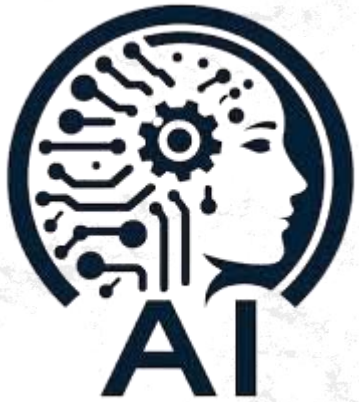


Overview of Python as an Artificial Intelligence (AI/ML) language

NIELIT Chandigarh/Ropar

Introduction to Python

- Python is a popular programming language. It was created by Guido van Rossum, and released in 1991.
- Python is a versatile and beginner-friendly programming language that has gained immense popularity in Data Science and Machine Learning due to its simplicity and a rich ecosystem of libraries.

It is used for:

Data Science and AIML

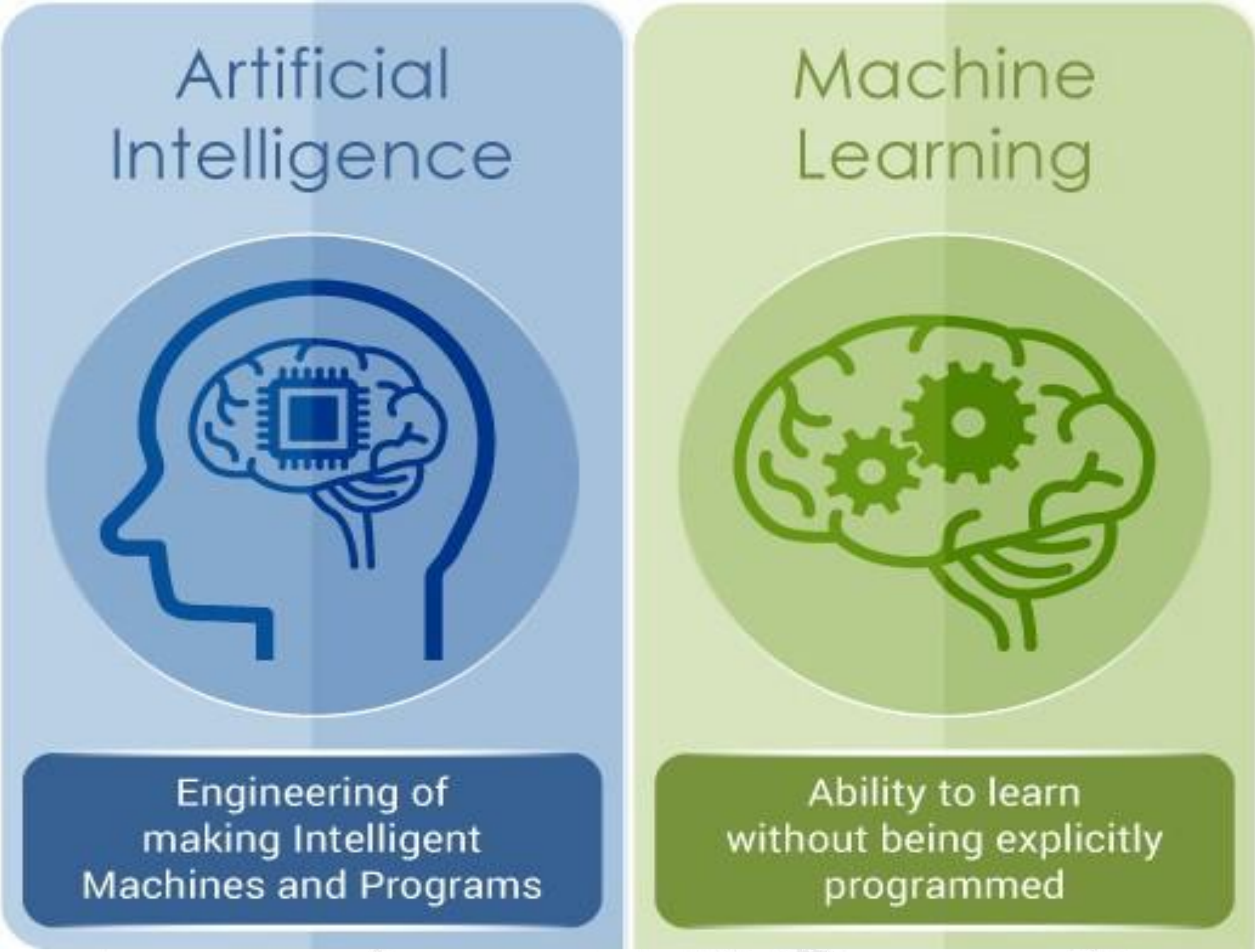
Web development (server-side),

Software development,

Mathematics,

System scripting.

OVERVIEW OF PYTHON AS AN AI/ML LANGUAGE



OVERVIEW OF PYTHON AS AN AI/ML LANGUAGE

AI- artificial intelligence:

1. It is the science of training machines to perform human tasks
2. The term was invented in the 1950s when scientists began exploring how computers could solve problems on their own.
3. AI is a computer that is given human-like properties. Like our brain which works effortlessly and seamlessly to calculate the world around us.
4. Artificial Intelligence is the concept that a computer can do the same.
5. It can be said that AI is the large science that mimics human aptitudes.

Machine learning:

1. It is a subset of AI that trains a machine how to learn
2. It is the art of study of algorithms that learn from examples and experiences.
3. Machine learning is based on the idea that there exist some patterns in the data which are to be identified and used for future predictions.
4. The machine does not need to be explicitly programmed by people. The programmers give some examples, and the computer is going to learn what to do from those samples.
5. The difference from hardcoding rules is that the machine learns on its own to find such rules.

OVERVIEW OF PYTHON AS AN AI/ML LANGUAGE

Why Python is Preferred for AI/ML?

Python has become the go-to programming language for **artificial intelligence** (AI) development due to its **simplicity** and the **powerful suite of libraries** it offers

Its **syntax is straightforward** and closely **resembles human language**, which reduces the learning curve for developers and enables them to focus on solving AI problems rather than wrestling with complex coding issues .Python is highly favored for AI and machine learning (ML) development for several compelling reasons that make it uniquely suitable for these technologies:

1). **Extensive Libraries and Frameworks**: Python boasts a wide range of libraries and frameworks, such as Scikit-learn for machine learning algorithms, TensorFlow, PyTorch, and Keras for deep learning, as well as NumPy, Pandas, and Seaborn for data manipulation and visualization. These libraries simplify coding tasks and reduce development time by providing pre-written code for common tasks.

OVERVIEW OF PYTHON AS AN AI/ML LANGUAGE

2). **Ease of Learning and Syntax Simplicity**: Python's syntax is straightforward, resembling everyday English, which significantly lowers the learning curve and enables developers to implement complex AI algorithms efficiently.
The simplicity of Python syntax, which avoids brackets and emphasizes indentation, contributes to its ease of use and readability, making code less prone to errors and more maintainable .

3**). No Need to Recompile Source Code**: Python allows for dynamic modification and execution of code without the need for recompilation, offering flexibility and speeding up the development process. This feature is particularly advantageous in AI and ML projects, where iterative testing and tweaking are common.

OVERVIEW OF PYTHON AS AN AI/ML LANGUAGE

4). **Platform Independence**: Python code can run on various operating systems, including Windows, Mac, UNIX, and Linux, without requiring any modifications, making it highly versatile for development across different platforms .

5). **Strong Community Support**: Python's large and active community contributes to a wealth of resources, including tutorials, forums, and documentation, which are invaluable for developers' encountering challenges or seeking to enhance their knowledge and skills in AI and ML.

OVERVIEW OF PYTHON AS AN AI/ML LANGUAGE

Artificial Intelligence (AI) is a discipline that focuses on creating intelligent machines that can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and natural language processing. It involves the development of algorithms and systems that can reason, learn, and make decisions based on input data.

Essential Python Libraries for AI/ML

For anyone diving into Artificial Intelligence (AI) using Python, a handful of libraries make the development process significantly smoother and more efficient. These libraries, equipped with pre-built functions and tools, are essentials in the AI developer's toolkit:

NumPy: Fundamental for scientific computing in Python, NumPy offers comprehensive mathematical functions, random number generators, linear algebra routines, Fourier transforms, and more. It's particularly useful for handling large, multi-dimensional arrays and matrices, which are prevalent in AI tasks.

Pandas: A library offering high-level data structures and tools designed to make data analysis fast and easy in Python. Pandas are ideal for data munging and preparation and can be used in conjunction with other data analysis workflows in Python.

OVERVIEW OF PYTHON AS AN AI/ML LANGUAGE

Matplotlib: This plotting library allows for the creation of static, animated, and interactive visualizations in Python. Visual data representation is crucial in AI for data exploration and the presentation of results.

TensorFlow: An open-source library developed by the Google Brain team, TensorFlow is used for numerical computation using data flow graphs. It's particularly known for its applications in deep learning and neural networks.

PyTorch: Developed by Facebook's AI Research lab, PyTorch is a library for machine learning that provides great flexibility and speed while working with deep learning projects. It's known for its ease of use and efficiency in creating complex AI models.

Machine Learning Introduction

NIELIT CHANDIGARH

Agenda

- Introduction ,History
- Why ML is Important (ExamplesWeather Forcast,Face Recogination,Attendence sys)
- ML vs Traditional Programing
- How does Machine Learning Works
- What is Data , Dataset , Pattern making , Prediction
- Activity
- Types Of ML(Supervised and Unsupervused)
- Linear Regression Working
- Supervised Vs Unsupervused
- Activity :Diabetes Prediction

Introduction

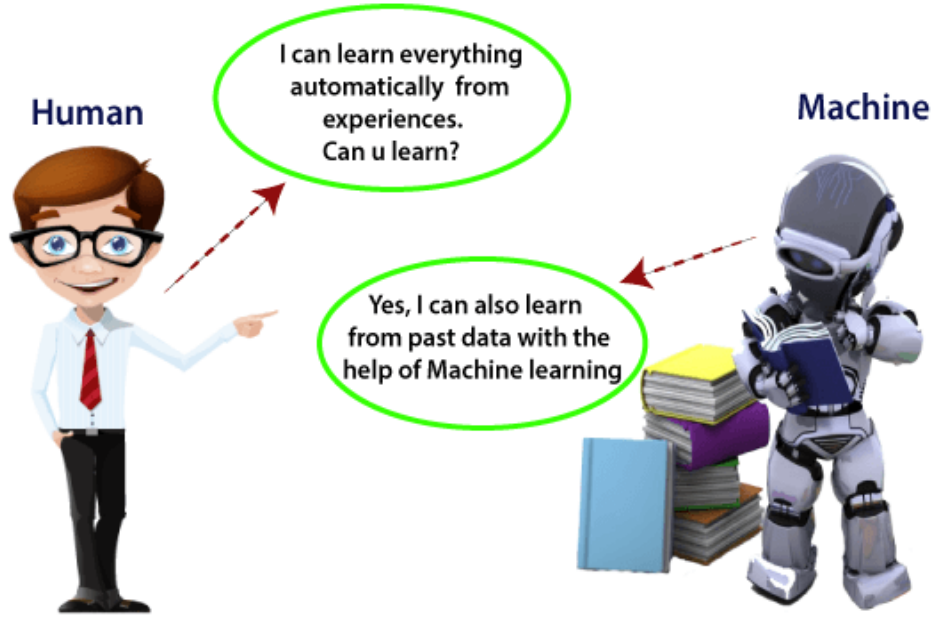
Machine Learning is when computers learn to do things on their own without being told exactly what to do every time.

Example :

Think of it like teaching your friend how to play a game—once they understand the rules, they get better with practice.

Introduction

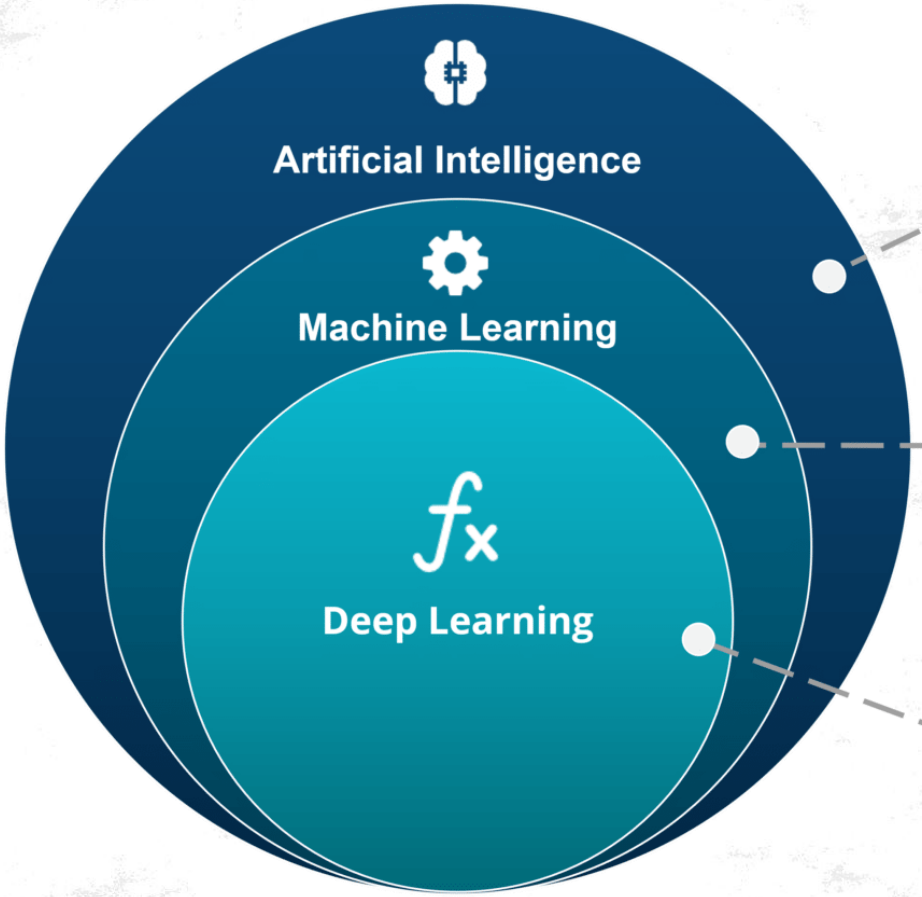
- In the real world, we are surrounded by humans who can learn everything from their experiences with their learning capability, and we have computers or machines which work on our instructions.



So here comes the role of

Machine Learning.

Introduction



ARTIFICIAL INTELLIGENCE
A technique which enables machines to mimic human behaviour

MACHINE LEARNING
Subset of AI technique which use statistical methods to enable machines to improve with experience

DEEP LEARNING
Subset of ML which make the computation of multi-layer neural network feasible

Example

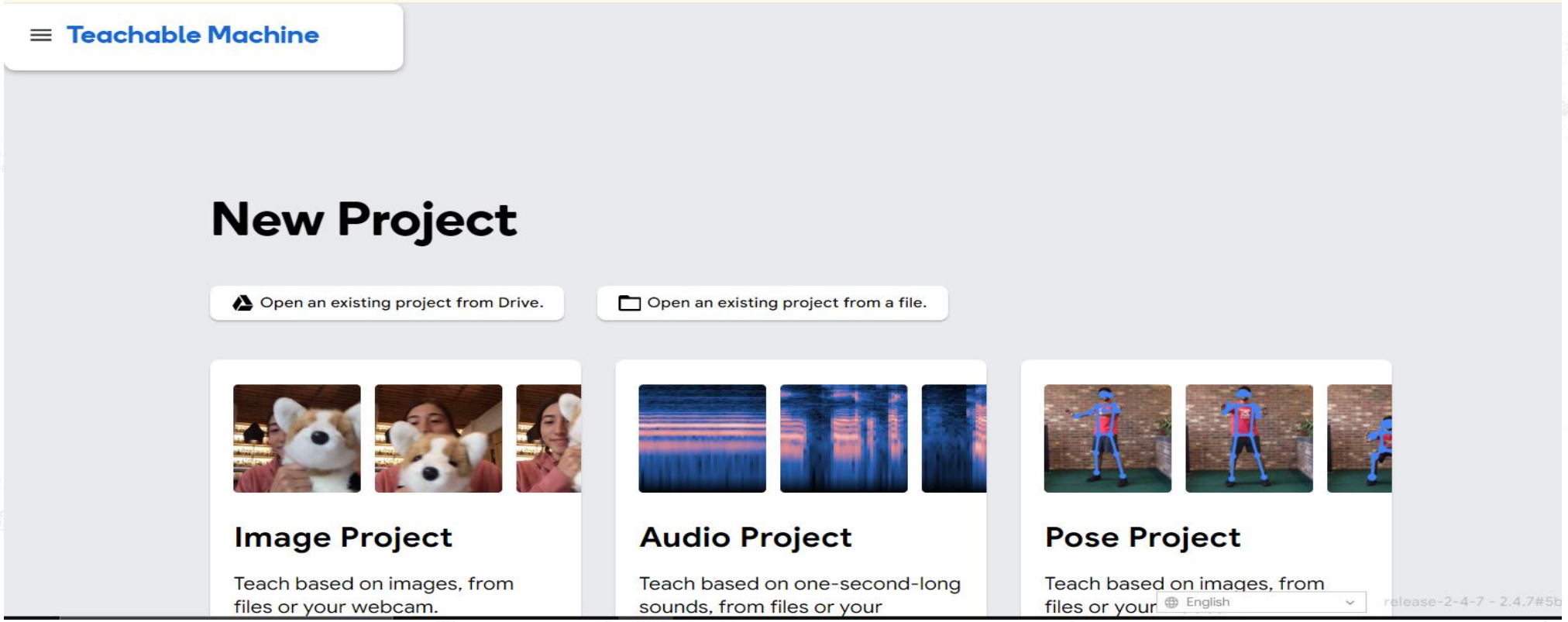
Imagine you are training your pet dog.

- If you say "sit" and give the dog a treat every time it sits, the dog learns that sitting gets a reward.
- Over time, the dog learns to sit whenever you say "sit," even if you don’t give a treat.

In the same way, computers use data (the treats) to learn patterns and make decisions.

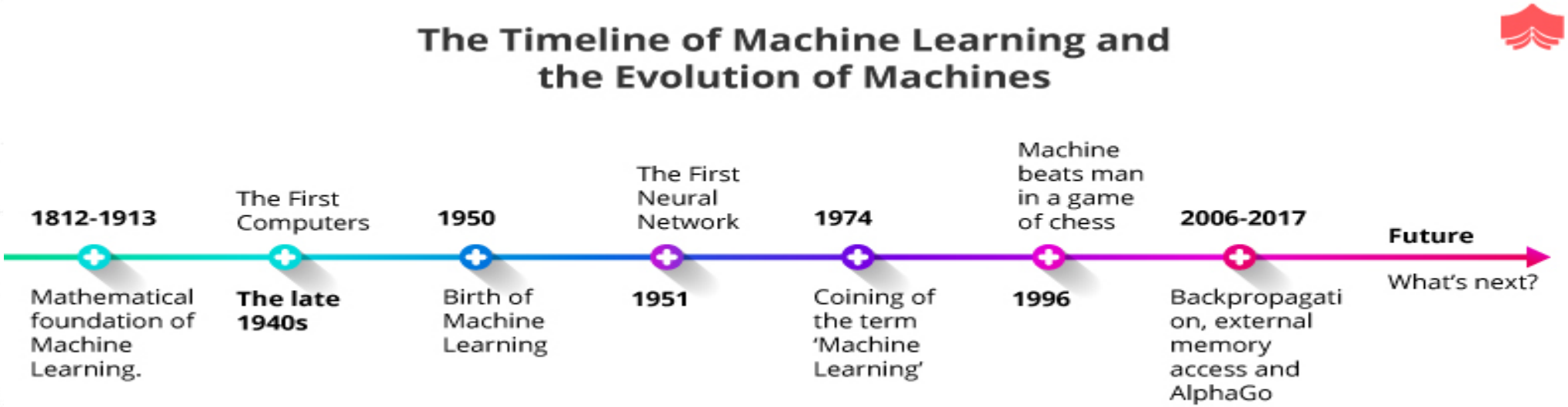
Example of Machine Learning

- Google's **Teachable Machine**
  https://teachablemachine.withgoogle.com/train



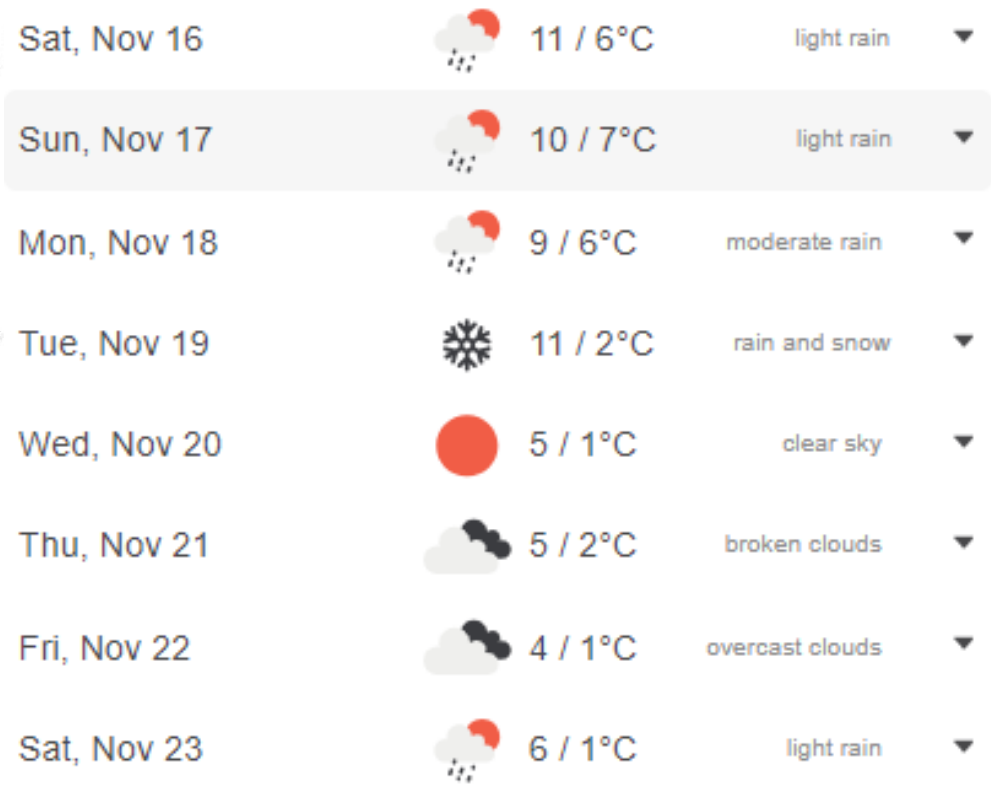
History

- Before some years (about 40-50 years), machine learning was science fiction, but today it is the part of our daily life. Machine learning is making our day-to-day life easy from **self-driving cars** to **Amazon virtual assistant "Alexa"**.



Why is Machine Learning Important?

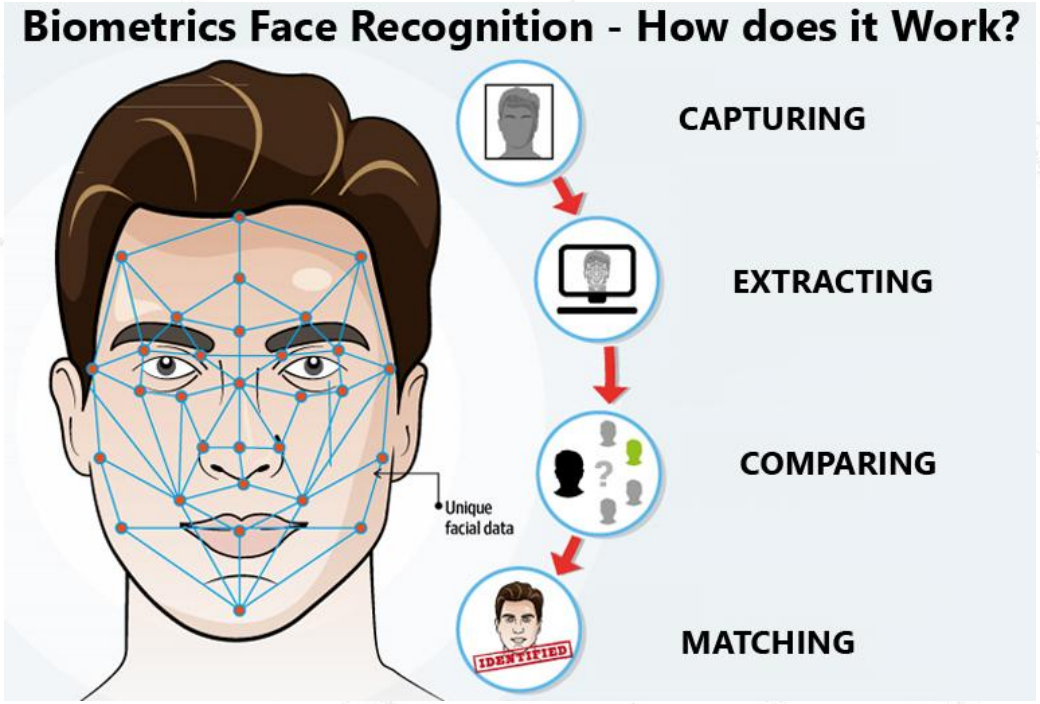
1. **Predicting Things (e.g., Weather Forecasts)**
   - We check the weather every day to decide what to wear or carry (like an umbrella).
   - Machine Learning helps us know what might happen in the future by looking at past data.
   - This helps us plan our day better!



Why is Machine Learning Important?

Recognizing Faces or Voices (e.g., Unlocking Your Phone)

- Your phone "learns" how your face looks by studying pictures of it.
- When you try to unlock the phone, it matches your face to what it has learned.
- If the match is correct, the phone unlocks.

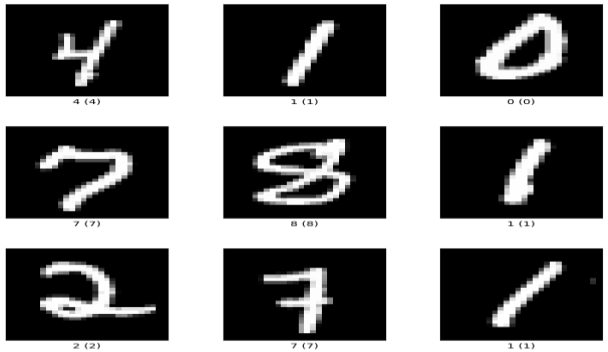


Example of Machine Learning Task: Recognizing Handwriting

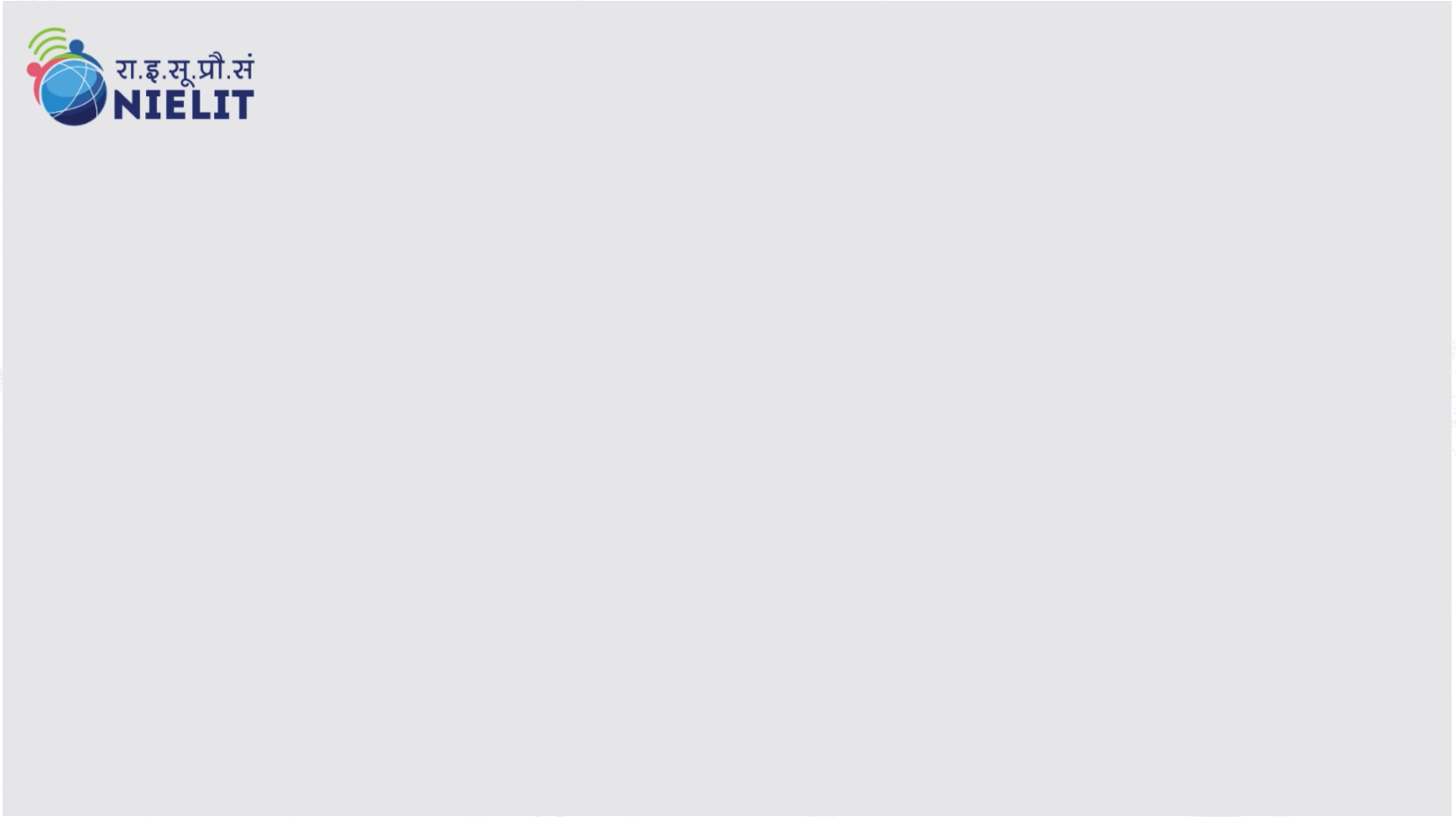
- **Task (T):** The computer's job is to recognize and classify handwritten words in pictures.
  Example: It looks at an image and says, “This is the word *Hello*.”
- **Performance Measure (P):**
  We check how well the computer did its job. For handwriting, this means checking the **percentage of words it got correct**.
  If it recognizes 9 out of 10 words correctly, its performance is 90%.
- **Training Experience (E):**
  The computer learns by practicing with a **database of handwritten words** (lots of examples).
  It sees different handwriting styles and learns to recognize them.

Activity

https://www.ccom.ucsd.edu/~cdeotte/programs/MNIST.html



Face Attendence System



Machine Learning vs. Traditional Programming

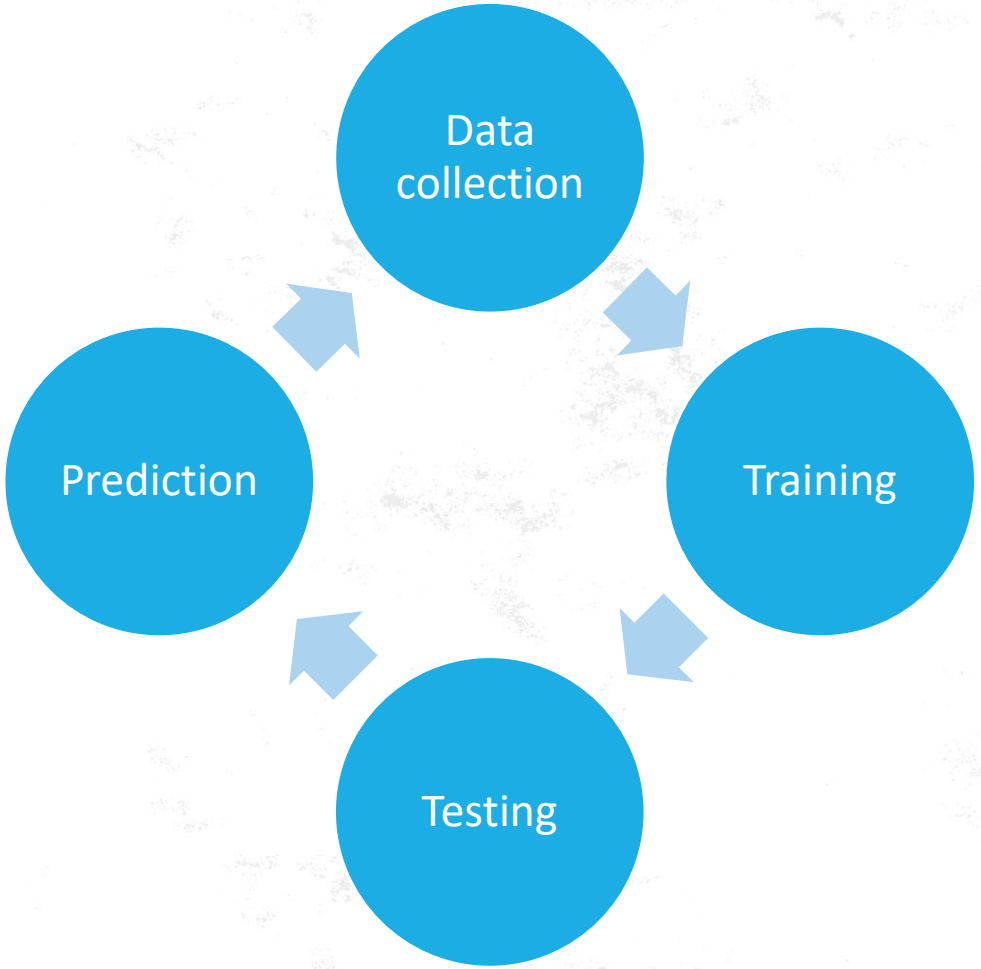
Traditional Programming

- **Rules-Based**: Relies on explicit instructions written by programmers.
- **Logic Driven**: Follows predefined logic and algorithms.
- **Input & Rules → Output**: Given input and a set of rules, produces a fixed output.

Machine Learning

- **Data-Driven**: Learns patterns from large data sets.
- **Model Training**: Requires training data to "learn" how to make predictions.
- **Input & Output** → Rules: Uses input-output pairs to infer rules (model).

How does Machine Learning work?



What is Data ?

- Data is information used by ML to learn.

Example

- Imagine you want to teach a computer to recognize fruits.
- You give it pictures of apples, bananas, and oranges (this is the **data**).
- Each picture is labeled so the computer knows which one is an apple, banana, or orange.
- The computer studies these pictures to learn the differences between the fruits, like their shape and color.

Example of Dataset

Name	English Marks	Favourite Colour	Sports
Aditi	85	Blue	Football
Raj	78	Green	Cricket
Simran	92	Red	Badminton
Aarav	60	Blue	Cricket
Pooja	70	Yellow	Football
Kabir	88	Red	Badminton

Patterns In Dataset

- Finding Patterns in Marks
  Who scored the highest marks in English?
- Finding Patterns in Favourite Colour
  Which colour is most popular? Which sport is played by the most students?
- Finding Patterns in Sports
- Deeper Patterns
  Can you spot any connection between favourite colour and sports?

Name	Favourite Color	Sports
Simran	Red	Badminton
Kabir	Red	Badminton

Activity No.1

- 1. **Do you notice any connections between English marks and sports?**

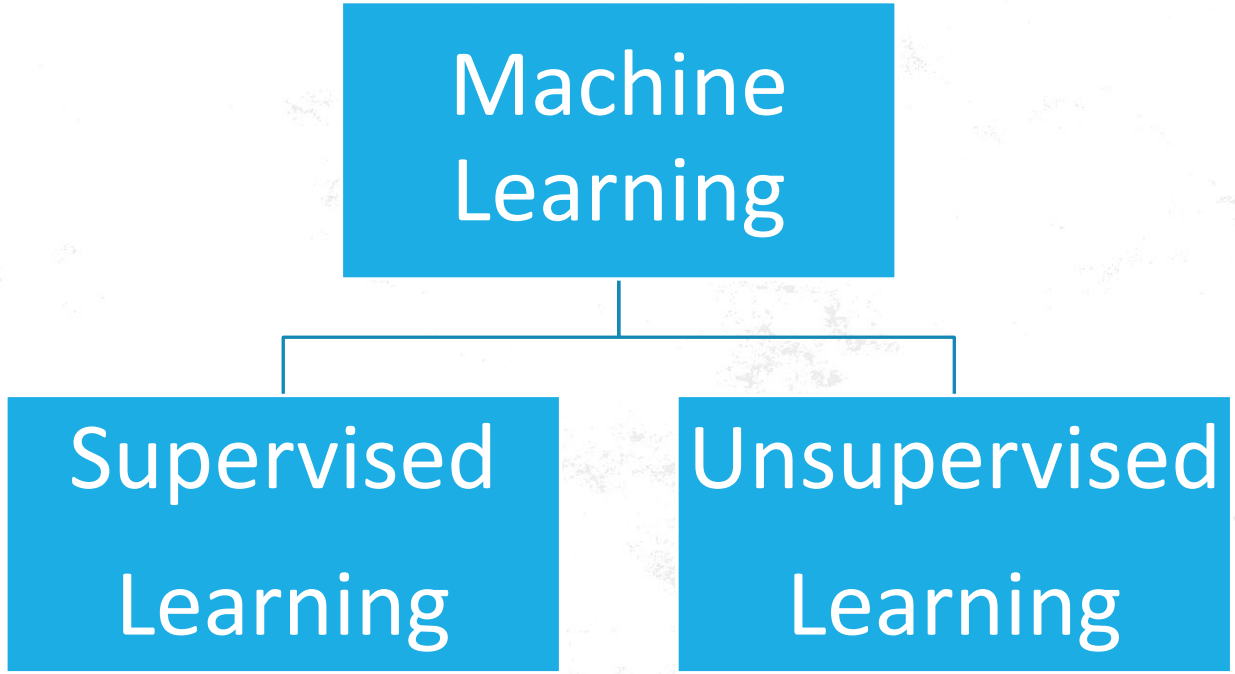
  Observation:

  1. Students with higher marks (above 85, like Simran and Kabir) are associated with Badminton.
  2. Students with moderate marks (70-85, like Aditi, Raj, and Pooja) are associated with Football and Cricket.
  3. Students with lower marks (like Aarav) tend to play Cricket.

Activity No.2

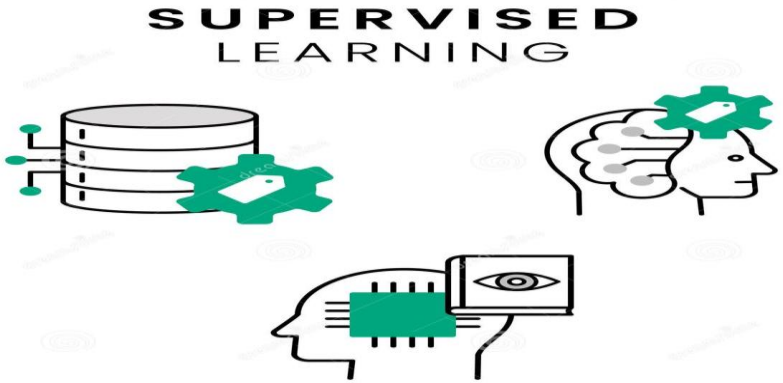
- Can you predict what sport or favourite colour a new student might like based on the existing data?
  - A student scores greater than 85 in English and their favourite colour is **Red**.
    → Likely sport: **Badminton**.

Classification of Machine Learning



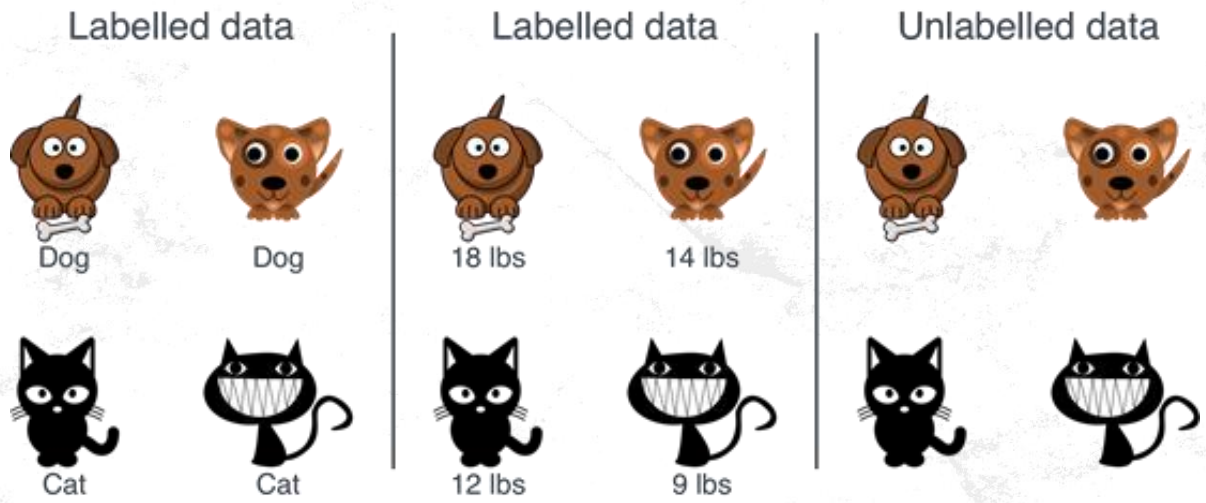
Supervised learning

- Supervised machine learning learns patterns and relationships between input and output data. It is defined by its use of labeled data.
- The training process continues until the model achieves a desired level of accuracy on the training data. once this model is determined, it can be used to apply labels to new, unknown data



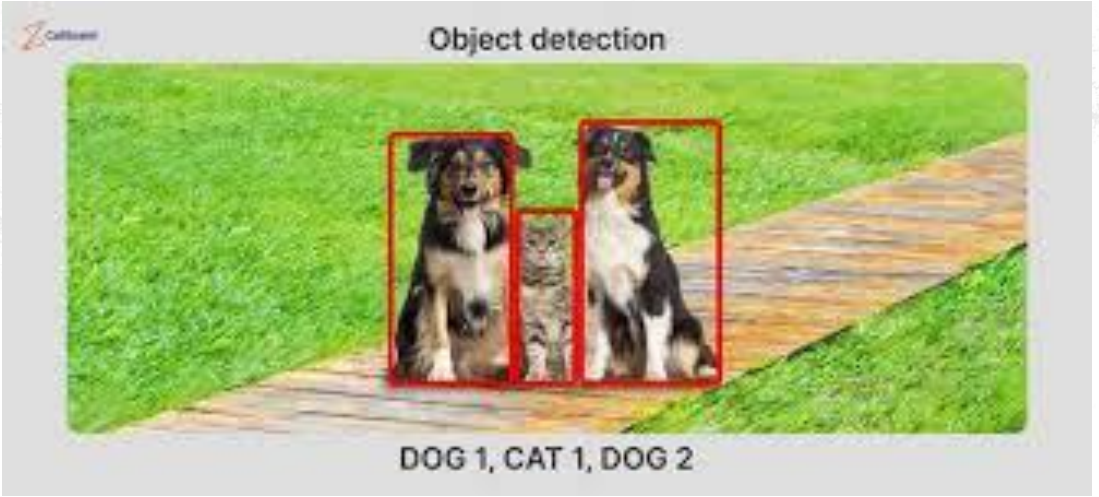
Supervised learning

- **Labeled Data :**Labeled data is data that has both inputs and correct answers. For example, an image labeled "cat" or "dog" tells a model what the picture shows. The labels help the model learn to make accurate predictions.



Supervised Learning

- **You give the computer a lot of examples where you also tell it the correct answer.**
  - **Show a picture of a dog and label it “Dog.”**
  - **Show a picture of a cat and label it “Cat.”**
- **Training the Model:**
  - The computer tries to find patterns in the examples.
  - It keeps practicing until it gets the answers mostly correct.

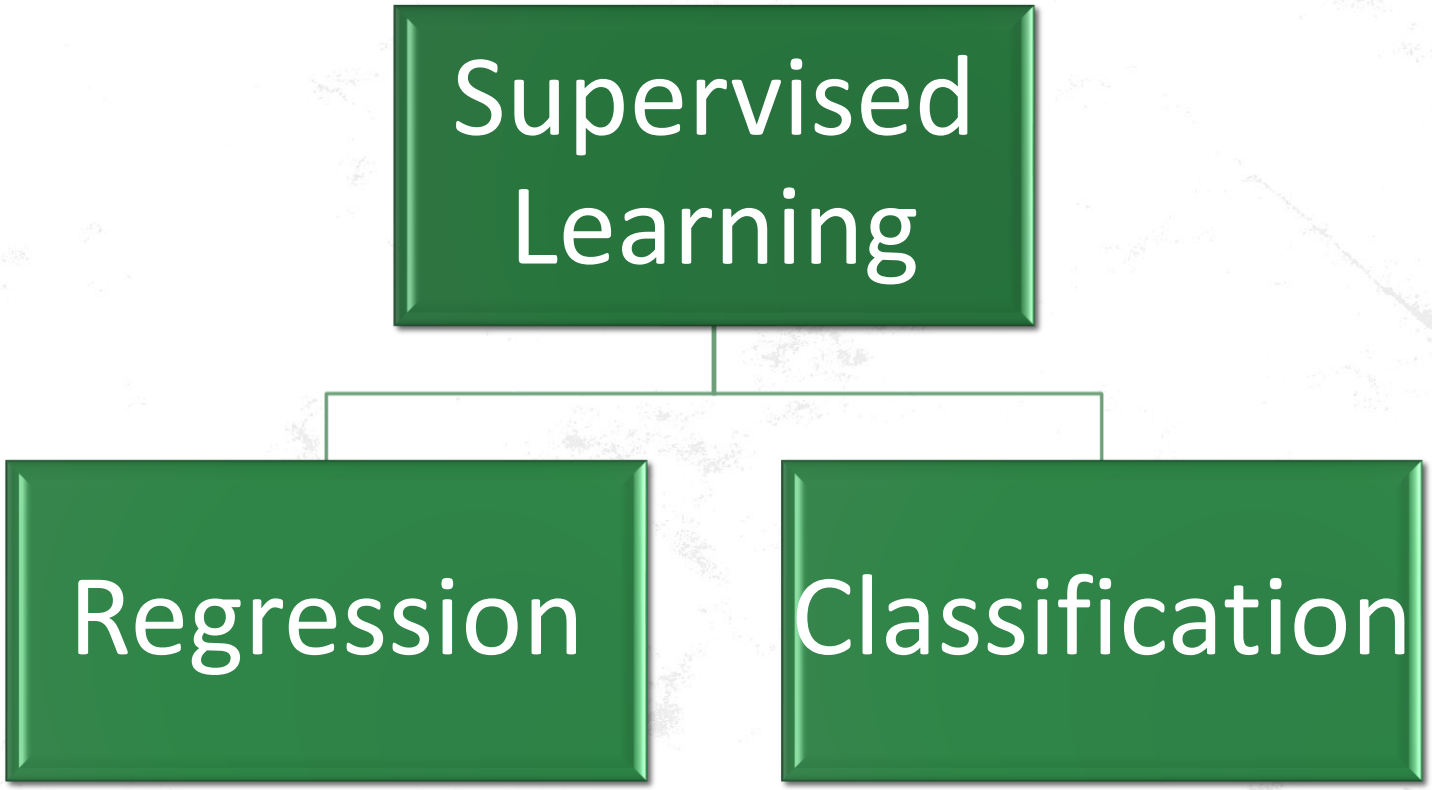


- **Using the Model:**
  - Once the computer learns enough, you can show it new pictures (unknown data), and it will try to guess the correct label.
  - **For example:** If you show it a new picture of a dog, it will say, “This is a Dog.”

Applications of Supervised learning

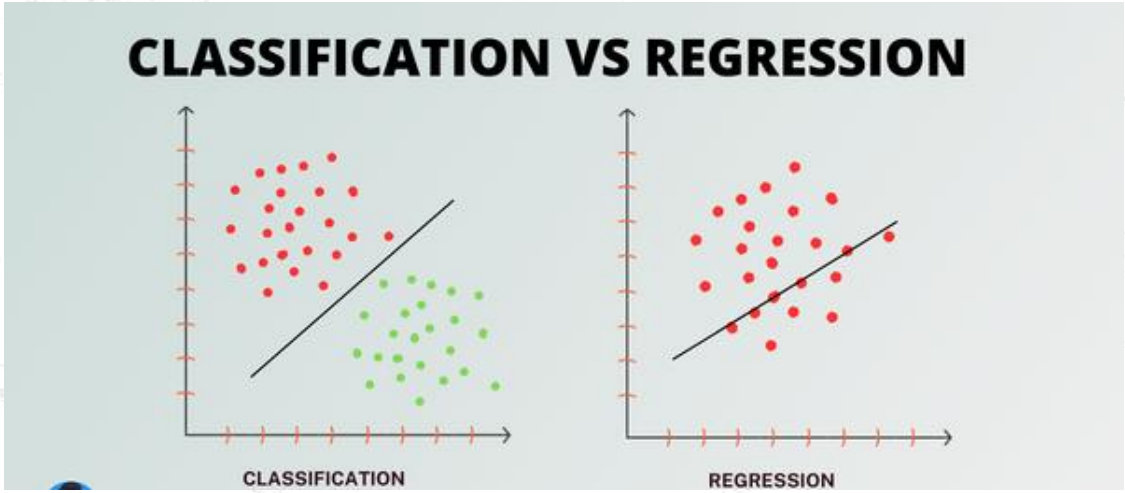
- Spam filtering
- Image classification
- Medical diagnosis
- Car Price Prediction
- Fraud detection
- Loan Price Prediction
- etc

Types of Supervised Learning



Types of Supervised Learning

- **Classification**: A supervised learning task that assigns data to predefined categories, like labeling an email as "spam" or "not spam."
- **Regression**: A supervised learning task that predicts continuous numerical values, such as forecasting house prices based on property features.



Classification

- Classification is like sorting things into groups or categories. The computer learns to put data into the right category.
- Imagine you have a basket of fruits. You sort the fruits into two groups:

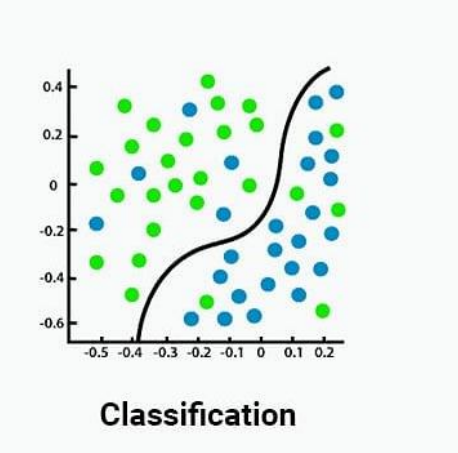
  Apples

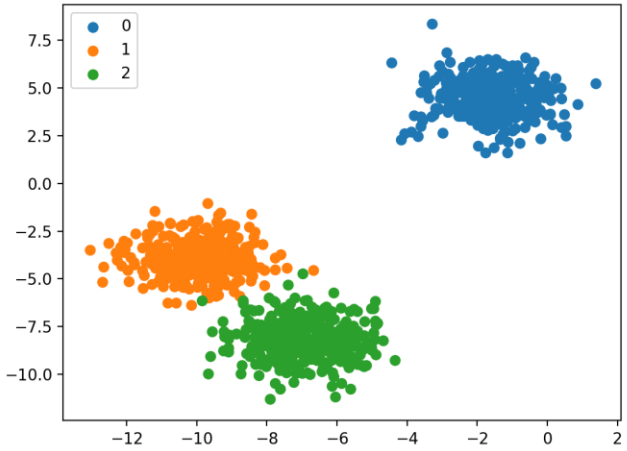
  Bananas

- Now, if you see a new fruit, you decide if it's an apple or a banana. That's what a computer does in **classification**!

Supervised Learning: Classification Problems

- Classification is about teaching a model to distinguish between different categories by learning from labeled examples.
- Each example in the training data belongs to a known class (like "cat" or "dog"), and the model uses this information to identify patterns in the features
- By finding boundaries that best separate these classes, the model can predict which class a new, unseen input belongs to. For example, in image recognition, classification helps the model decide whether an image shows a "cat," "dog," or another object based on features like shape and color.



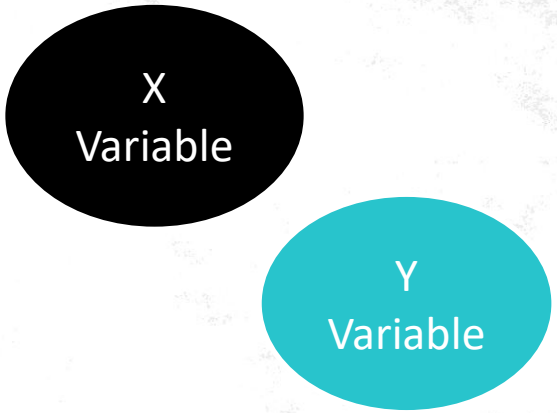


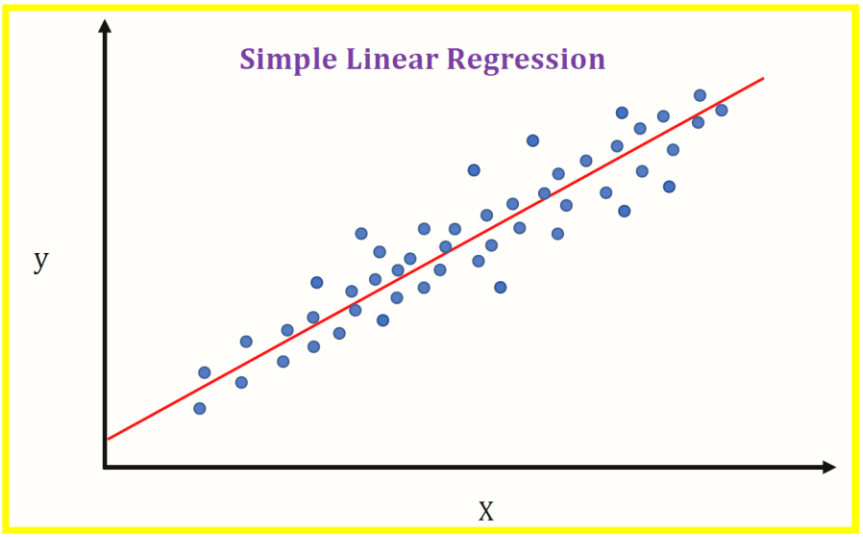
Regression

- Regression is a type of supervised machine learning where algorithms learn from the data to predict continuous values such as sales, salary, weight, or temperature.
- The goal of regression is to find the relationship between input variables (also called independent variables or features) and an output variable (also known as the dependent variable or target).
- This relationship allows the model to predict future values based on new data.

Regression

- The regression model analyzes historical data where both the input features and the output target are known. It tries to identify a mathematical function (often represented as a line or curve) that best represents the relationship between inputs and outputs. This function can then be applied to new input data to predict an output value.





Example of Linear Regression

Scenario:

You want to predict someone's **weight** based on their **height**.

Data:

Height (inches)	Weight (lbs)
60	115
62	120
64	125
66	130
68	135

Example of Linear Regression

- Linear Regression Concept: Linear regression assumes that there is a straight-line relationship between height (input) and weight (output). The formula for the linear relationship looks like

$$\text{Weight} = m \times \text{Height} + b$$

Where:

- m is the slope of the line (how much weight changes per inch of height),
- b is the y-intercept (the weight when height is zero, which may not make sense in real life but is part of the mathematical model).

Example of Linear Regression

- **Train the Model:** Using the data, the linear regression model finds the best-fitting line that minimizes the error between predicted and actual weights.

- **Fitting the Line:** After training, the model might determine that the best-fitting line is:

$$\text{Weight} = 5 \times \text{Height} - 200$$

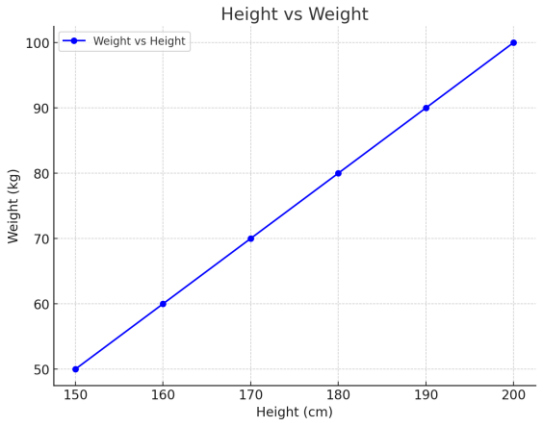
This means for each additional inch in height, the weight increases by 5 lbs, and if the height were 0 inches, the model predicts the weight would be -200 lbs (a mathematical artifact)

Example of Linear Regression

- **Make Predictions:**

  If you have a person who is 70 inches tall, you can predict their weight as:

$$\text{Weight} = 5 \times 70 - 200 = 150 \,\text{lbs}$$



Conclusion: In this example, linear regression is used to predict weight based on height. The model learns the relationship between height and weight, then uses that to predict new values for unseen heights.

House Price Prediction

Logo | Home | About | Project-HPP | Project-Diabetes | Contact

Show Data
Add User
Delete user

House Price Prediction

:

Location : 1st Block Jayanagar
Size(sqft) :
BHK(2/3/4/5..) : 1
Bathroom(2/3/4/5..) : 1
predict

House Price is estimated to be Lakhs

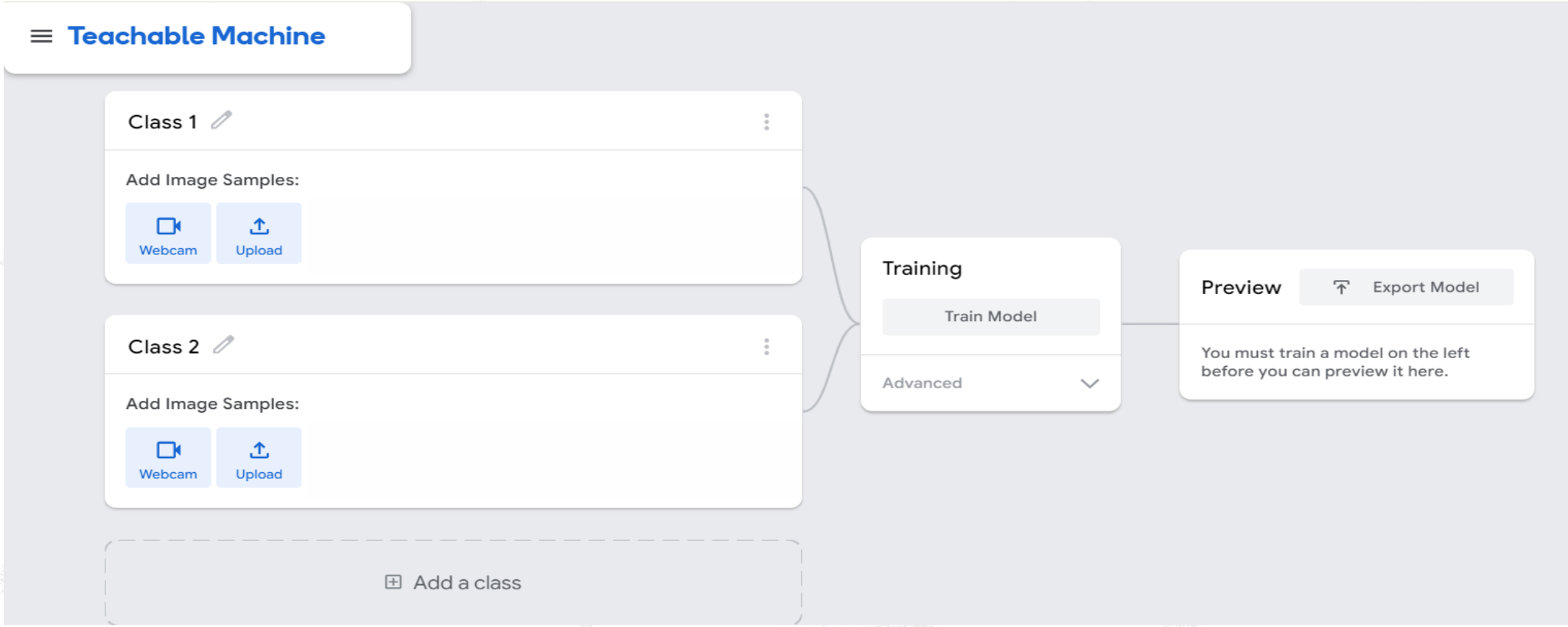
https://house-price-predication.glitch.me/project click here

Classification Vs Regression

Task	Classification	Regression
What it does	Sorts data into categories	Predicts a number
Example	Is the email "spam" or "not spam"?	What will the house price be?
Real-Life Use	Recognizing animals in photos	Forecasting the weather temperature

Example of Machine Learning

Image Project



Unsupervised learning " letting the dataset speak for itself "

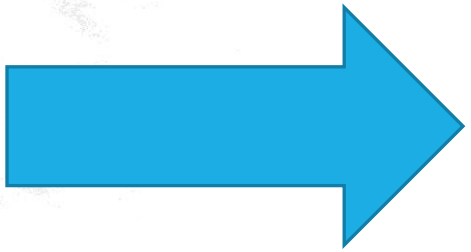
- Unsupervised learning is like letting the computer explore on its own without giving it any answers (no labels). It looks at the data and tries to find patterns or groups. Think of it as solving a puzzle without knowing what the final picture looks like.

- How Does It Work?

  The computer is given data and told:"Look at the information and figure out what things are similar."It groups similar items together or finds hidden patterns.

Activity

- Imagine you have a jar of mixed candies of different colors.
- You didn’t label the candies (no one told you which is which).
- You want to group them by color (red, yellow, green).
- You observe and group the candies based on their similarities.



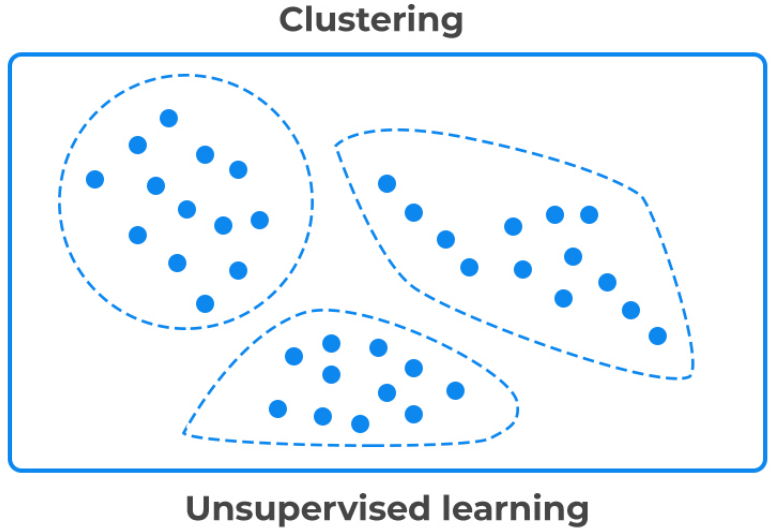
Application of Unsupervised learning

- Recommendation systems
- Customer segmentation
- Document and Text Analysis
- Image and Video Processing
- Anomaly Detection
- Behavioural Analysis
- Stock Market Analysis
- *and many more….*

Unsupervised learning Clustering

Clustering is a technique in machine learning where we group similar things together.

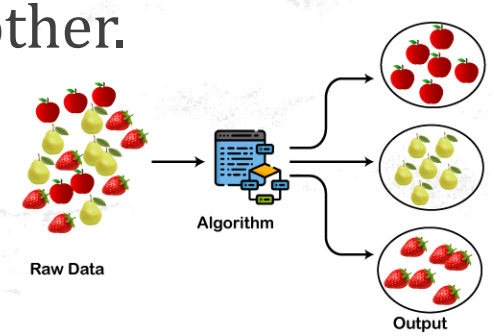
Imagine you have a bunch of different types of fruits, like apples, bananas, and oranges. Clustering is like sorting them into separate baskets based on how similar they are. So, all apples go into one basket, bananas into another, and oranges into another.



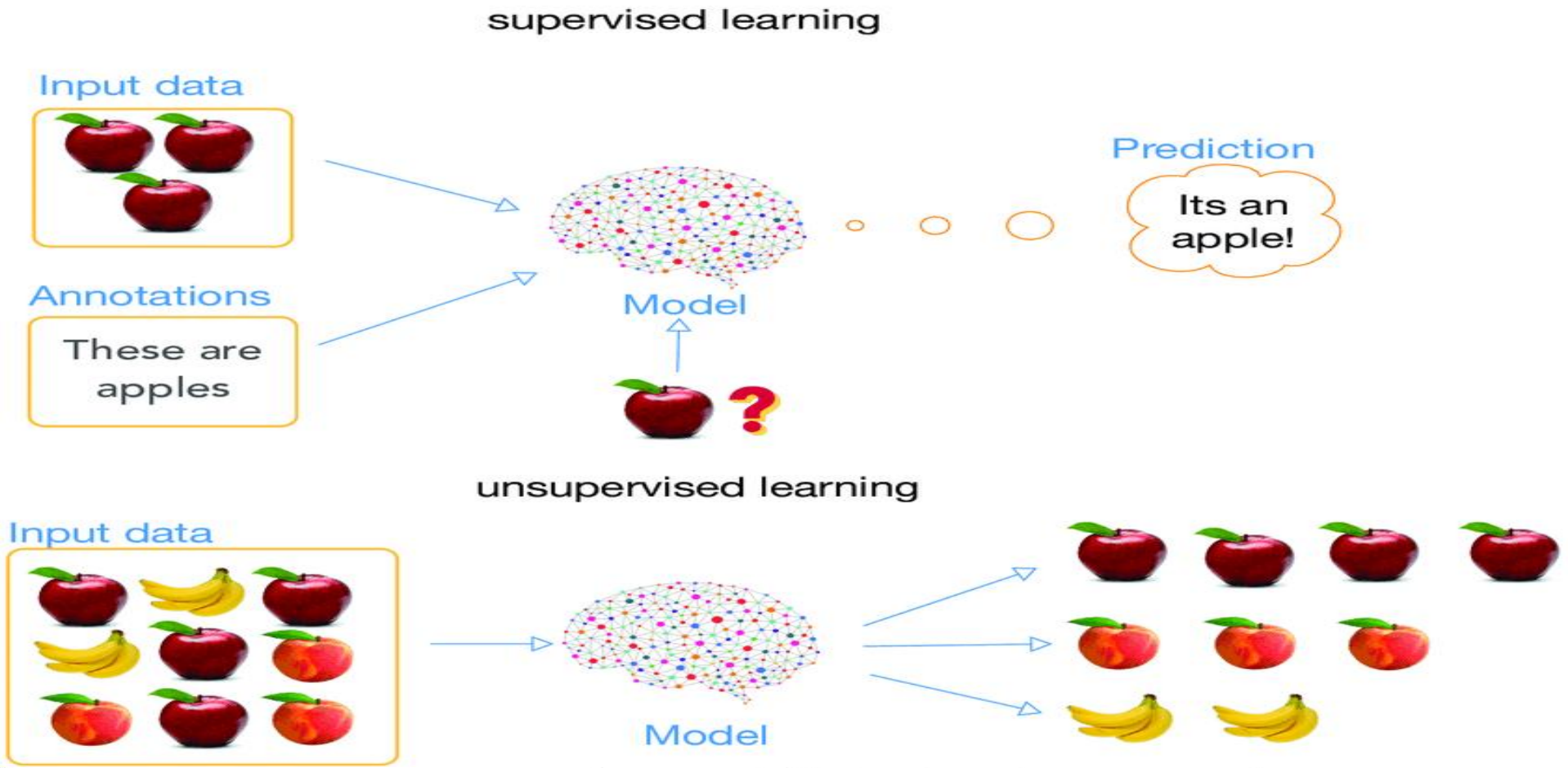
Clustering :How it works ?

Here's how it works in simple steps:

1. **Input Data:** We give the machine data points (like the features of each fruit or customer).
2. **Find Similarities:** The machine looks for patterns and figures out which data points are similar to each other.
3. **Group the Data:** Based on these similarities, it puts the data points into different groups (or clusters).
4. **Results:** Each group contains items that are similar to each other.



Supervised vs Unsupervised learning



Supervised vs Unsupervised learning

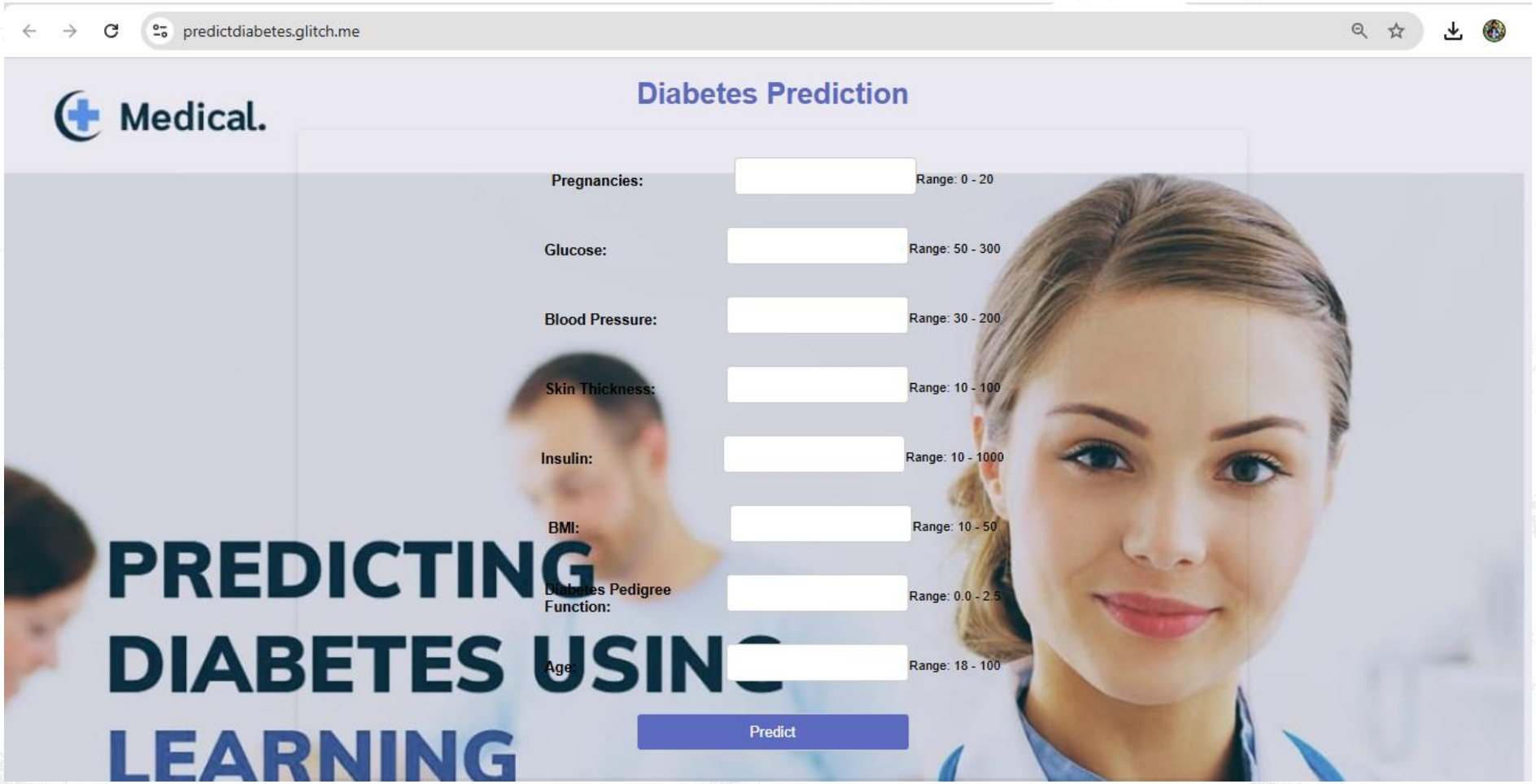
Supervised learning	Unsupervised learning
Input data is labeled	Input data is unlabeled
Has a feedback mechanism	Has no feedback mechanism
Data is classified based on the training dataset	Assigns properties of given data to classify it
Divided into Regression & Classification	Divided into Clustering & Association
Used for prediction	Used for analysis
Algorithms include: decision trees, logistic regressions, support vector machine	Algorithms include: k-means clustering, hierarchical clustering, apriori algorithm
A known number of classes	A unknown number of classes

Diabetes Prediction

	A	B	C	D	E	F	G	H	I
1	Pregnancie	Glucose	BloodPres	SkinThickn	Insulin	BMI	DiabetesP	Age	Outcome
2	6	148	72	35	0	33.6	0.627	50	1
3	1	85	66	29	0	26.6	0.351	31	0
4	8	183	64	0	0	23.3	0.672	32	1
5	1	89	66	23	94	28.1	0.167	21	0
6	0	137	40	35	168	43.1	2.288	33	1
7	5	116	74	0	0	25.6	0.201	30	0
8	3	78	50	32	88	31	0.248	26	1
9	10	115	0	0	0	35.3	0.134	29	0

https://raw.githubusercontent.com/sarwansingh/Python/master/ClassExamples/data/diabetes1.csv

Diabetes Prediction



https://predictdiabetes.glitch.me/

Thank You