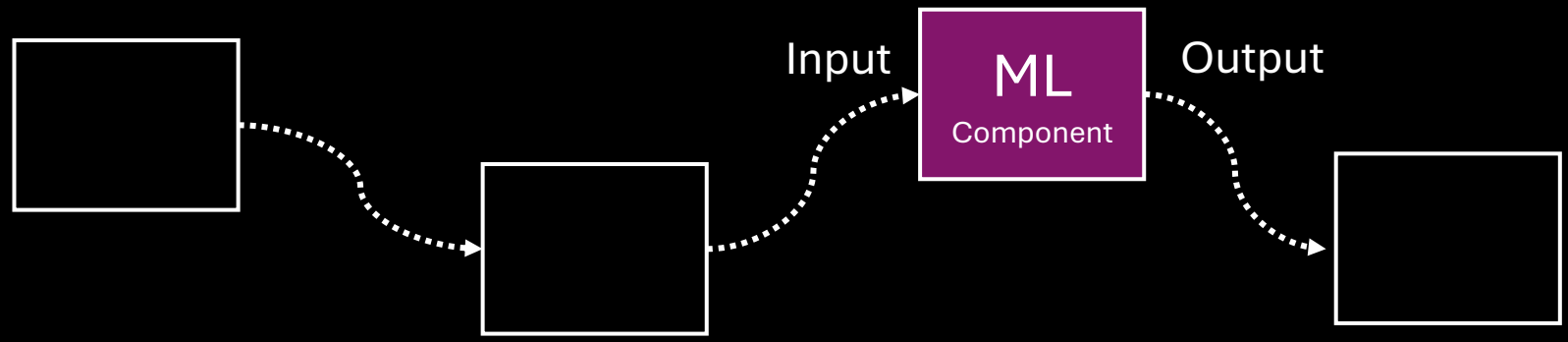
Product Picture → ML Box #1 → **Perfect\Defective**

Product Review (Text) → ML Box #2 → **Positive\Negative**

Story (Text) → ML Box #3 → **Video File**

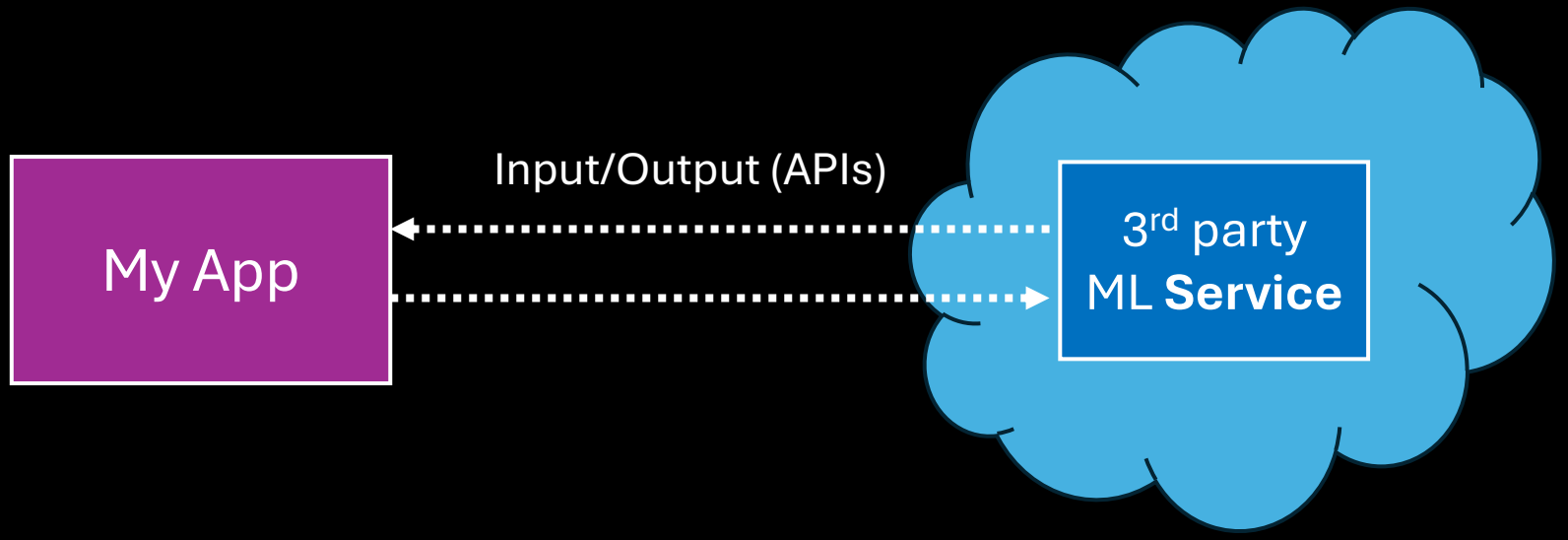
The ML Box (I/O)

The Box Analogy



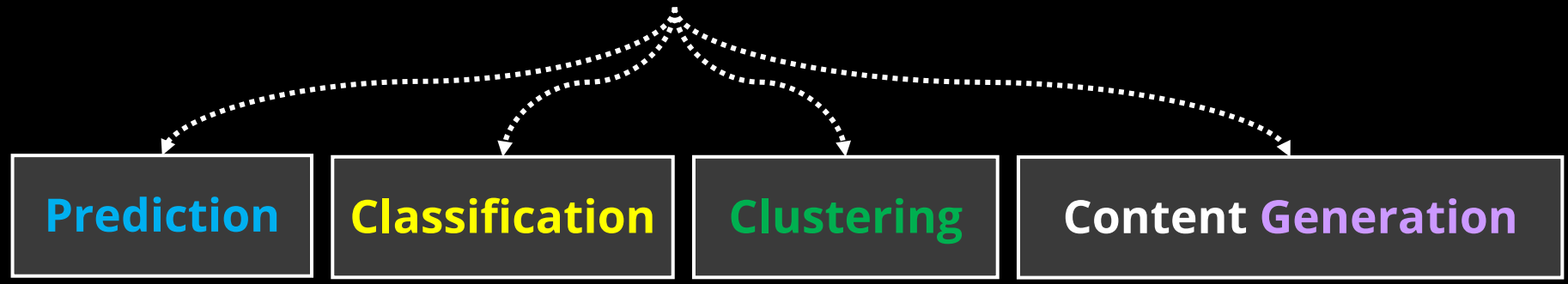
The ML Box (I/O)

The Box Analogy



The Box Analogy

Typical ML Tasks



Prediction

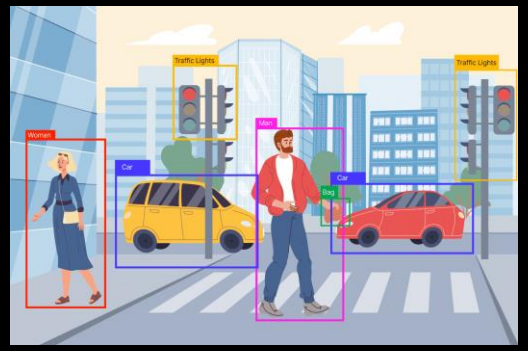
Input Data → ML Box → Value of a **Target Variable**

- ✓ **Stock Market Prediction**
- ✓ **Sales Forecasting**
- ✓ **Weather Forecasting**
- ✓ **Customer Churn Prediction**

Classification

Input Data → ML Box → **Labels** of **Categories**

- ✓ **Spam Detection**
- ✓ **Sentiment Analysis**
- ✓ **Image Classification**

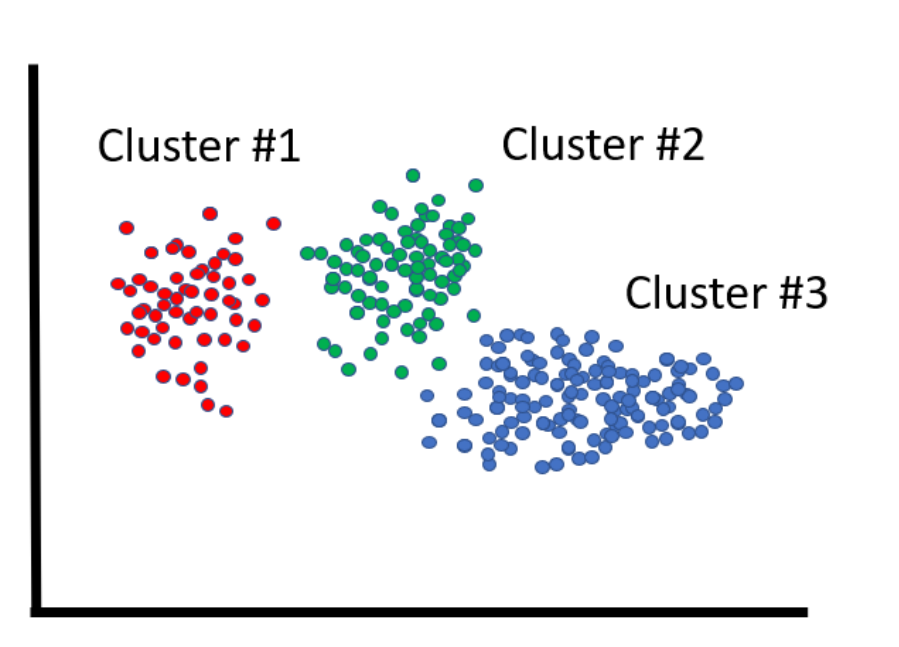


Clustering

Input Data → ML Box → **Clusters**

groups of similar data points

- ✓ **Personalized Product Recommendations**
- ✓ **Social Networks**
- ✓ **Knowledge Sharing**



Content Generation

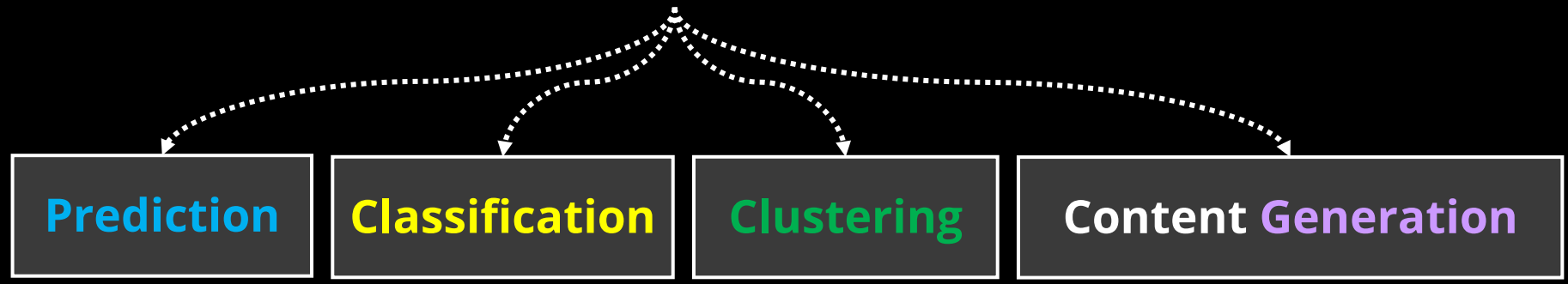
Text Description

ML Box

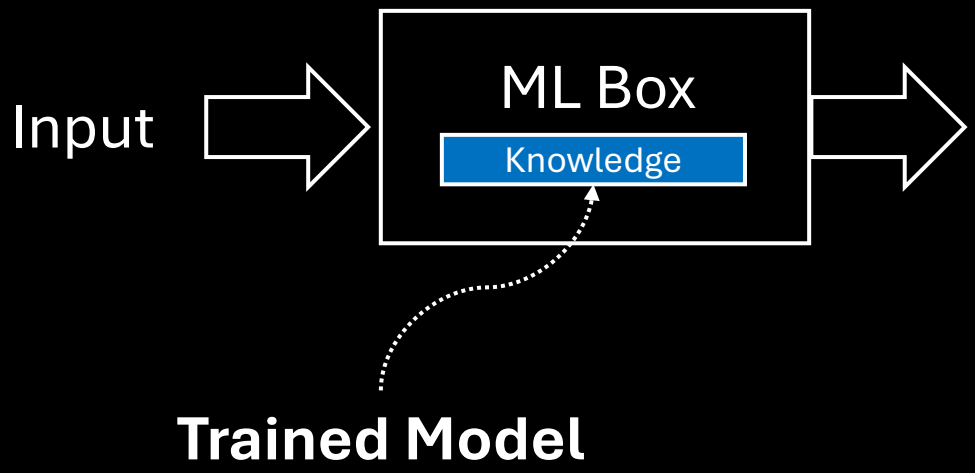
- Text-To-Text
- Text-To-Image
- Text-To-Video
- Text-To-Audio

The Box Analogy

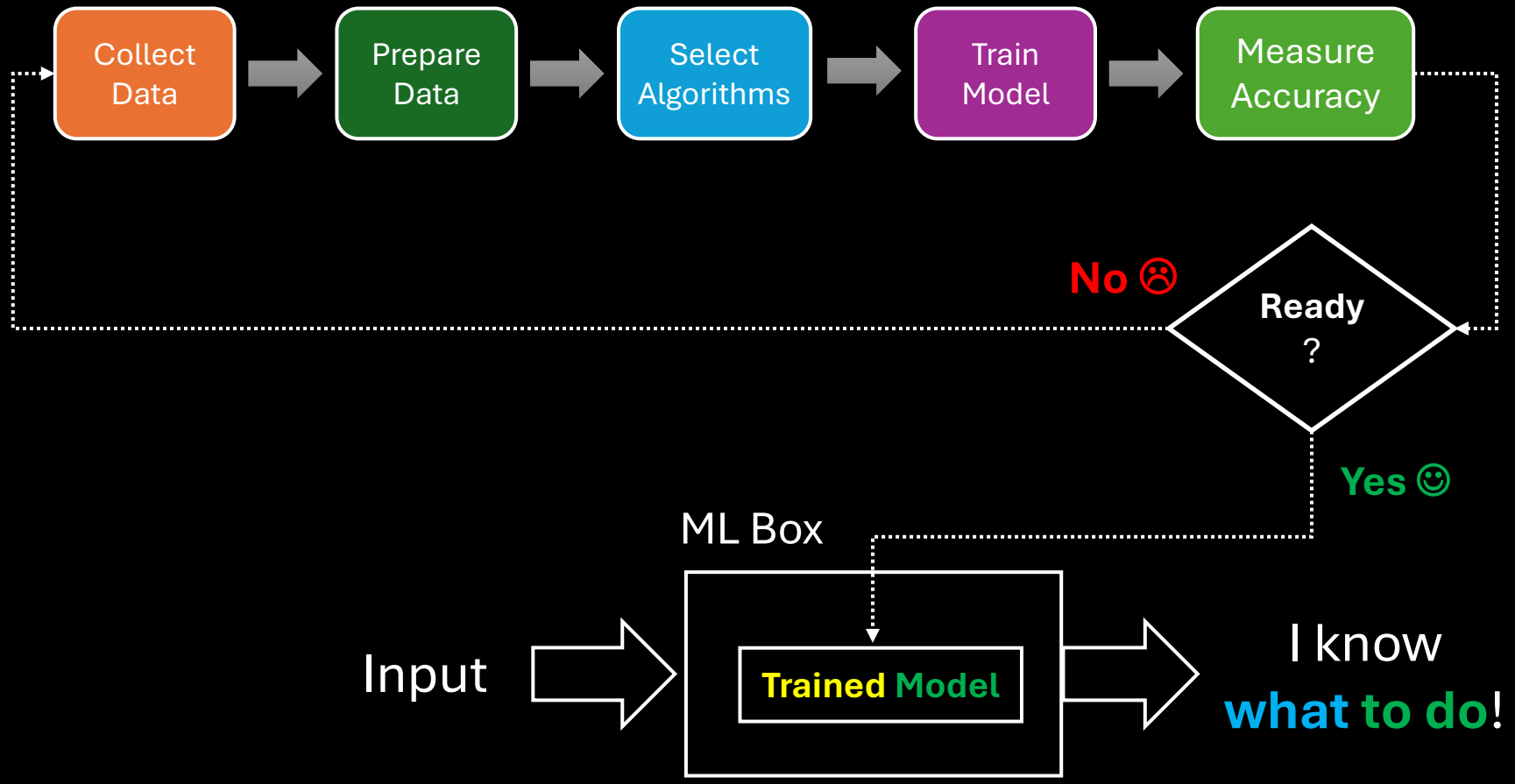
Typical ML Tasks



Training Phase

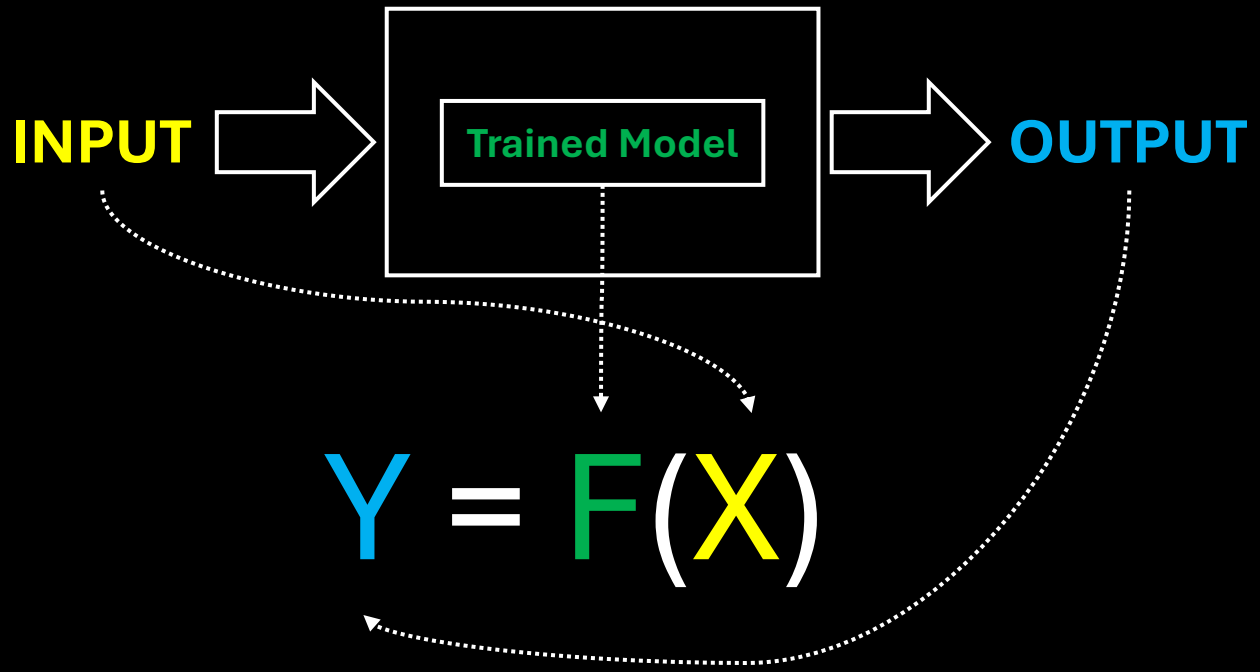


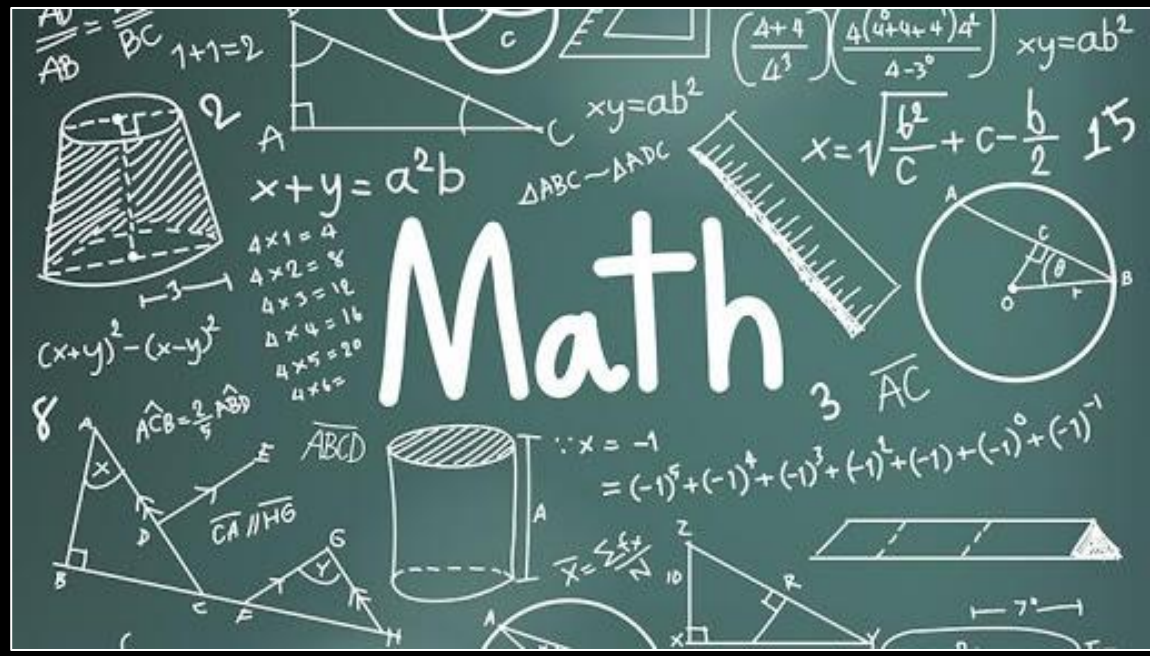
Creating a Trained Model



Y = F(X) – OMG!

The Box Analogy

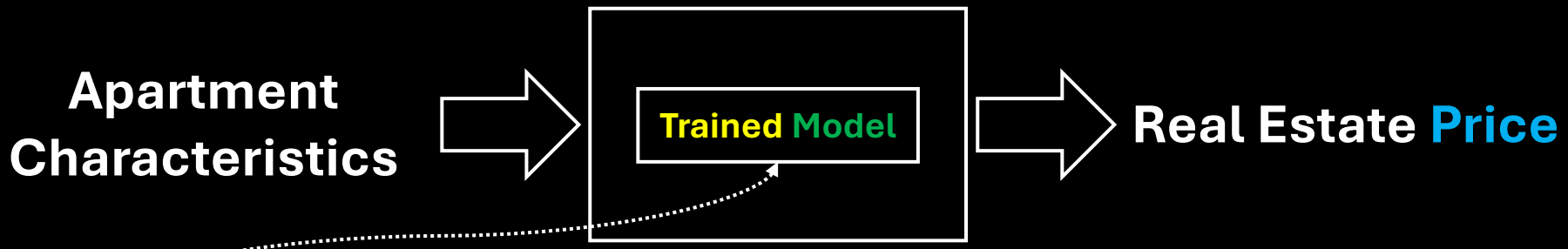




F - Mapping function

X → Y

Y = F(X) – OMG!

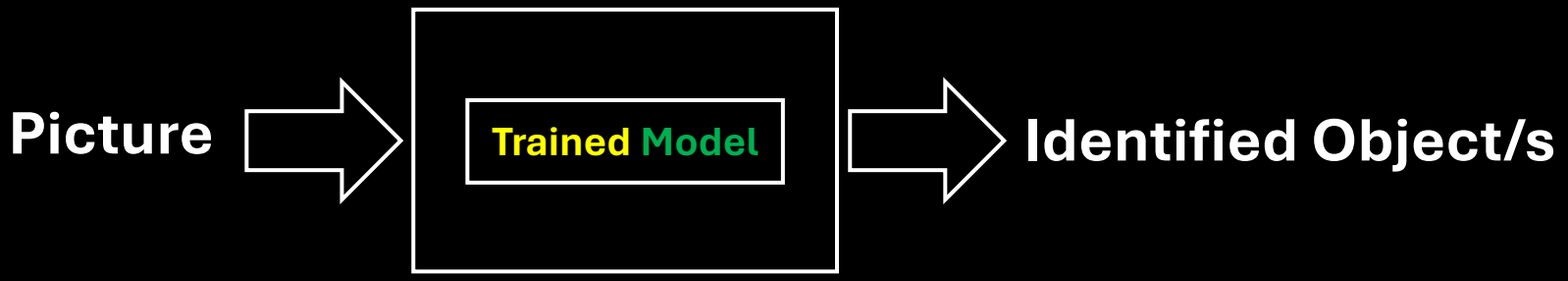


$$Y = F(X) = 0.1 + 3*X1 + 0.4*X2 + 1.6*X3 + 0.2*X4$$

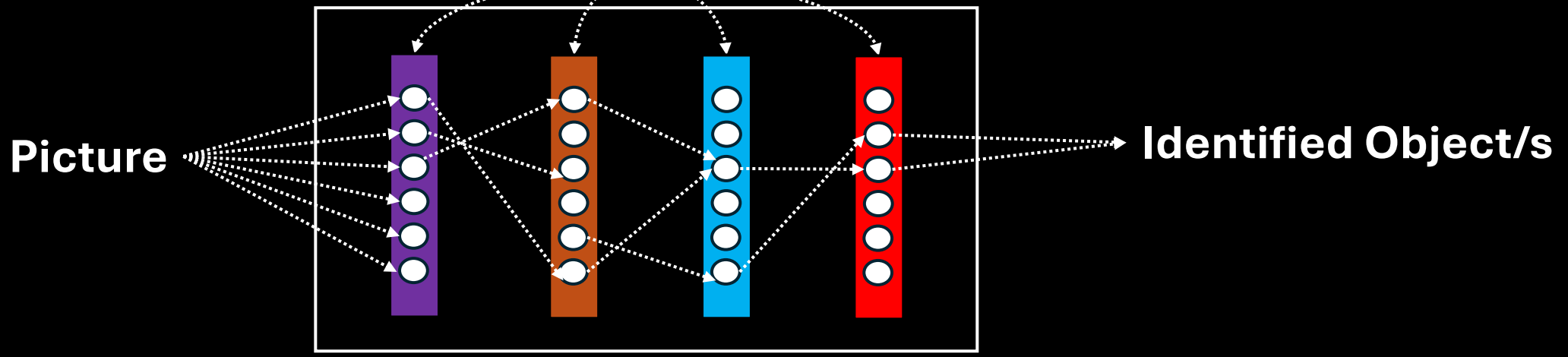
- X1 – number of rooms in the apartment
- X2 – the square size
- X3 – distance from nearby school
- X4 – distance from nearby hospital etc.

Model Weight/Parameter

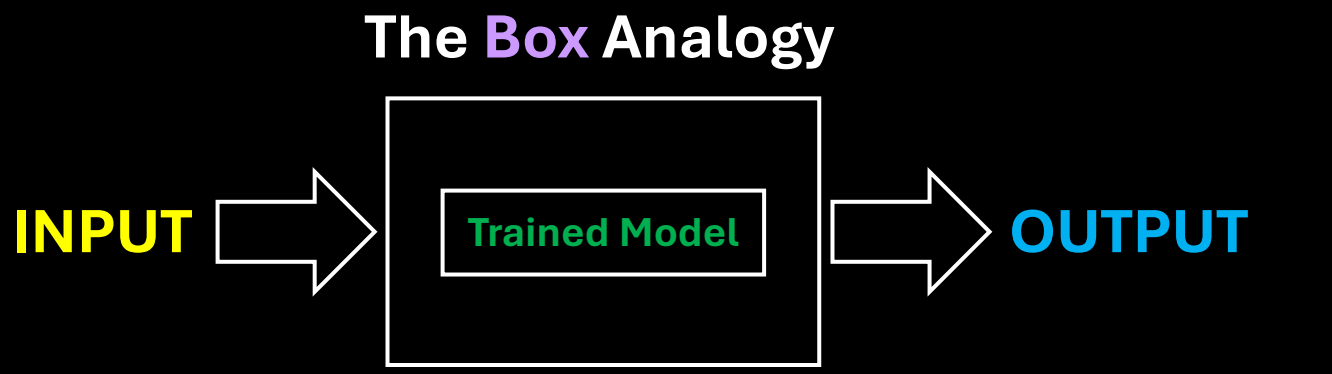
Y = F(X) – OMG!



$$Y = F(X) = F4\,(\,F3\,(\,F2\,(\,F1\,(X\,)\,)\,)\,)$$



4-layer neural network


The Box Analogy
INPUT
Trained Model
OUTPUT

#1 – Structured Data

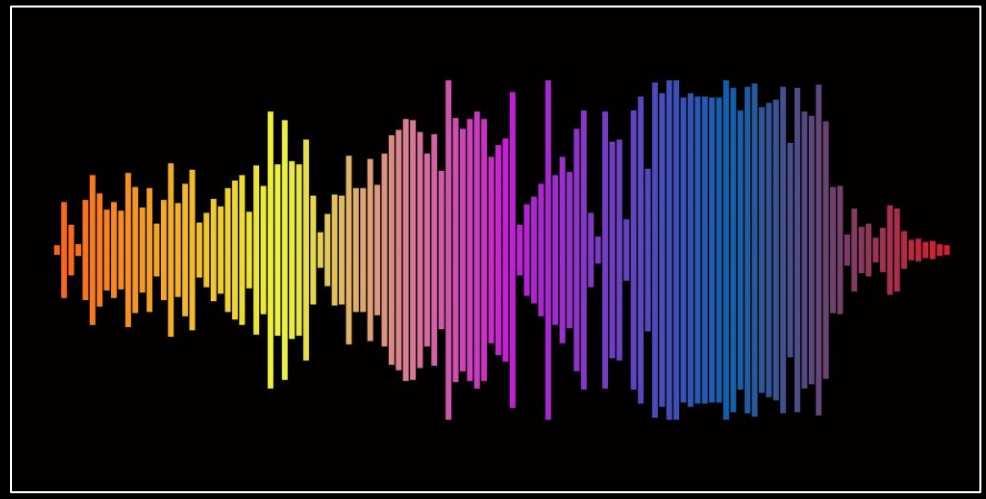
- ✓ Has a **defined format**
- ✓ highly organized and arranged in a predefined structure
- ✓ **Easily** searchable and accessible
- ✓ **Lower flexibility** for changing structure

List of Customers

Name	Age	Address	Phone	Email	ID
John	36	…	…	…	…
Michael	58				
Maya	29				

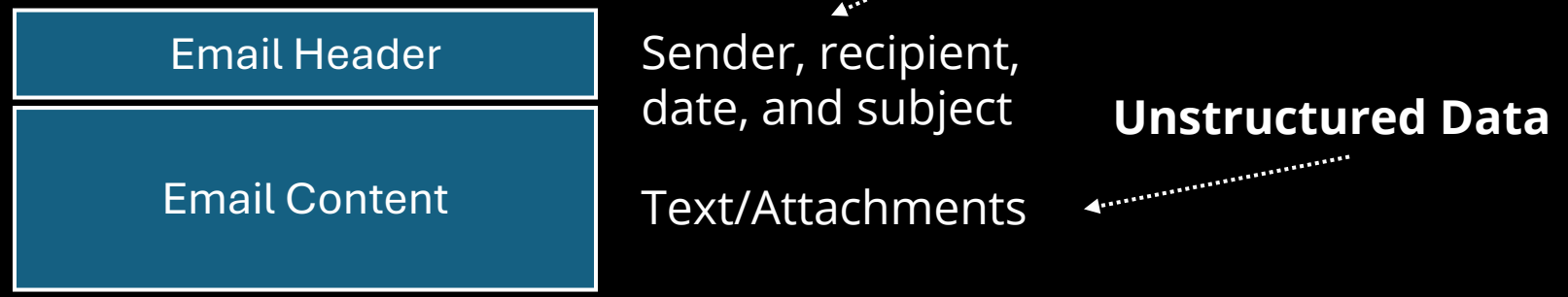
#2 – Unstructured Data

- ✓ **No pre-defined** data structure
- ✓ Examples
  - ✓ Textual data (emails, social media posts, documents…)
  - ✓ Multimedia (images, videos, audio files)
- ✓ More **complex** to process
  - ✓ Advanced machine learning methods

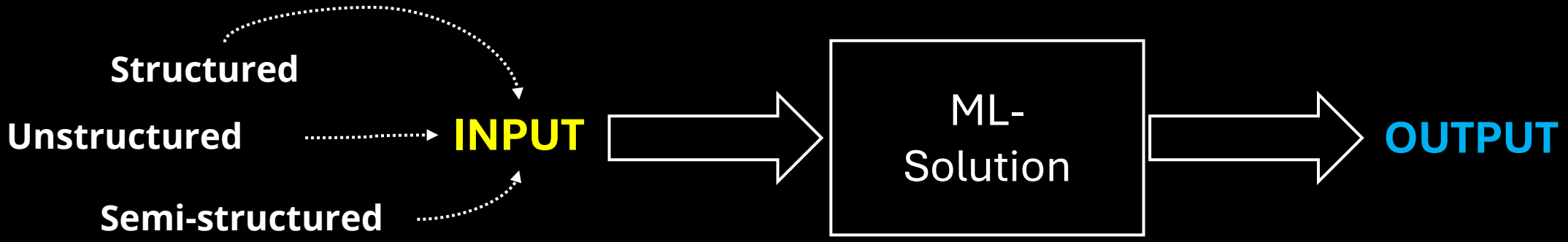


#3 – Semi-structured Data

- ✓ **Hybrid** type (between structured and unstructured)
- ✓ Has a **partial structure**

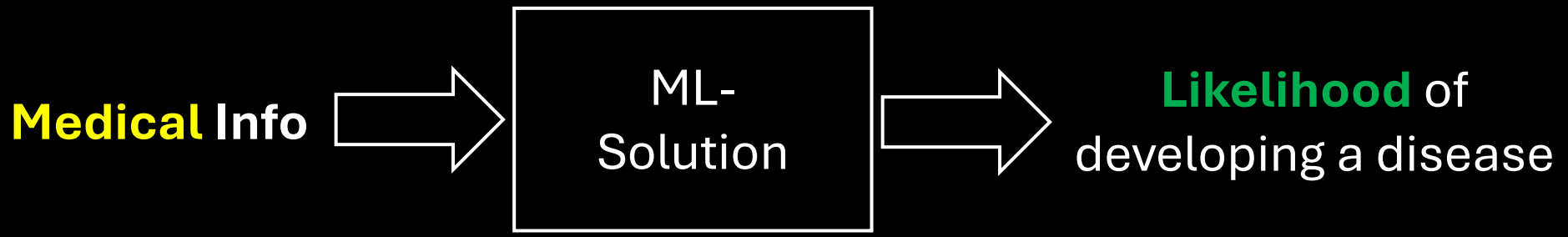


Log Message: 2024-08-25 12:34:56, HIGH, ERROR: Unable to connect to database



Features – Input Variables

- ✓ Numerical value (age)
- ✓ Categorical data (gender, color)
- ✓ Date and time
- ✓ Text
- ✓ Images
- ✓ Audio



Features – Input Variables

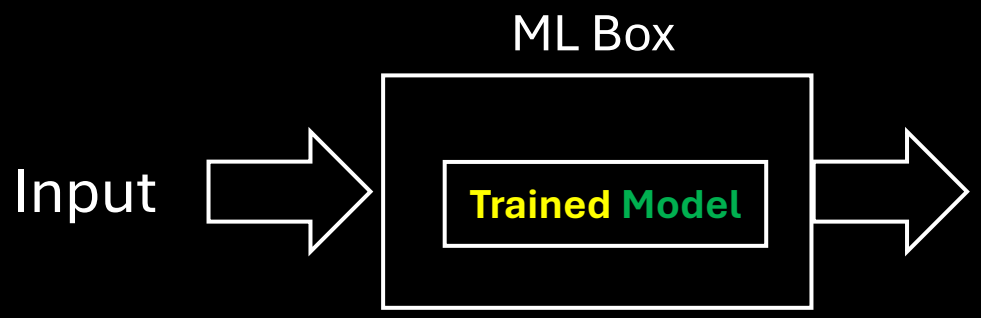
- ✓ Age
- ✓ Geo Location
- ✓ Gender
- ✓ Blood Pressure
- ✓ Smoking Status
- ✓ Health Condition

Feature Engineering

Age
(numerical number)

0-18
19-30
31-45
46-60
(categories)

Please Call the Supervisor!



- #1 – Supervised Learning
- #2 – Unsupervised Learning
- #3 – Semi-supervised Learning
- #4 – Reinforcement Learning

#1 – Supervised Learning

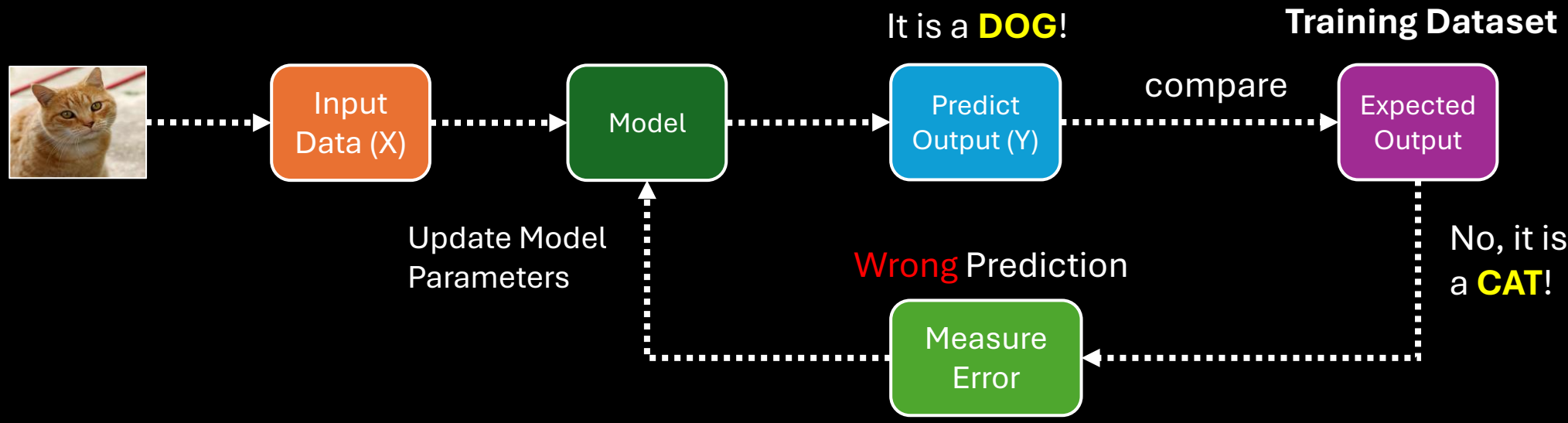
Training is guided by **labeled** data → **Training Dataset**

Labeled data = a collection of **many** data examples

Data example - Input + Output

#1 – Supervised Learning

Training Dataset



#2 – Unsupervised Learning

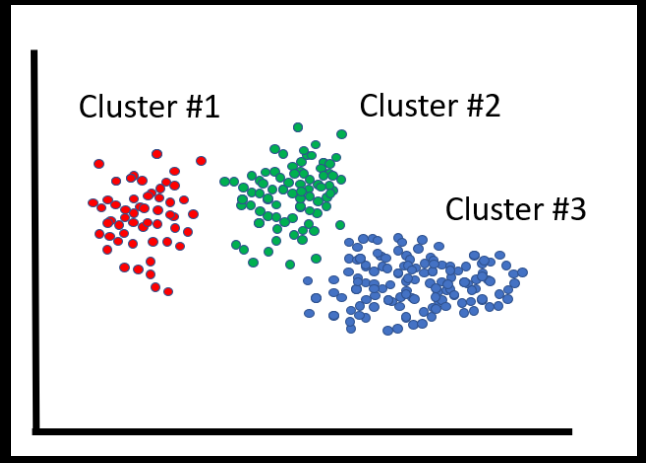
Training is guided by **unlabeled** data

Learns patterns directly from the data **without any guidance**

Main goal – **patterns discovery**

Discover **hidden patterns**, **structures**, or **relationships** within the data itself

Example - Clustering



#3 – Semi-supervised Learning

In some use cases, getting enough labeled data is a challenge

A **hybrid approach** – supervised + unsupervised

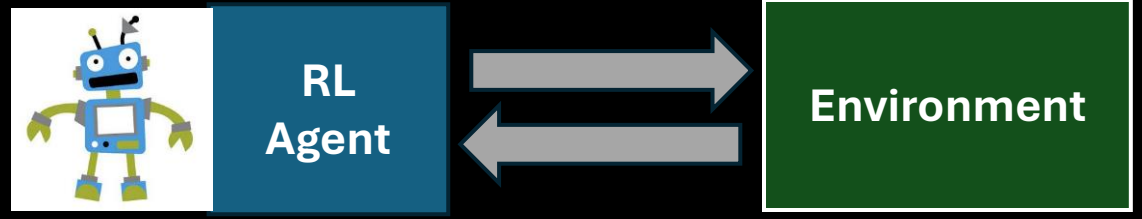
Training using:

- Small amount of **labeled** data
- Large amount of **unlabeled** data

#4 – Reinforcement Learning

Inspired by how humans and animals learn through **trial and error**

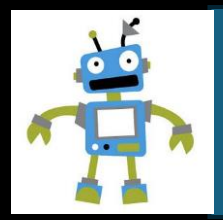
We **try things** and **get feedback**, and based on the feedback we are **learning**



Decision-making machine

Please Call the Supervisor!

#4 – Reinforcement Learning

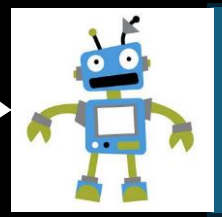


RL Agent ⇄ Environment

Winning a game → **Good Job!**

Losing a game → You should improve...

Game #1
Game #2
Game #3
Game #4



RL Agent ⇄ Policy/ Strategies

Trained Model