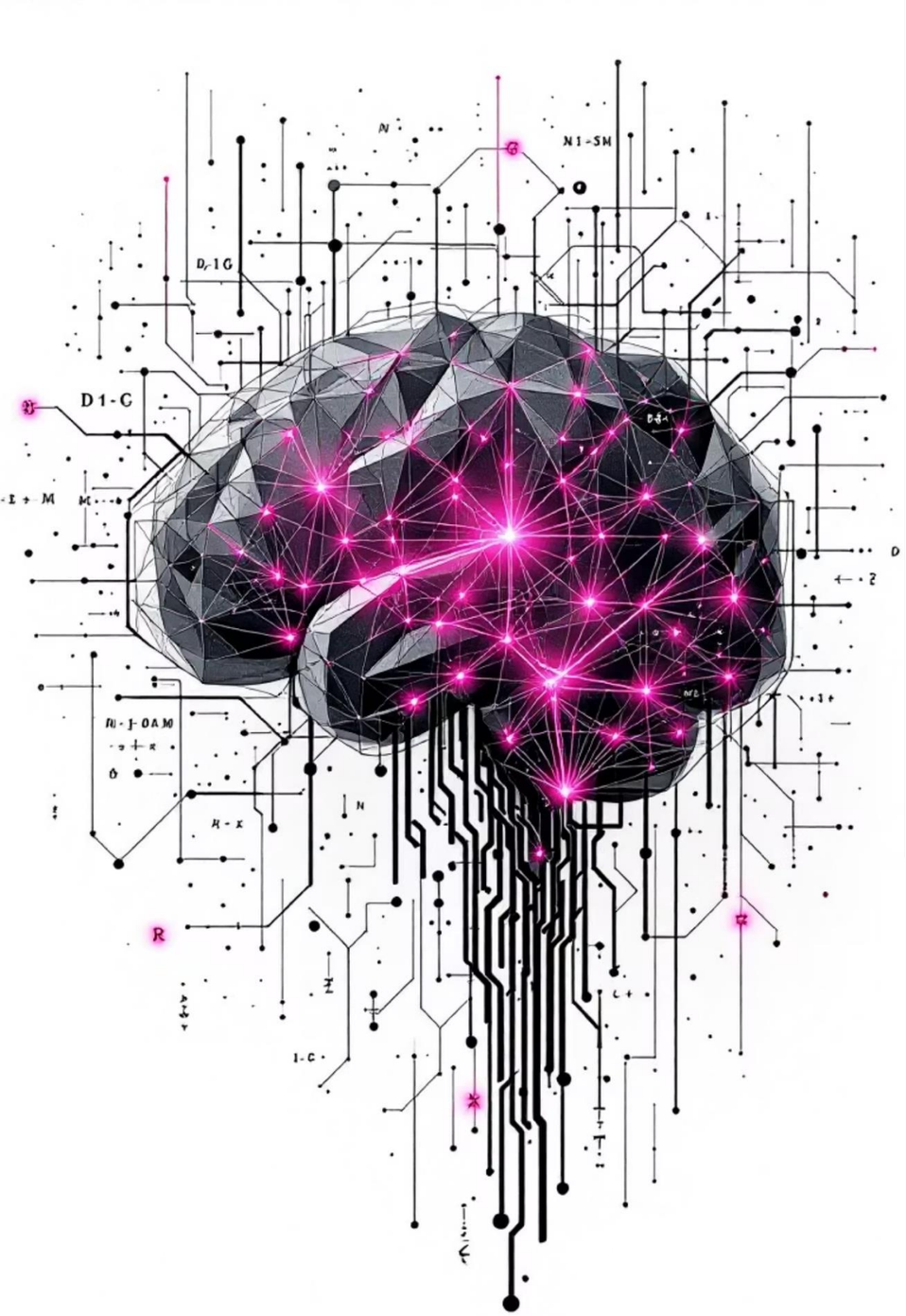

# Machine Learning: An Introduction


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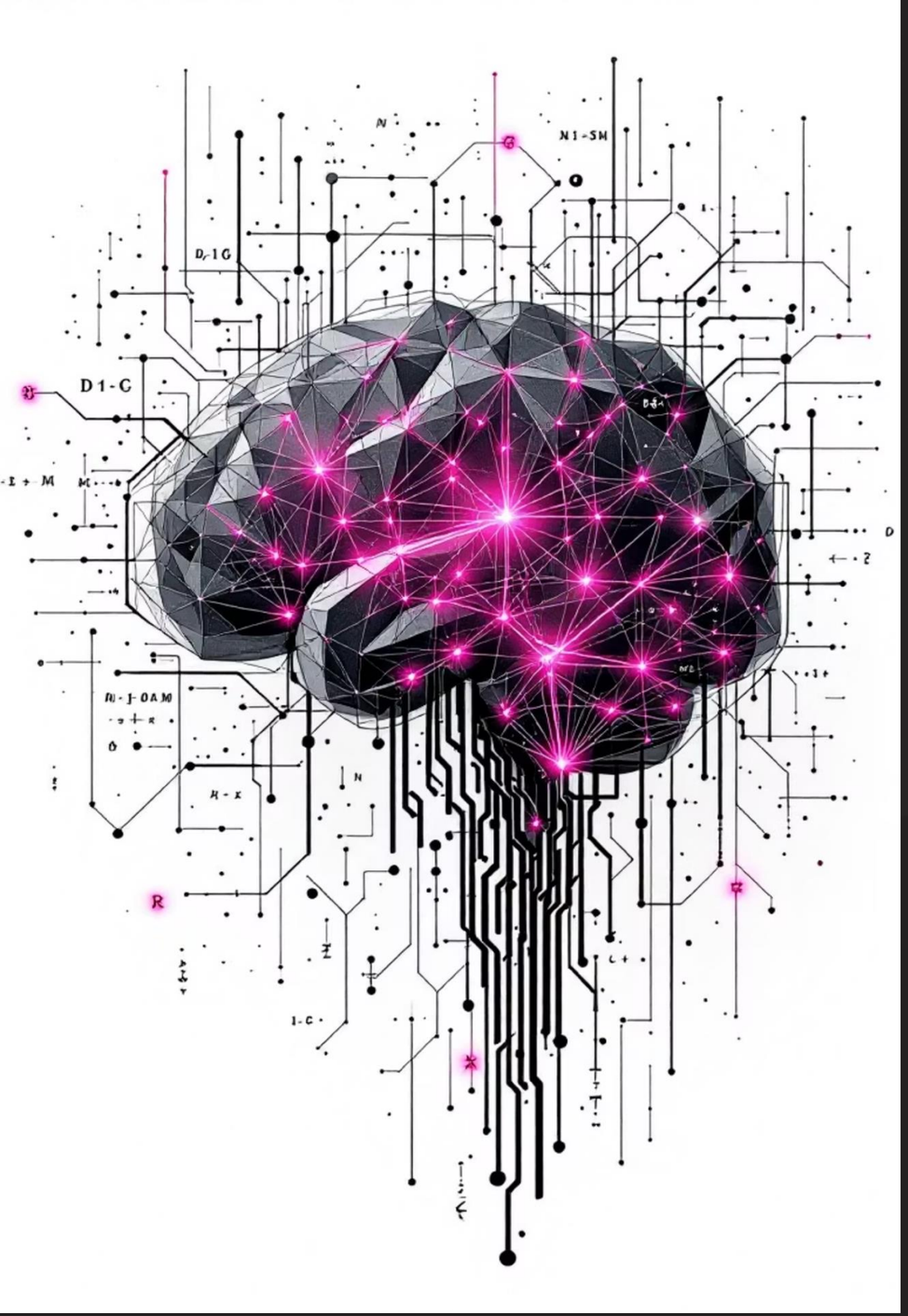
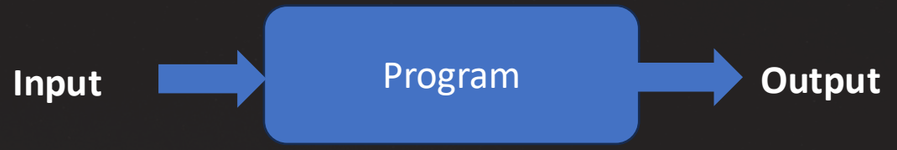
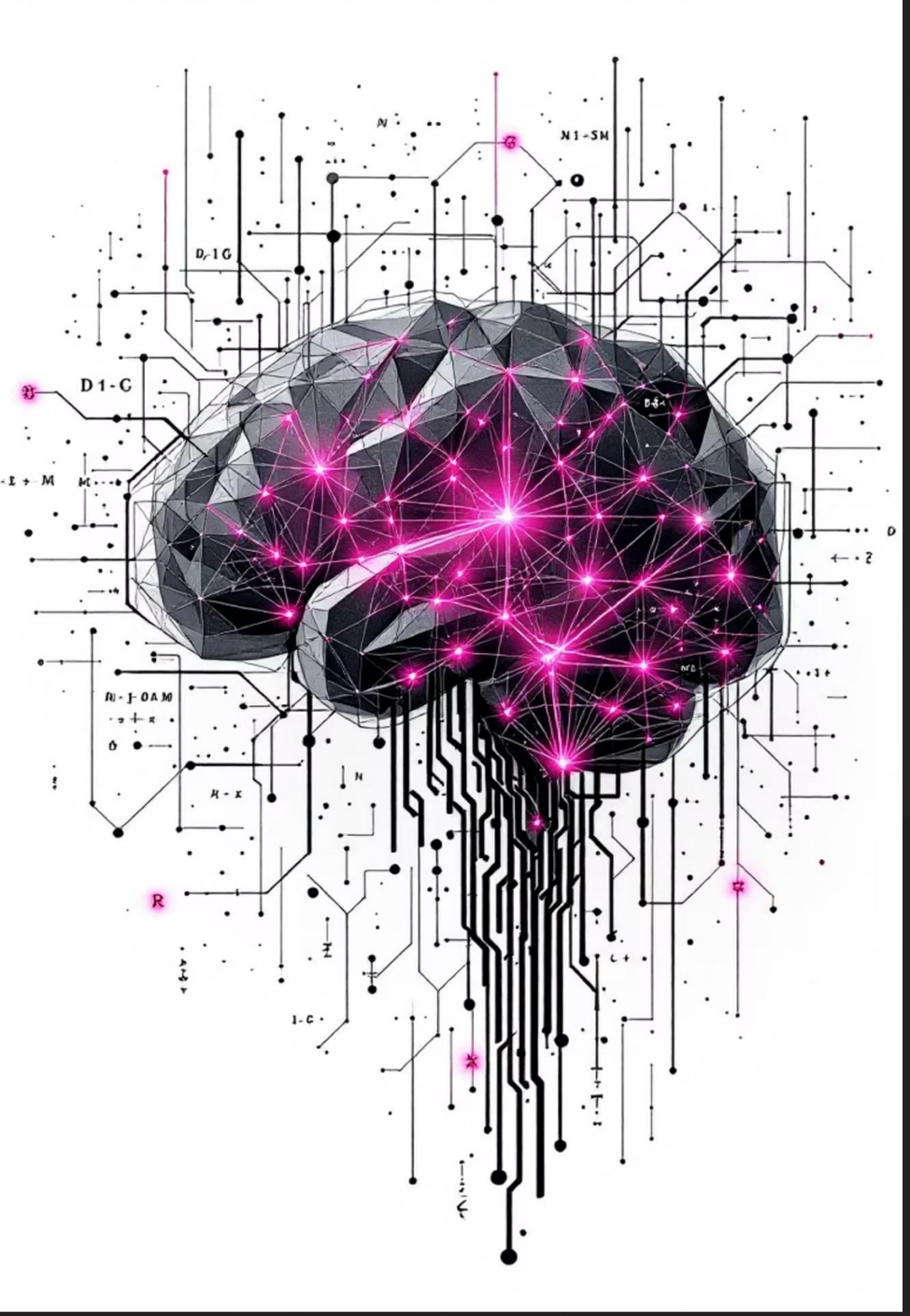


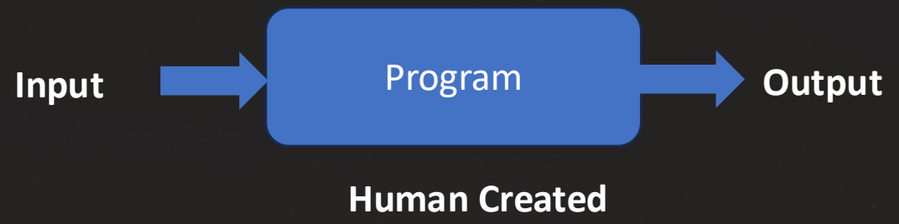
# Traditional Programming



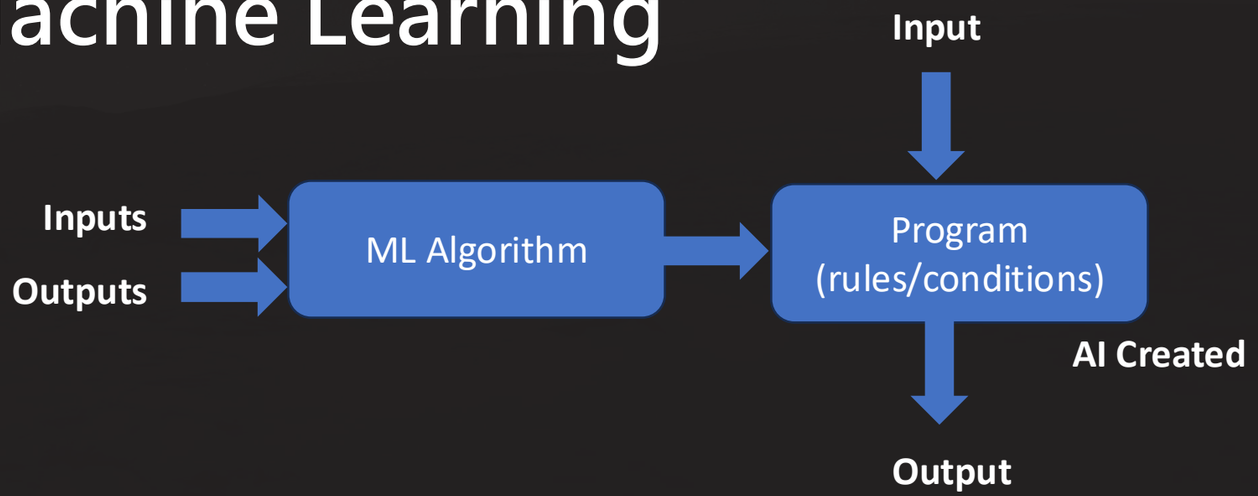

**Human Created**

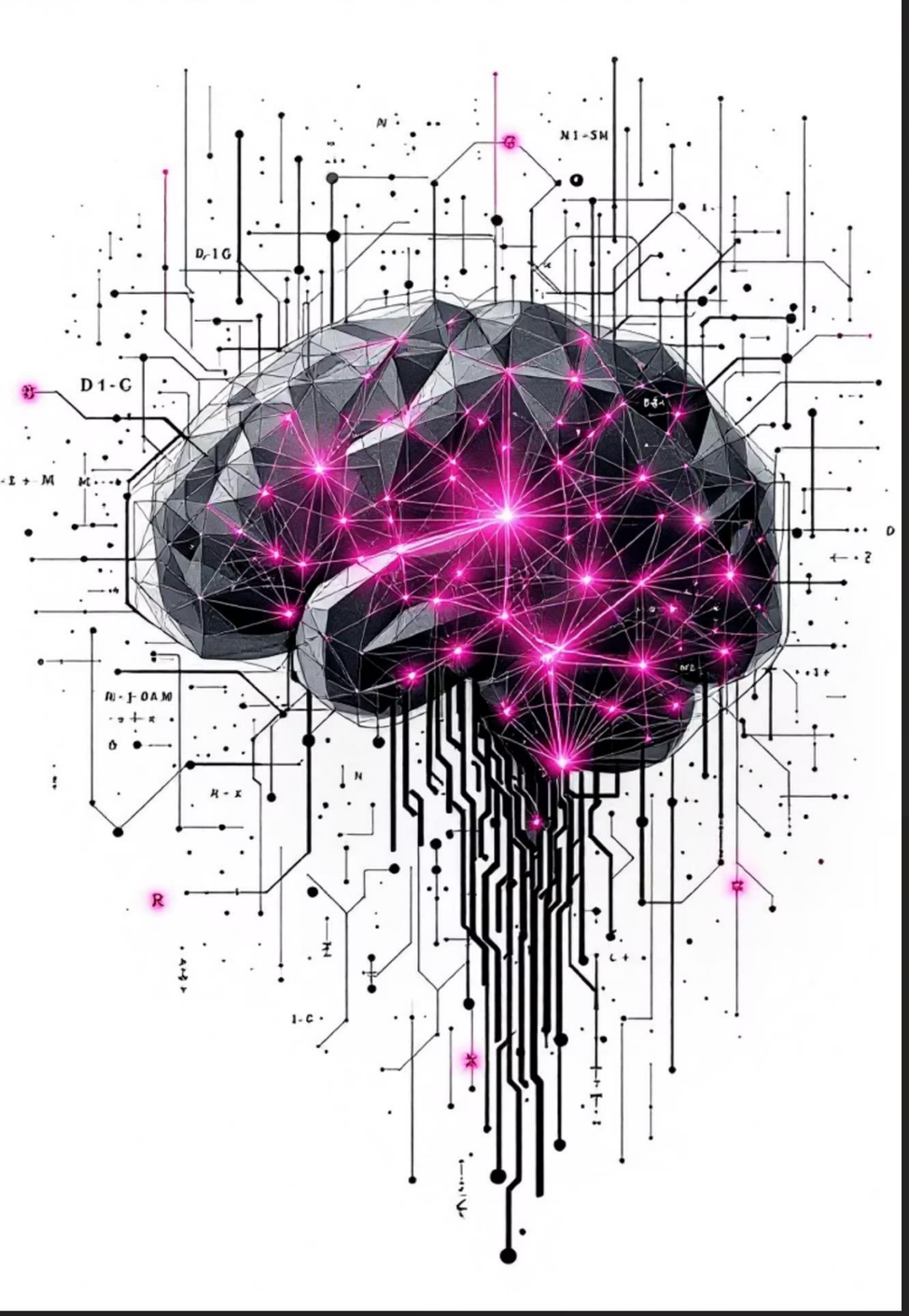


# Traditional Programming

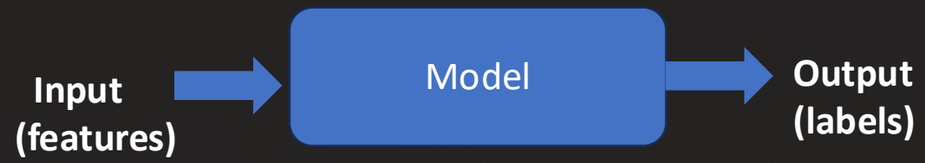


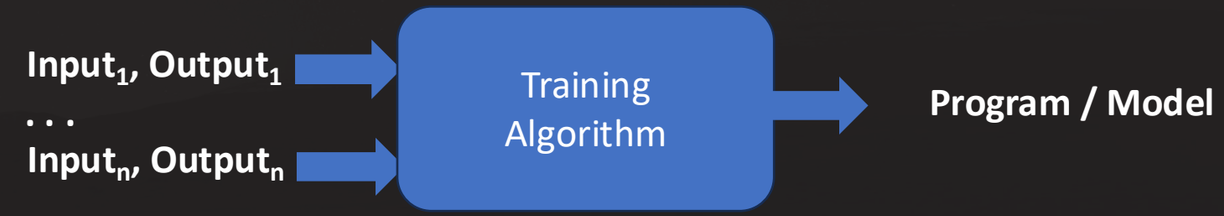

# Machine Learning

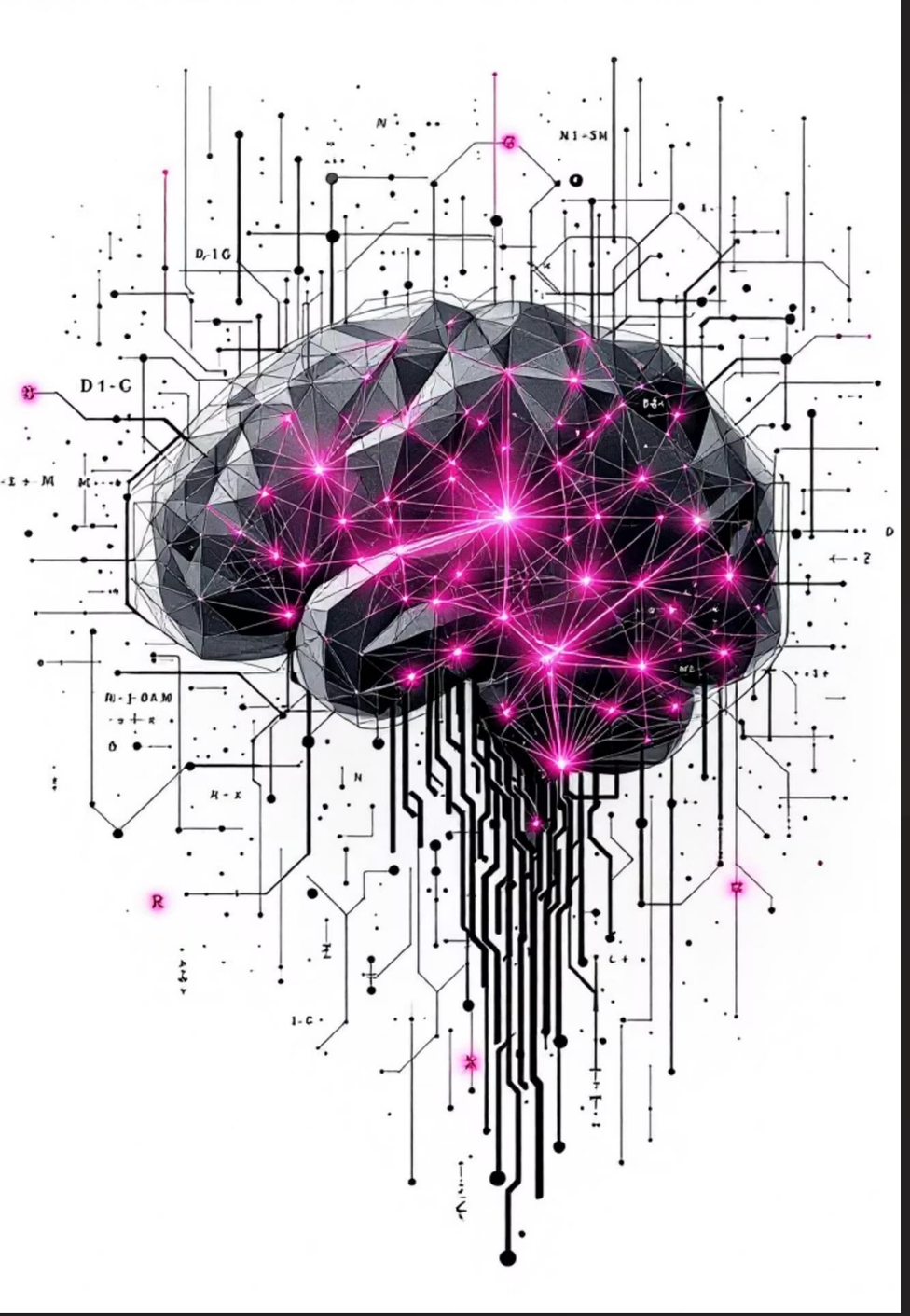




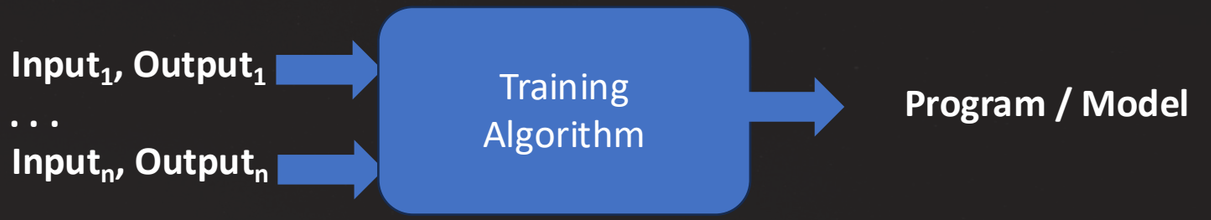
# Machine Learning





# Types of Machine Learning


Based on

1: Labels (Output)

2: Amount of labeled data for training

# Types of ML
## 1: Based on Output / label

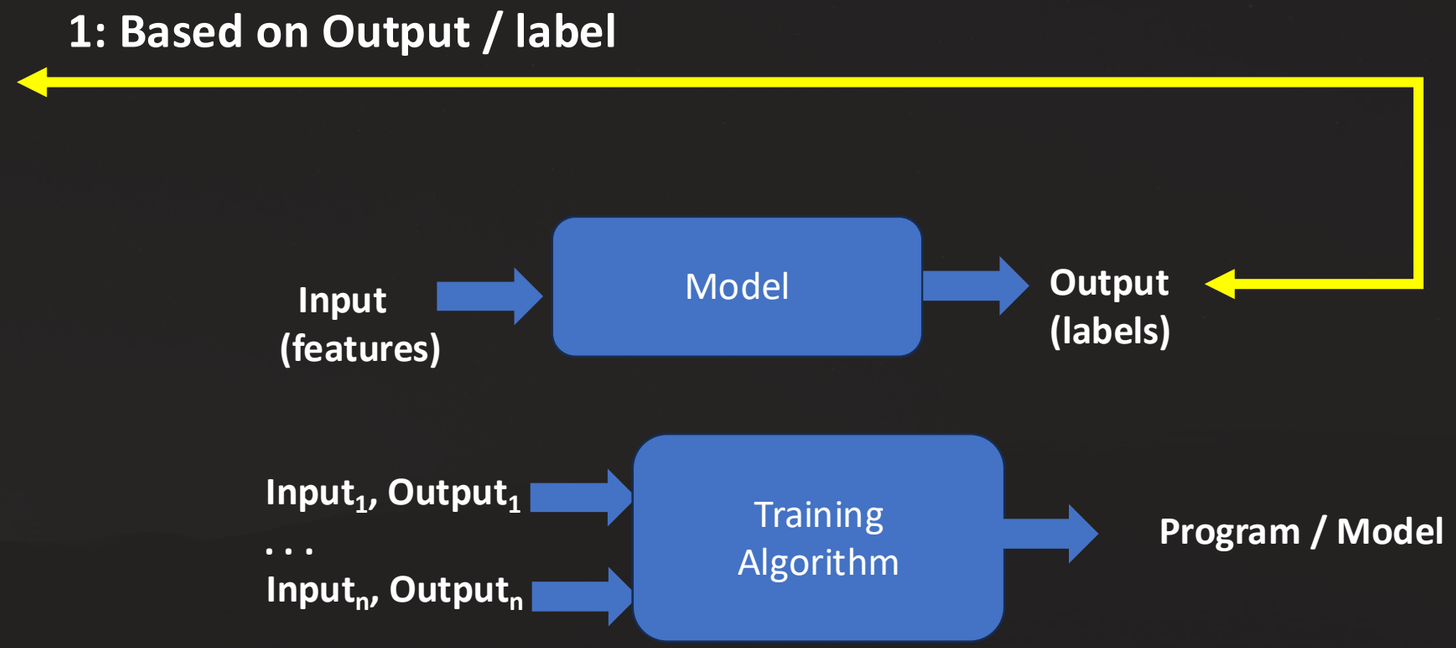
Discrete Classes
(Classification)

Continuous Value
(Regression)

Actions
(Reinforcement Learning)

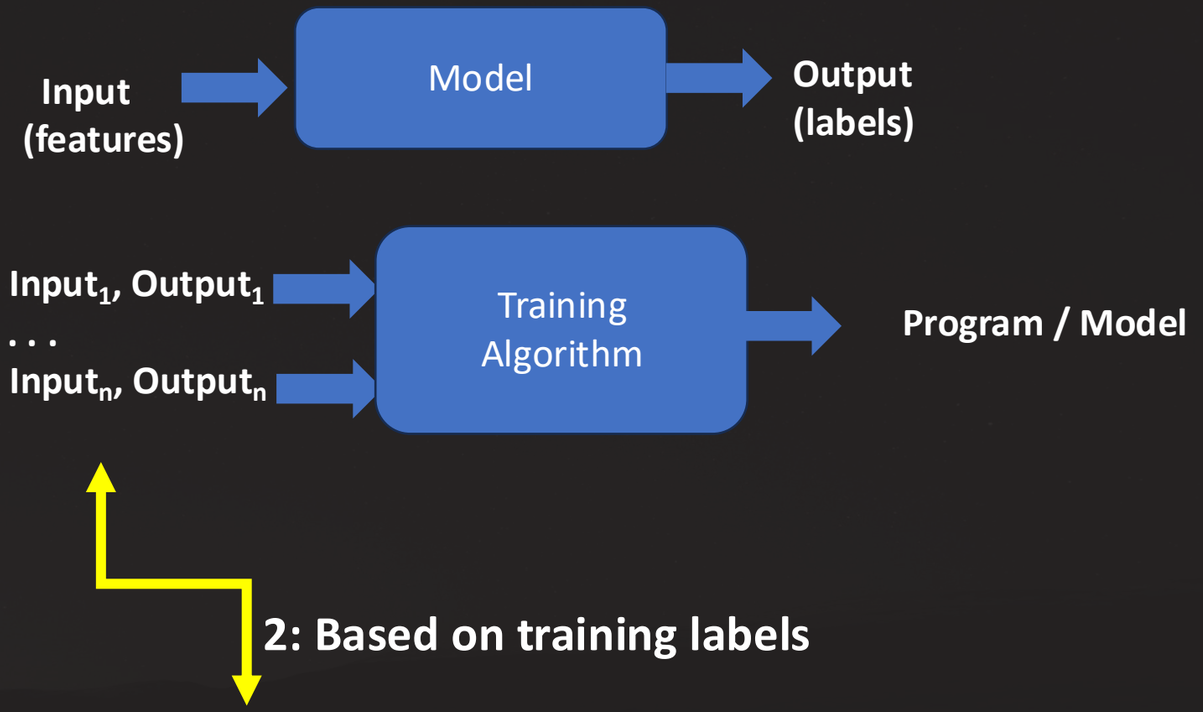
Ranking among items
(Ranking)

Recommendations
(Recommendation System)



# Types of ML

## 2: Based on training labels




Unsupervised
(No Labels)

Semi-supervised
(Labeled + unlabeled)

Active learning
(gets labels iteratively)

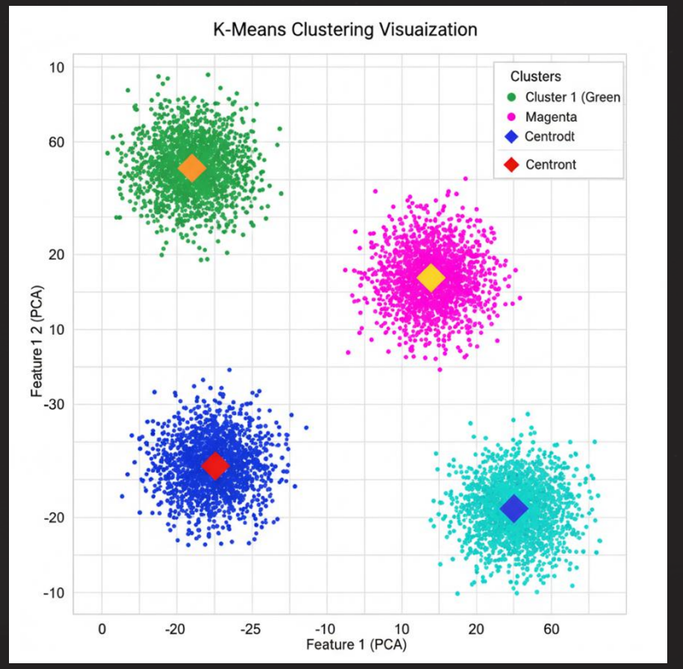
Online
(Stream)

Supervised
(Labeled)

(No Label) Amount of label Labeled)

# Types of ML

## 2: Based on training labels

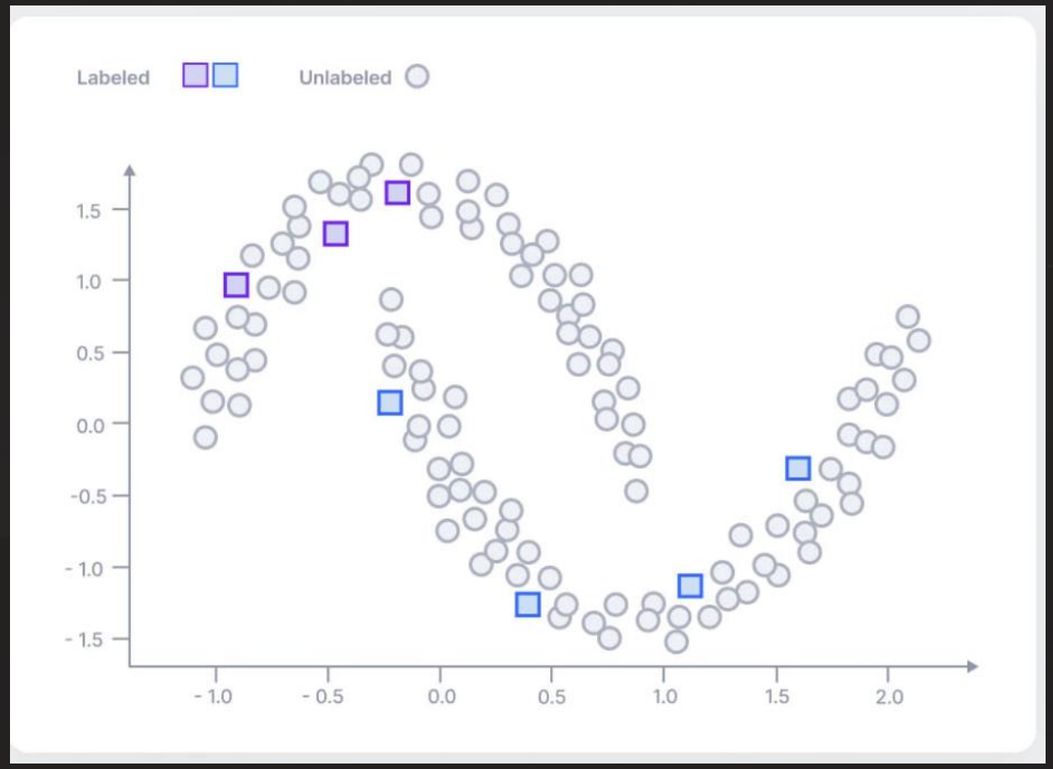



**Unsupervised**
**(No Labels)**

**(No Label)** **Amount of label** **Labeled)**

# Types of ML

## 2: Based on training labels

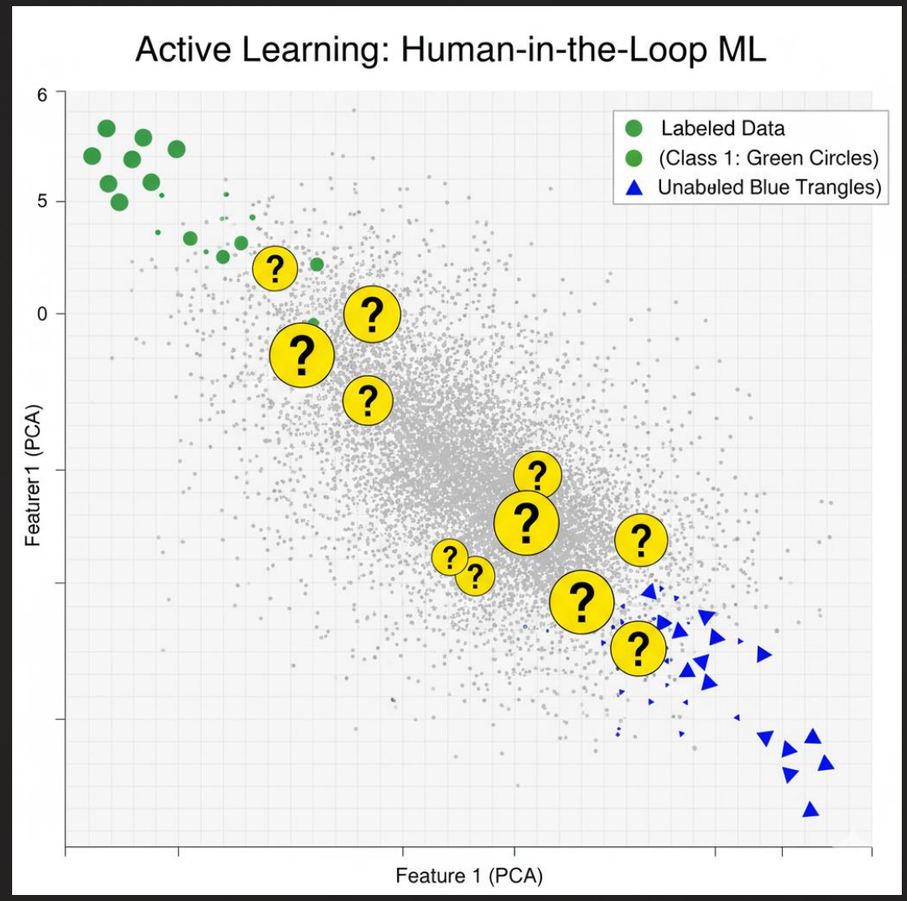



**Semi-supervised**
**(Labeled + unlabeled)**

**(No Label)** **Amount of label** **Labeled)**

# Types of ML

**2: Based on training labels**

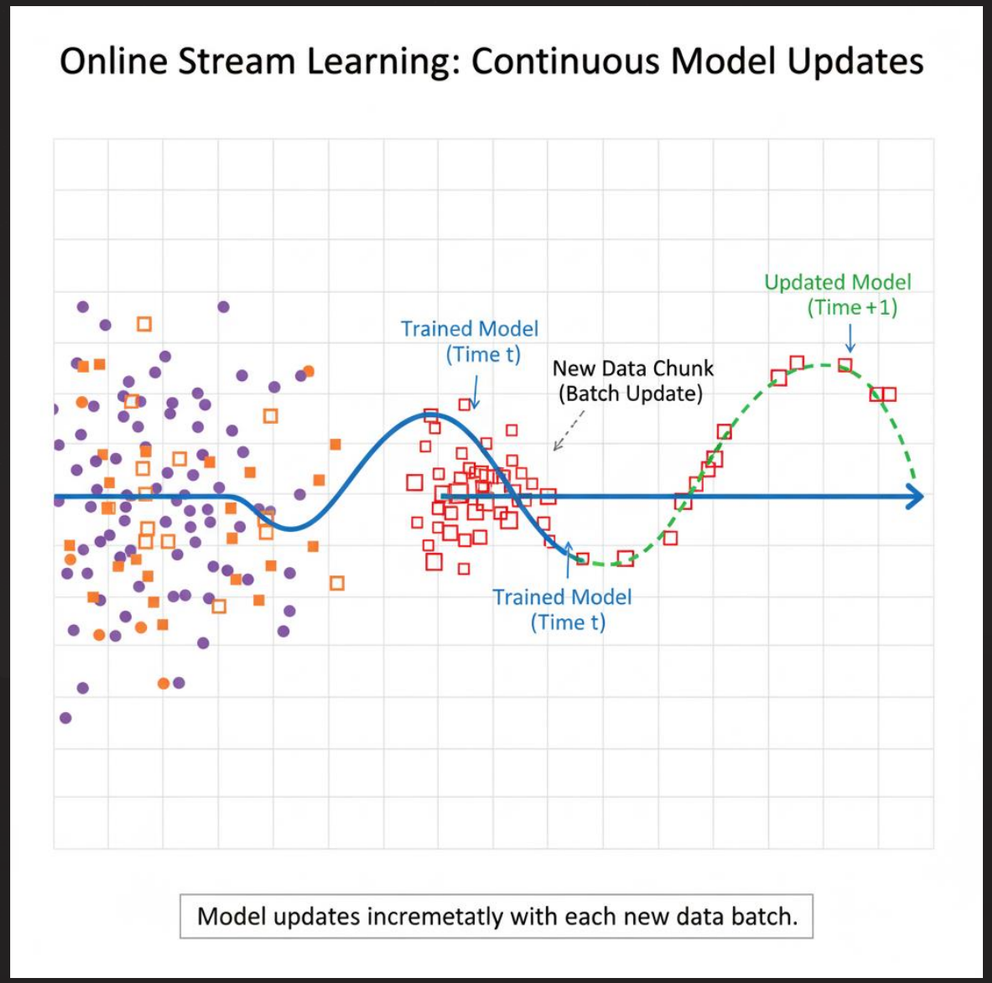



**Active learning**
**(gets labels iteratively)**

**(No Label)** **Amount of label** **Labeled)**

# Types of ML

## 2: Based on training labels




**Imagine learning to drive a car:**

- **Batch Learning**
  - You take **one long driving course**, finish it, and never practice again.
  - Your driving skills **don't improve** after the course ends.
- **Online (Stream) Learning**
  - You **drive every day**.
  - Each new experience (traffic, weather, mistakes) slightly **improves how you drive**.
  - You don't restart driving school every time — you **adjust continuously**.

**Online (Stream)**

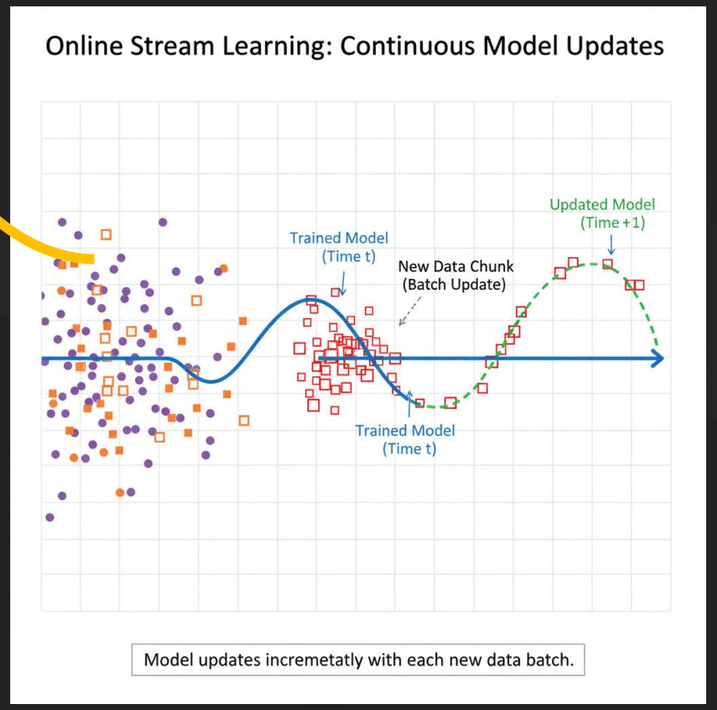
**(No Label)** ← **Amount of label** → **Labeled)**

# Types of ML

## 2: Based on training labels

**Older data**

The model was trained earlier (**"Trained Model – Time t"**).




**Online (Stream)**

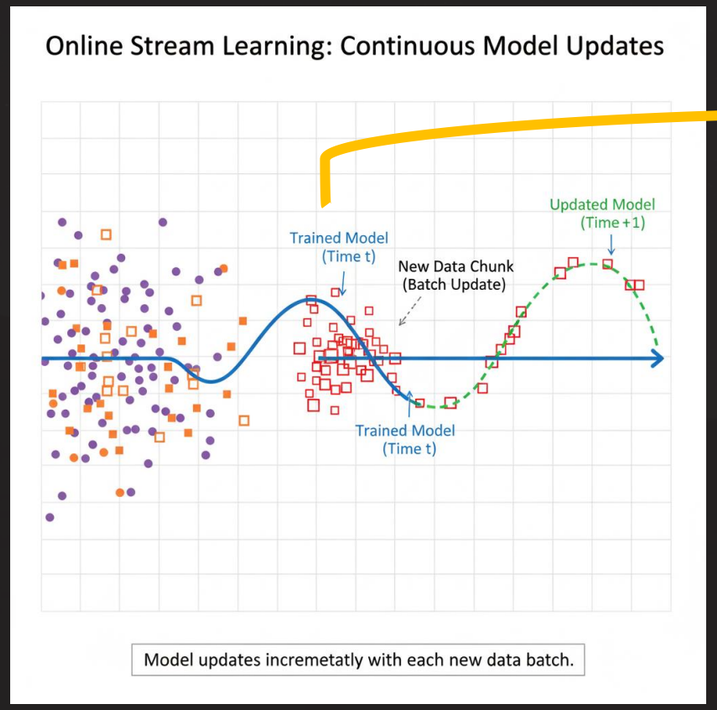
**(No Label)** — **Amount of label** — **Labeled)**

# Types of ML

## 2: Based on training labels

**Older data**

The model was trained earlier (**“Trained Model – Time t”**).




**New data chunk arrives**

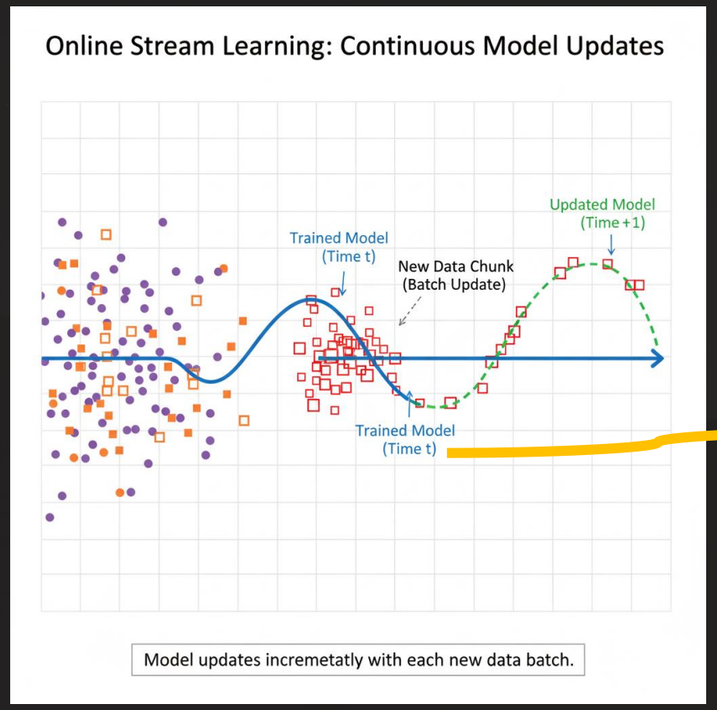
Data comes in small batches or one point at a time (stream).

**Online (Stream)**

**(No Label)** ⟷ **Amount of label** ⟷ **Labeled)**

# Types of ML

## 2: Based on training labels




**Older data**

The model was trained earlier (**"Trained Model – Time t"**).

**New data chunk arrives**

Data comes in small batches or one point at a time (stream).

**Model updates itself**

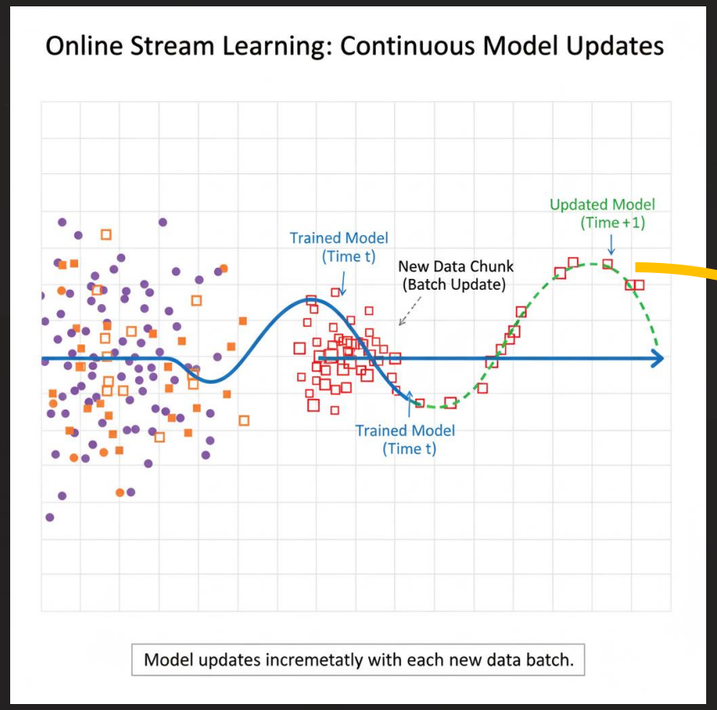
Instead of retraining from scratch, it **adjusts incrementally**.

**Online (Stream)**

(No Label) **Amount of label** Labeled)

# Types of ML

## 2: Based on training labels




**Older data**

The model was trained earlier (**"Trained Model – Time t"**).

**New data chunk arrives**

Data comes in small batches or one point at a time (stream).

**Model updates itself**

Instead of retraining from scratch, it **adjusts incrementally**.

**Updated model (Time t+1)**

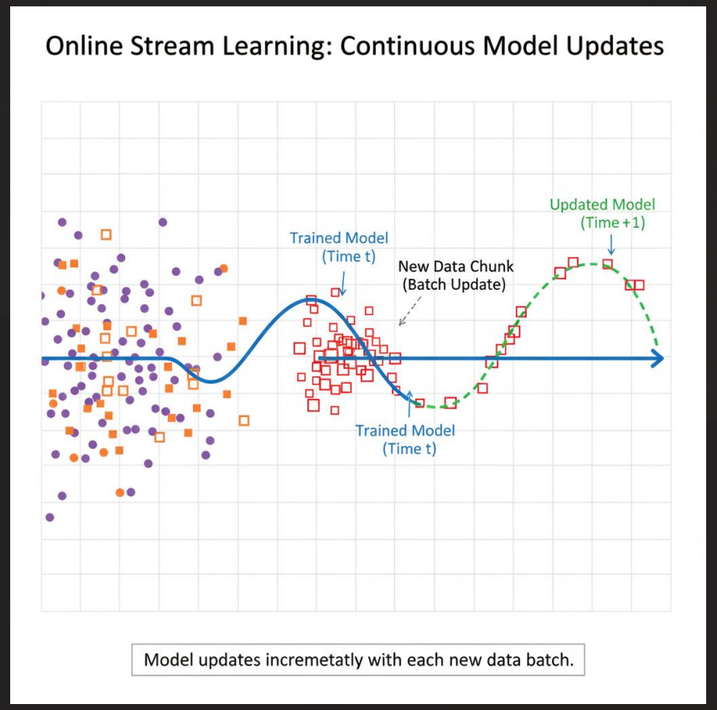
The green dashed curve shows how the model changes after seeing new data.

**Online (Stream)**

**(No Label)** **Amount of label** **Labeled)**

# Types of ML

## 2: Based on training labels




**Examples:**

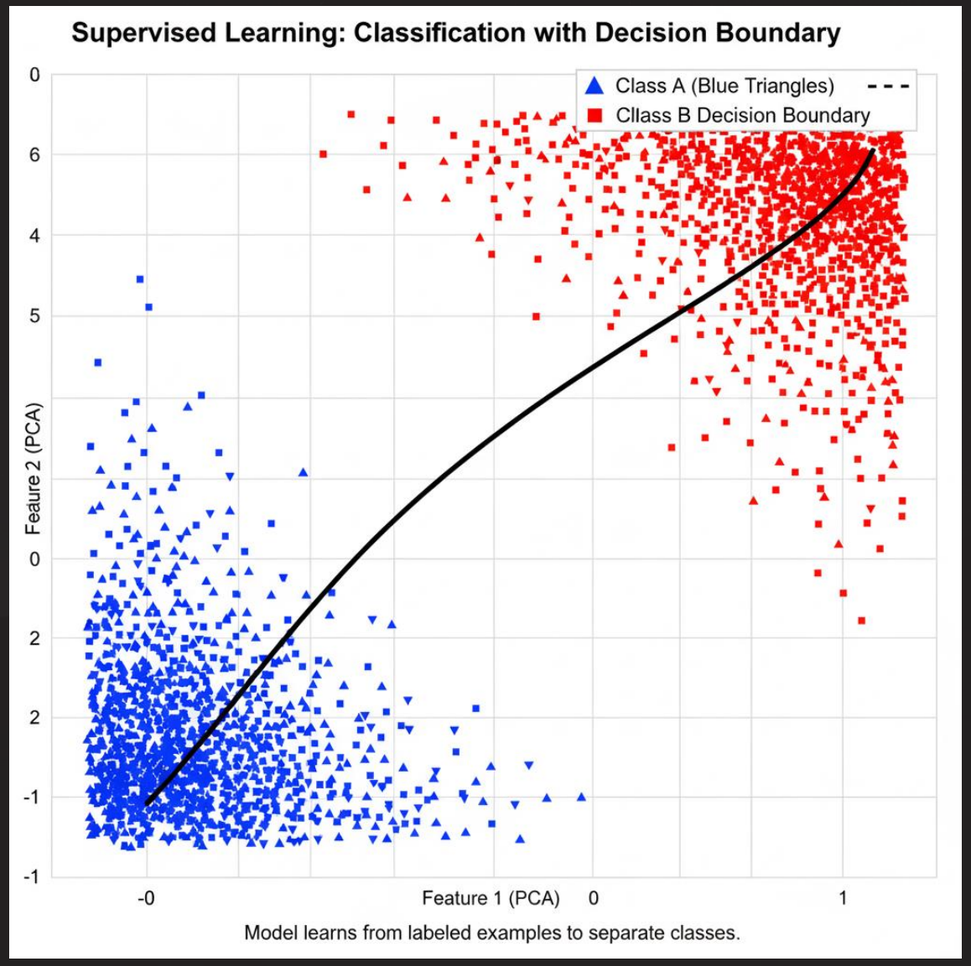
- Stock price prediction
- Recommendation systems (Netflix, Amazon)
- Fraud detection
- Sensor and IoT data
- Real-time user behavior tracking

**Online (Stream)**

**(No Label)** **Amount of label** **Labeled)**

# Types of ML

## 2: Based on training labels




**Supervised (Labeled)**

**(No Label)** **Amount of label** **Labeled)**

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