

Machine Learning: An Introduction



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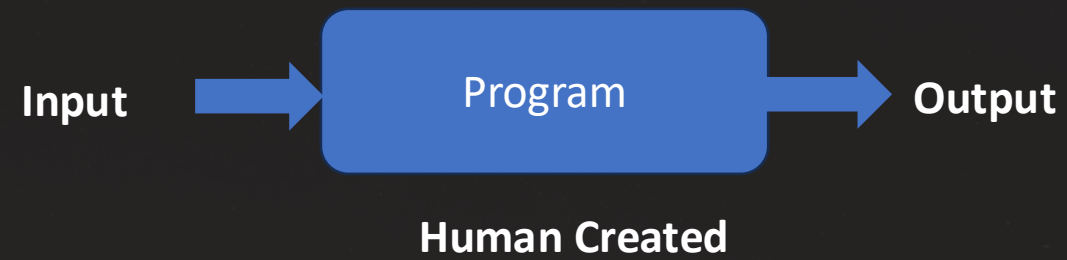
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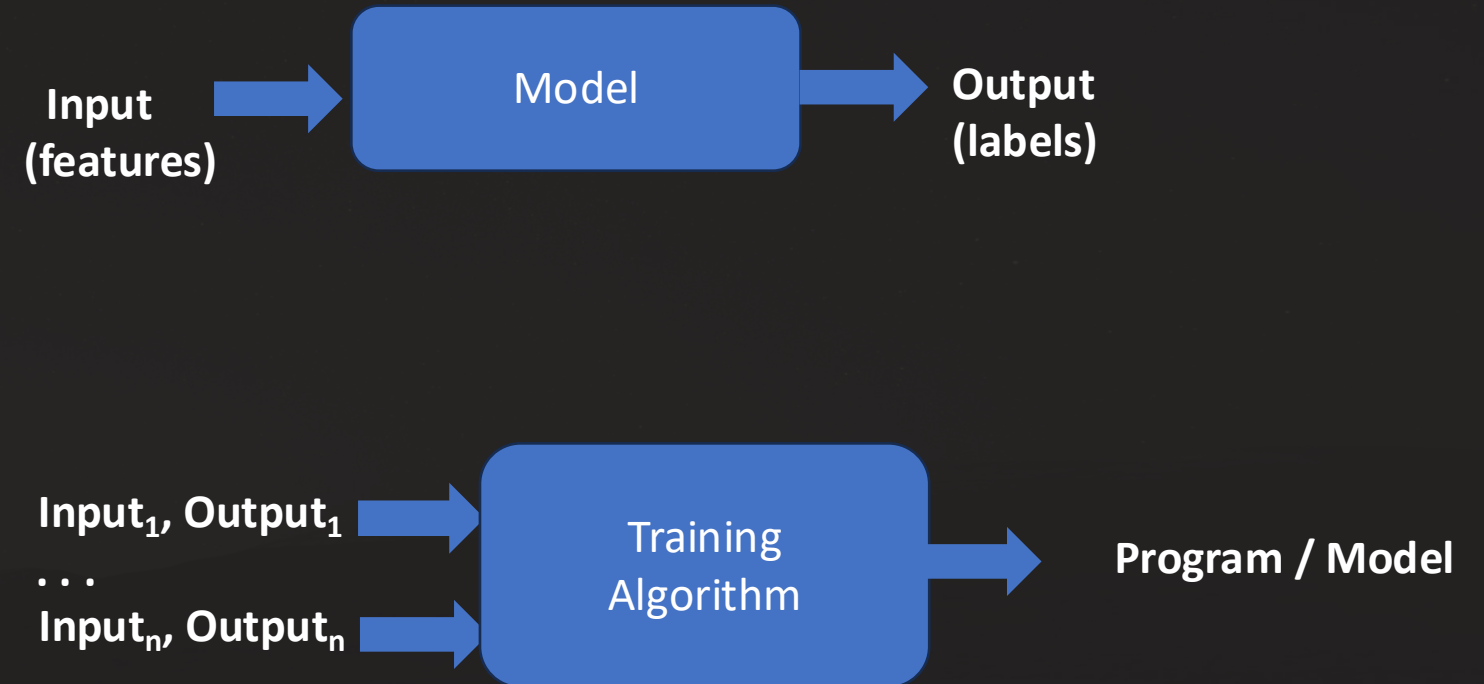


Traditional Programming

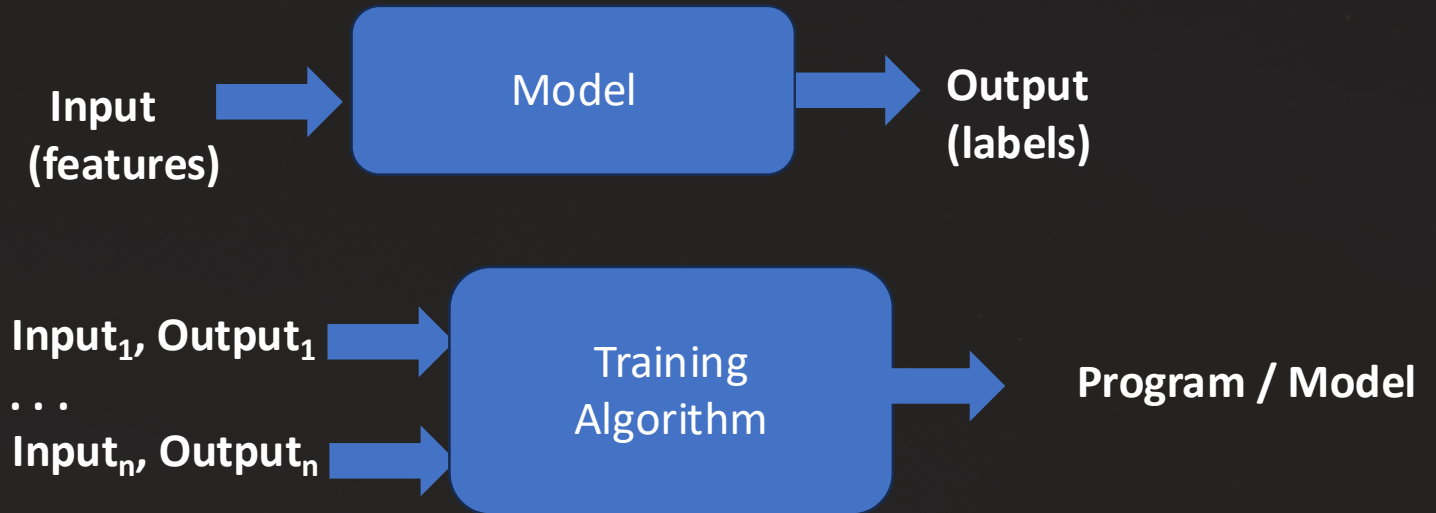





Machine Learning



Types of Machine Learning



Based on

- 
- ```
graph LR; A[] --> B[1: Labels (Output)]; A --> C[2: Amount of labeled data for training];
```
- 1: Labels (Output)**
- 2: Amount of labeled data for training**

# Types of ML

## 1: Based on Output / label

Discrete Classes  
(**Classification**)

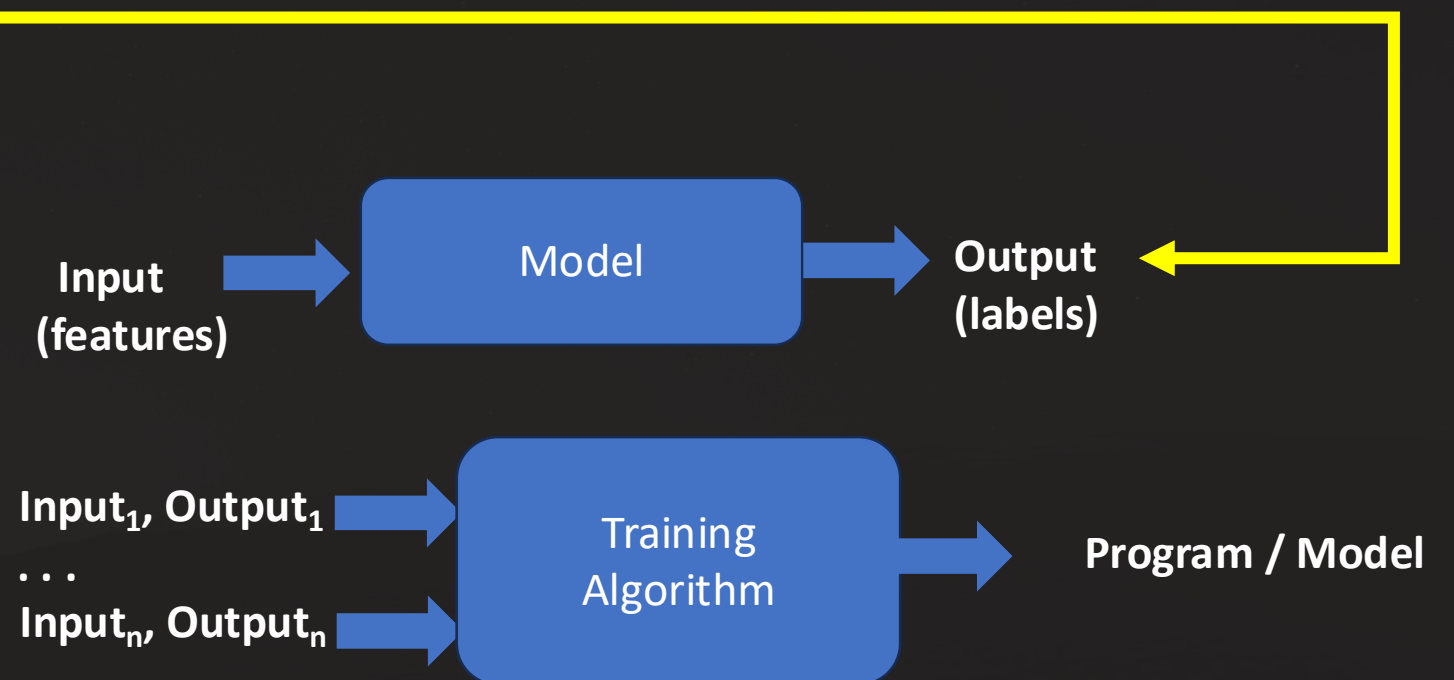
Continuous Value  
(**Regression**)

Actions  
(**Reinforcement Learning**)

Ranking among items  
(**Ranking**)

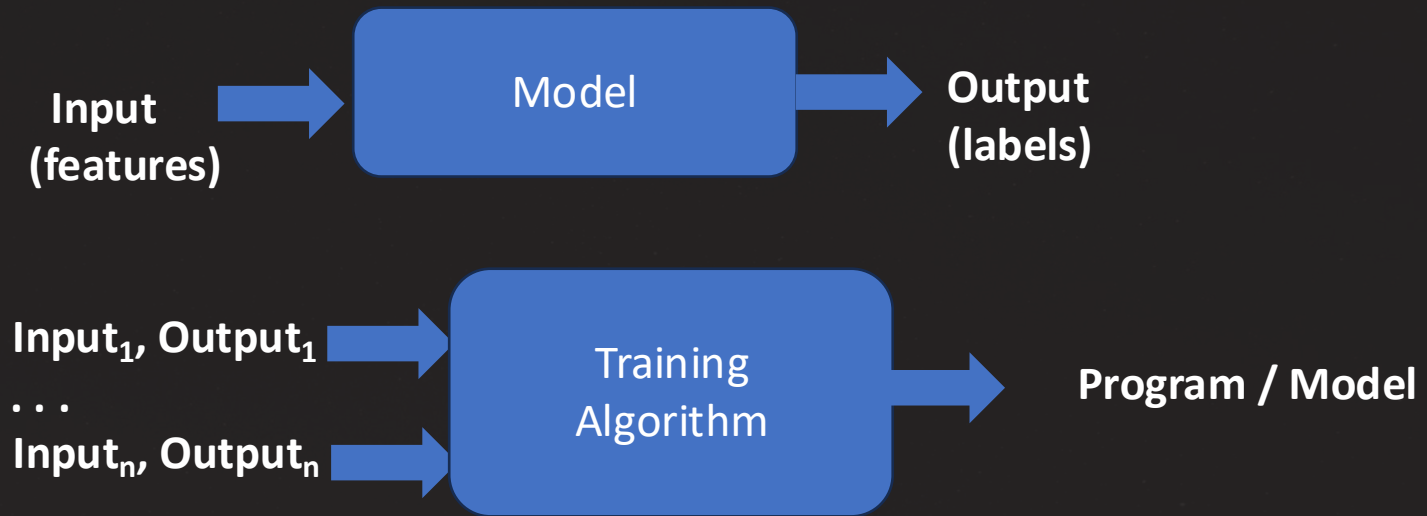
Recommendations  
(**Recommendation System**)

1: Based on Output / label



# Types of ML

## 2: Based on training labels



2: Based on training labels

Unsupervised  
(No Labels)

Semi-supervised  
(Labeled + unlabeled)

Active learning  
(gets labels iteratively)

Online  
(Stream)

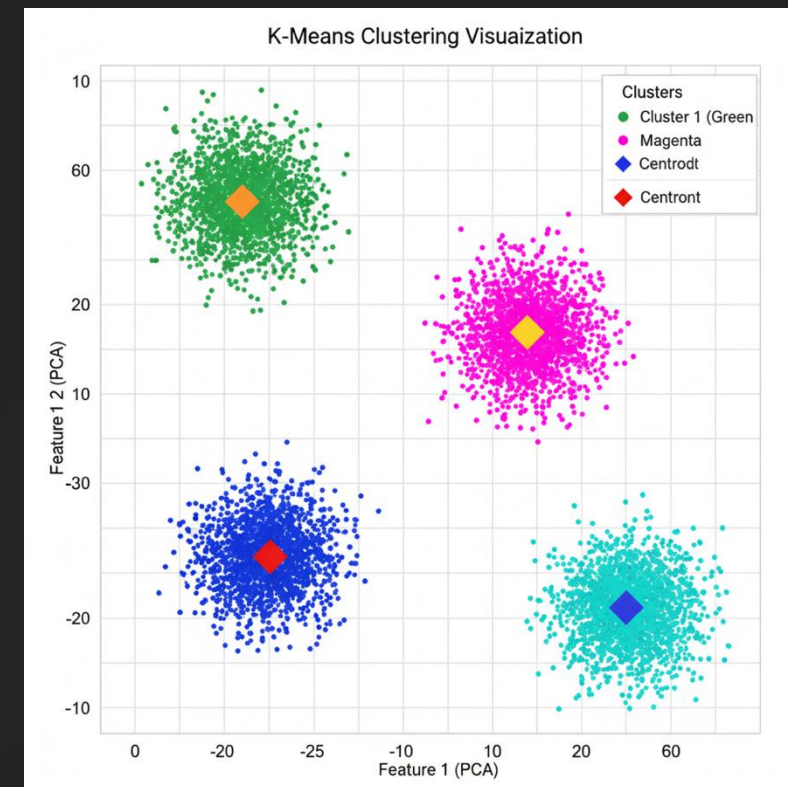
Supervised  
(Labeled)



# Types of ML

## 2: Based on training labels

Unsupervised  
(No Labels)

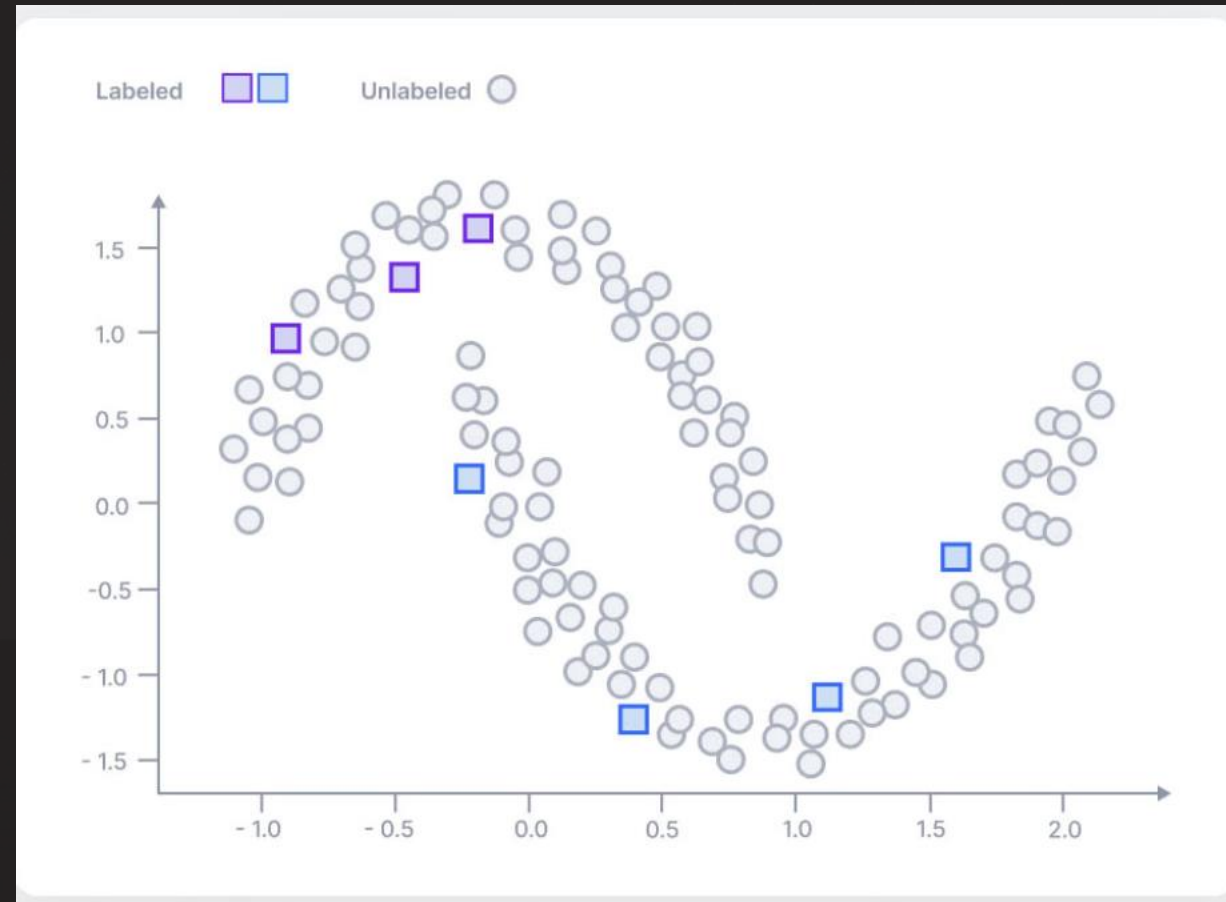




# Types of ML

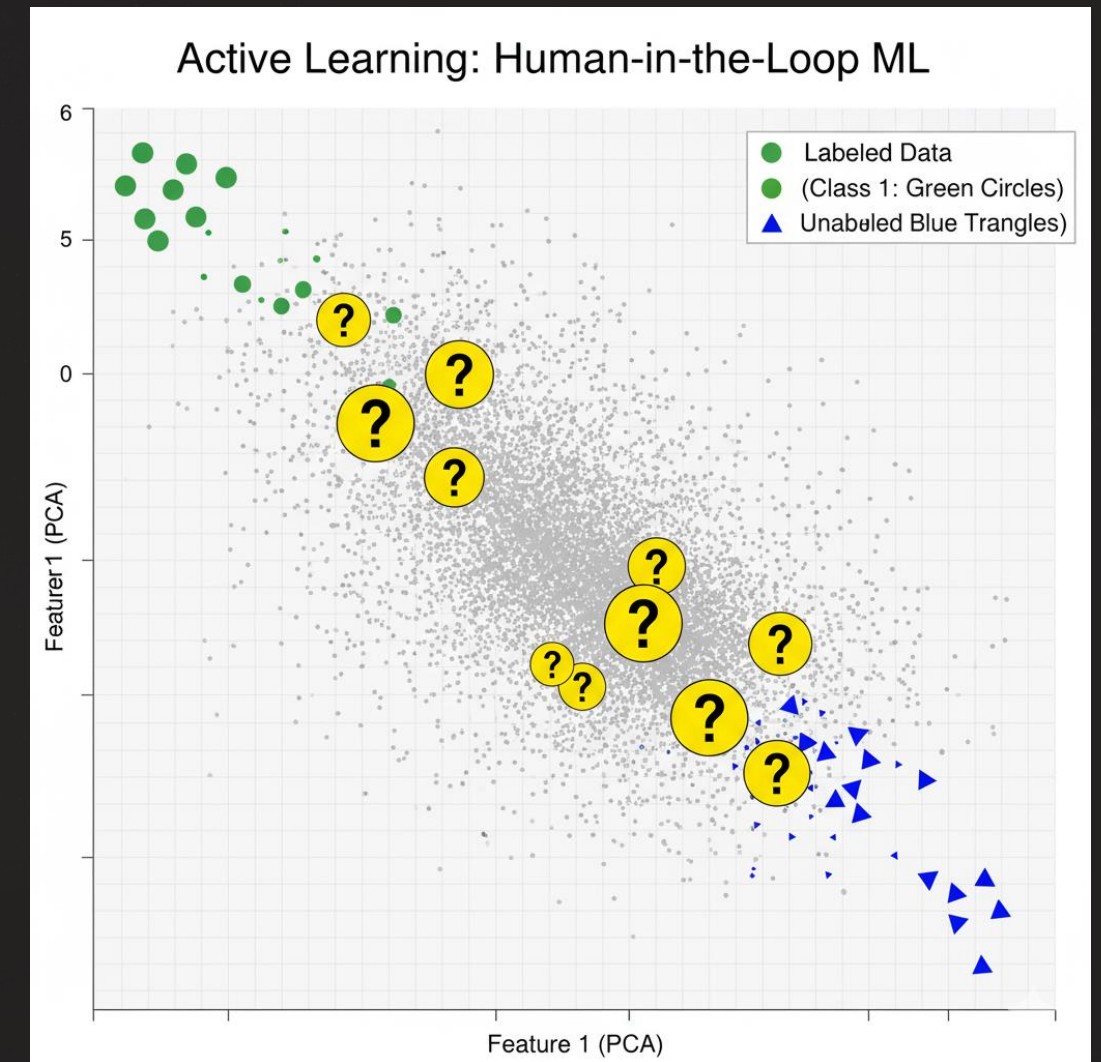
## 2: Based on training labels

Semi-supervised  
(Labeled + unlabeled)



# Types of ML

## 2: Based on training labels



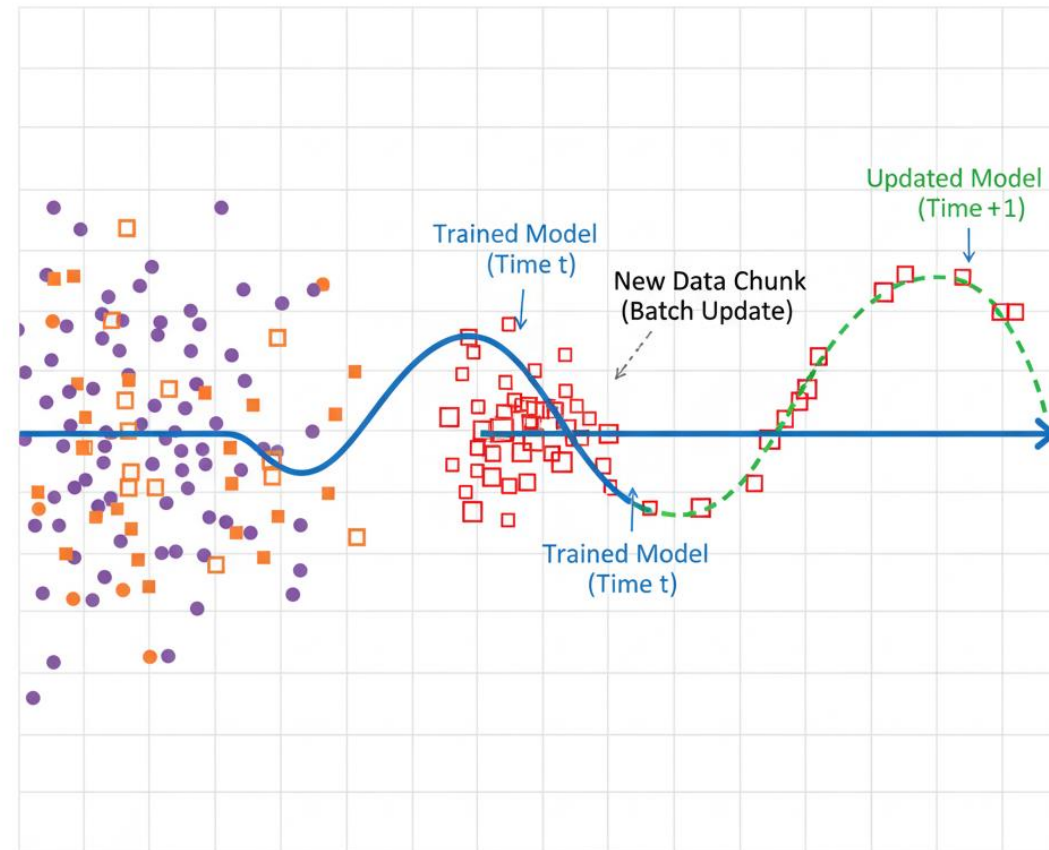
Active learning  
(gets labels iteratively)



# Types of ML

## 2: Based on training labels

### Online Stream Learning: Continuous Model Updates



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)



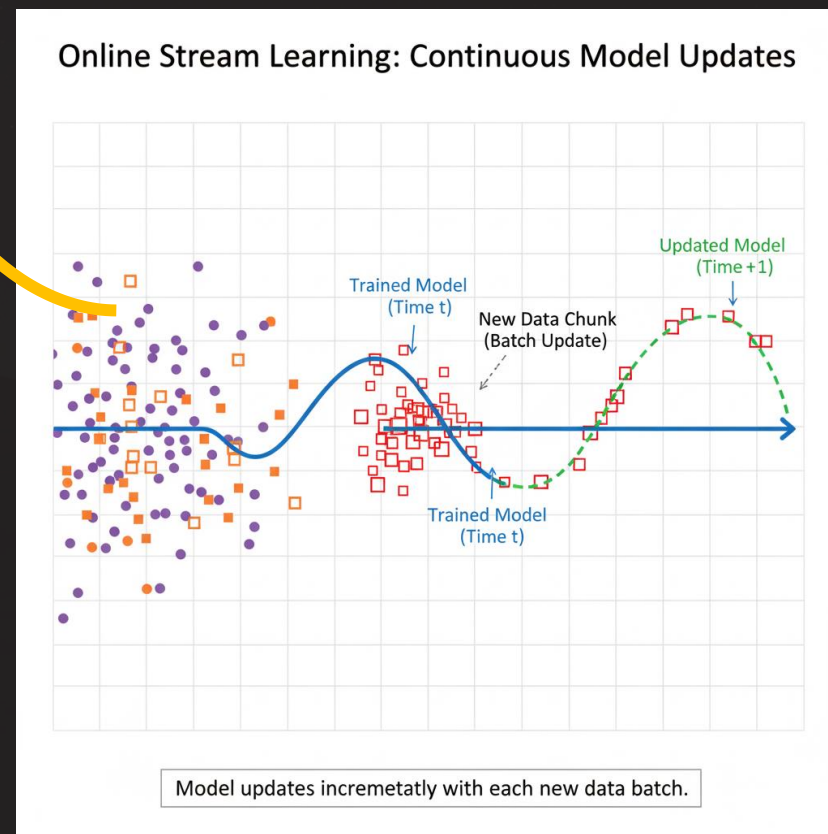


# Types of ML

## 2: Based on training labels

### Older data

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



Online  
(Stream)

(No Label)

Amount of label

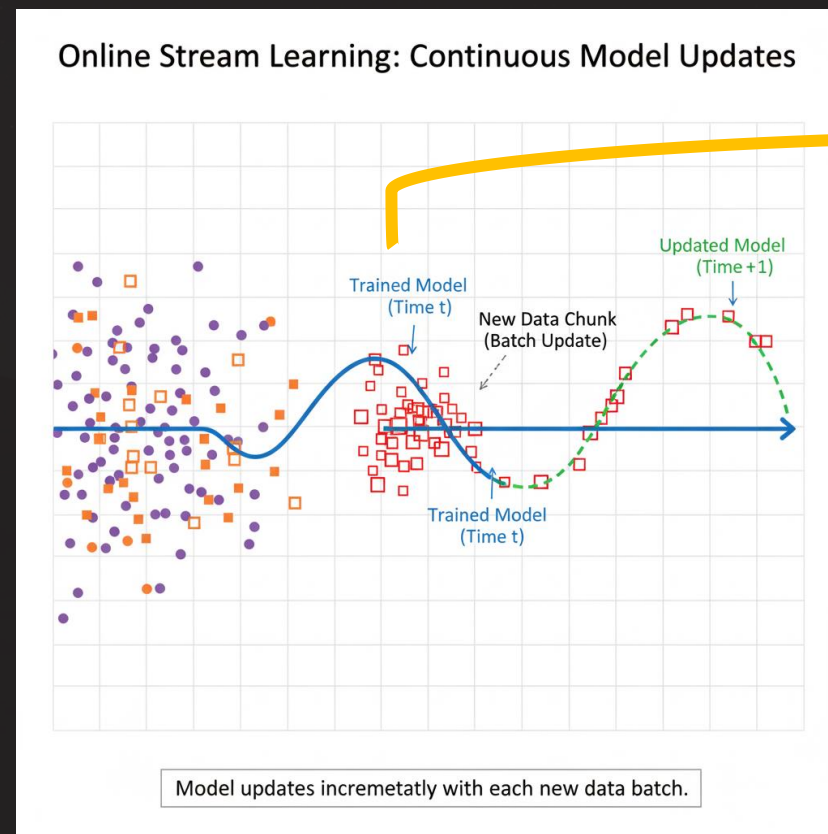
Labeled)

# Types of ML

## 2: Based on training labels

### Older data

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



### New data chunk arrives

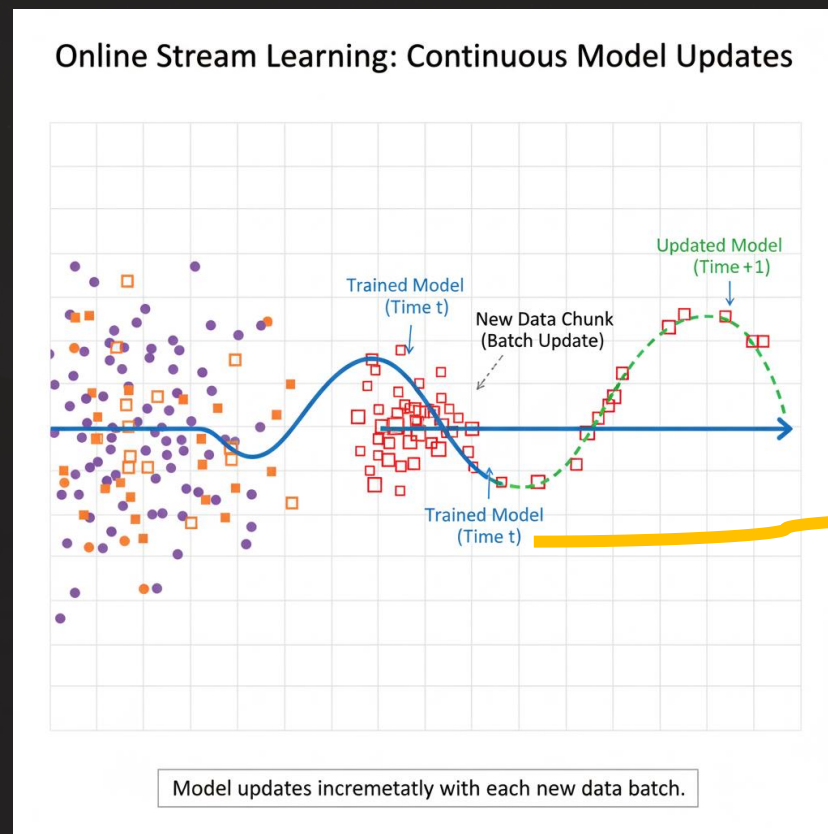
Data comes in small batches or one point at a time (stream).

Online  
(Stream)



# 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)





# Types of ML

## 2: Based on training labels

### Older data

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

### New data chunk arrives

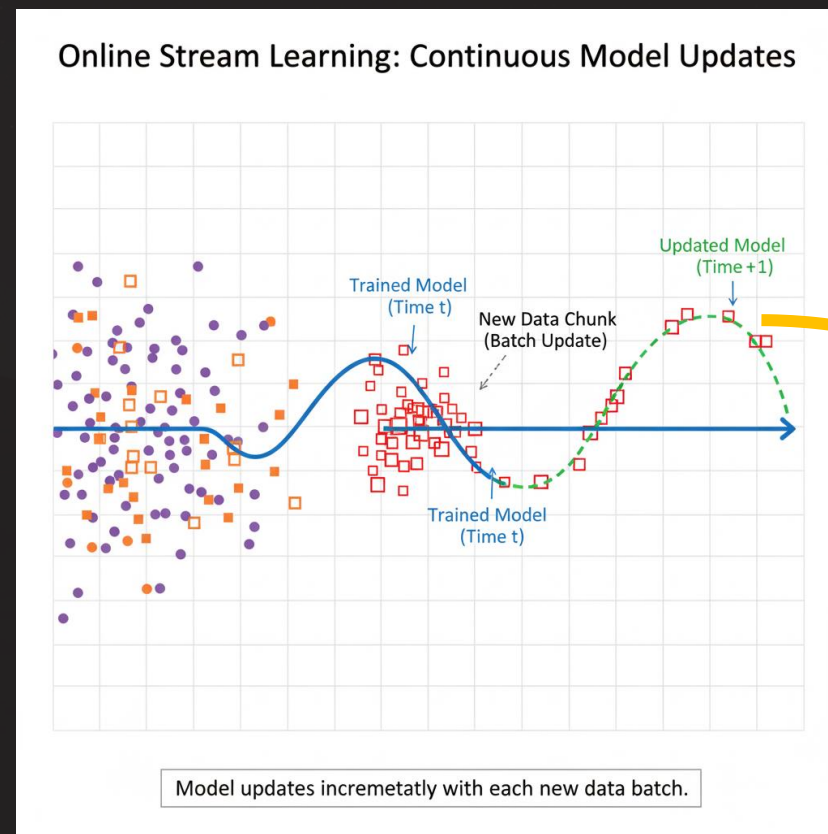
Data comes in small batches or one point at a time (stream).

### 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.



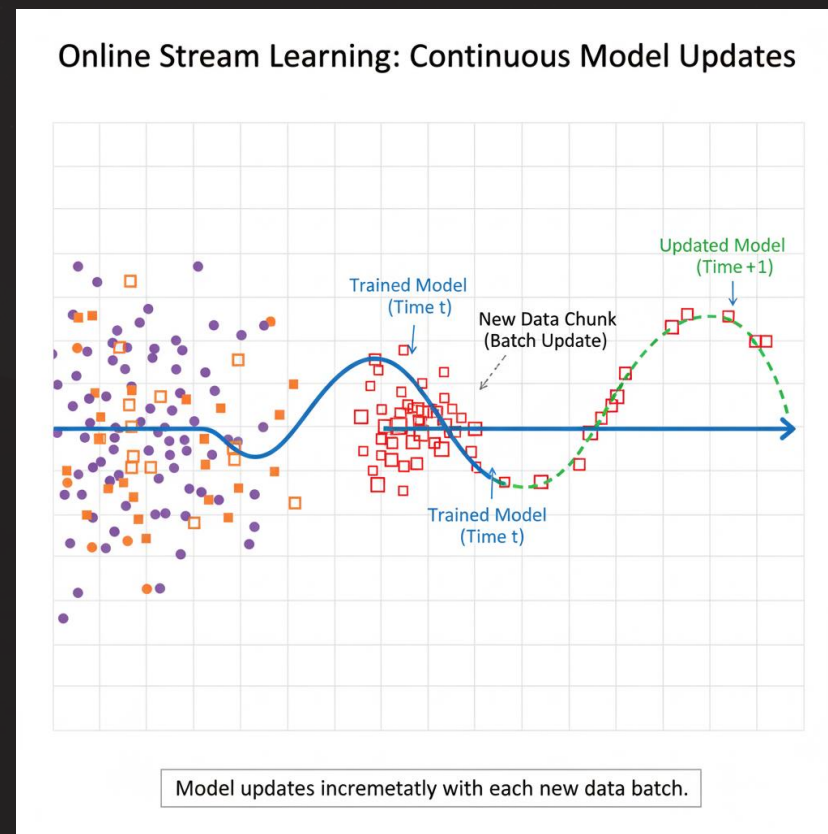
Online  
(Stream)



# Types of ML

## 2: Based on training labels

### Examples:



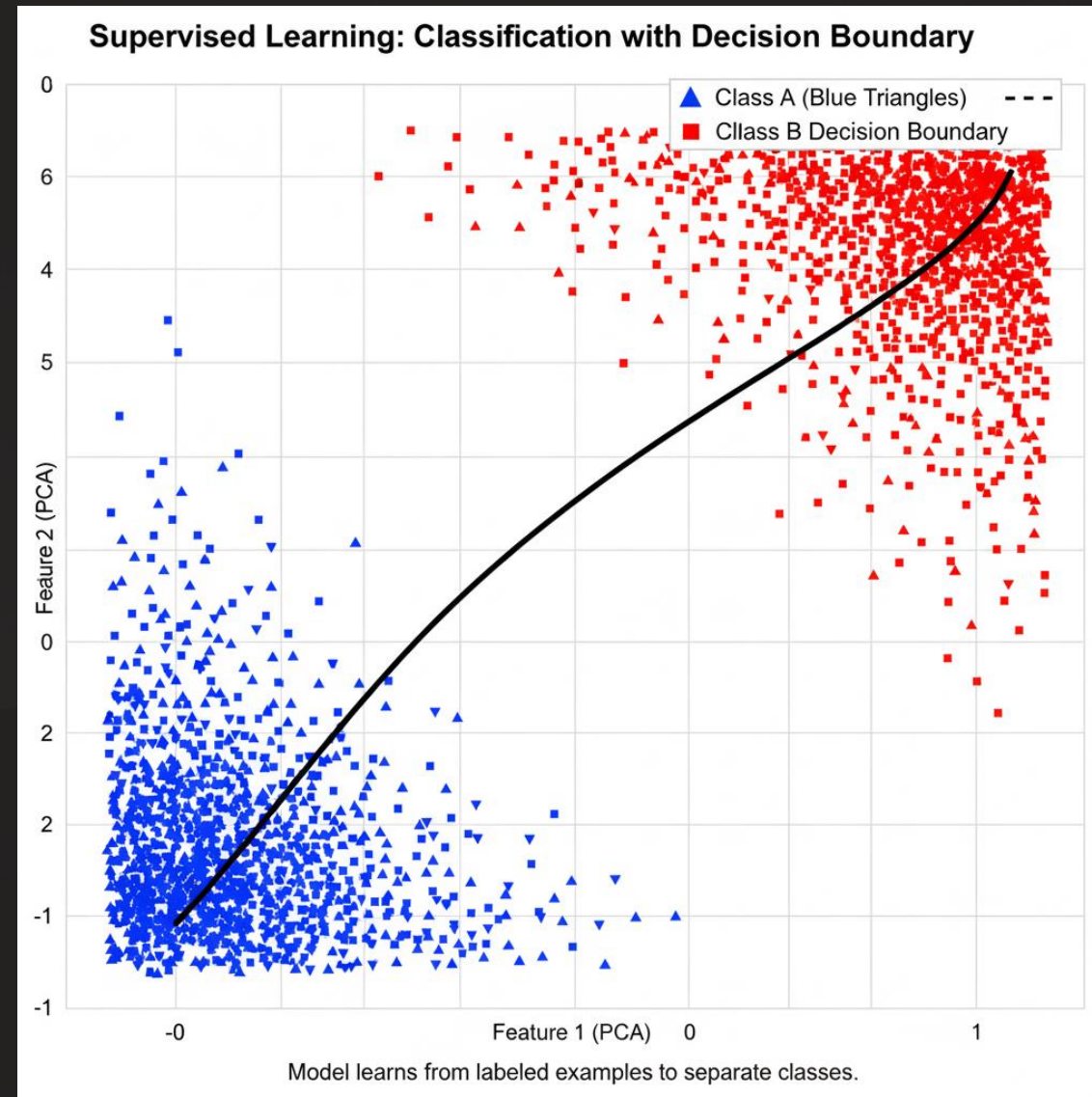
- Stock price prediction
- Recommendation systems (Netflix, Amazon)
- Fraud detection
- Sensor and IoT data
- Real-time user behavior tracking

Online  
(Stream)



# Types of ML

## 2: Based on training labels



Supervised  
(Labeled)

Labeled)

(No Label)

Amount of label



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