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MAXELERATOR FOUNDATION

A Technology Ideation Nursery For Startups

&

FUTURENET TECHNOLOGIES INDIA PVT LTD

Maxelerator Foundation
A
Technology
Ideation
Nursery™

Artificial Intelligence,Machine Learning & Data Science

At Madurai Kamaraj University on 24th & 25th May 2022

IITM INCUBATION CELL

Non-profit Sec.8 company (Est. 2013)
governed by Board of Directors

INDIA'S LEADING
DEEP-TECH STARTUP HUB

10 X

NVIDIA INCEPTION PROGRAM

NVIDIA INCEPTION
MEMBER

amtdc

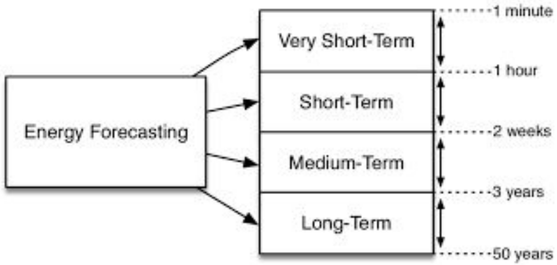
Advanced
Manufacturing
Technology
Development
Centre

OUR TEAM

Team Members:

- Nanu Swamy (Founder)
- Dr .T.Karthick
- Robin Joseph
- Manaz
- Vijay Balaji
- Dharani
- Tharani

Electricity Forecasting - Dr.T.Karthick



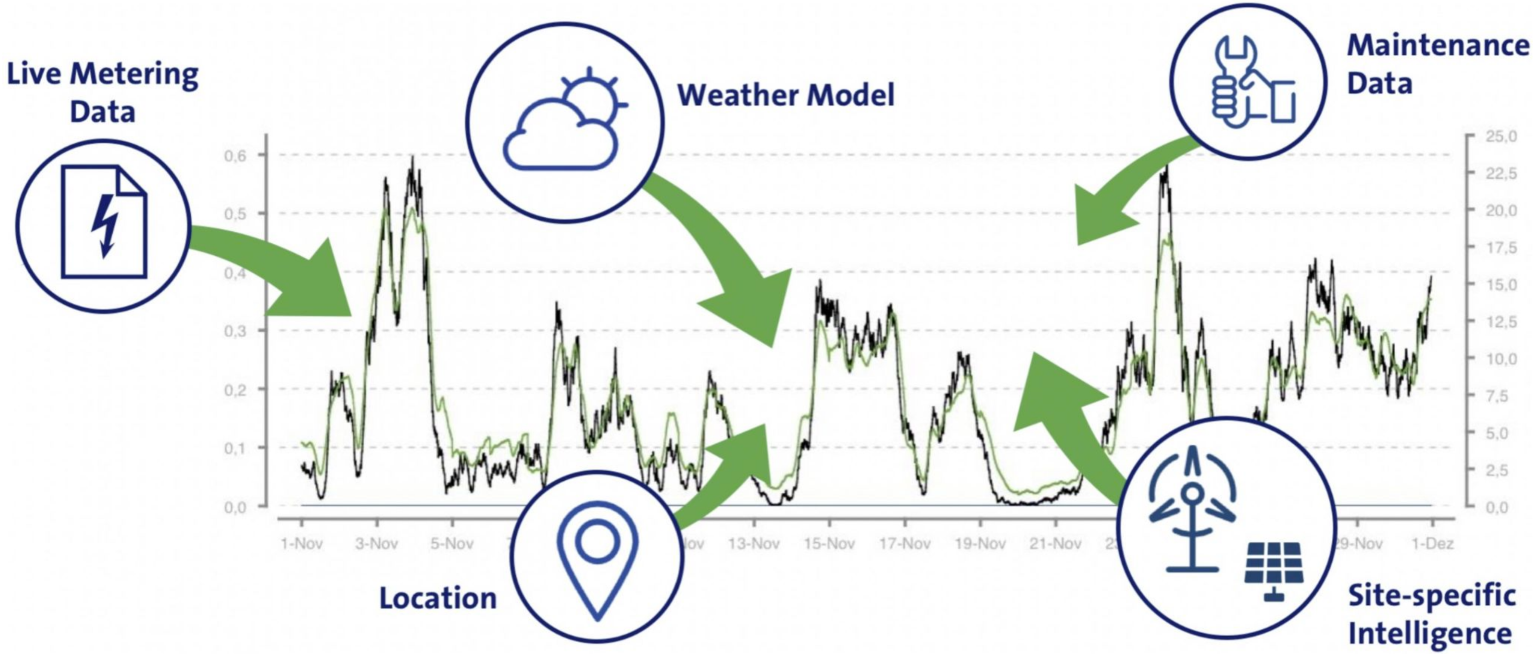
Energy Forecasting

Very Short-Term

Short-Term

Medium-Term

Long-Term



Live Metering Data

Weather Model

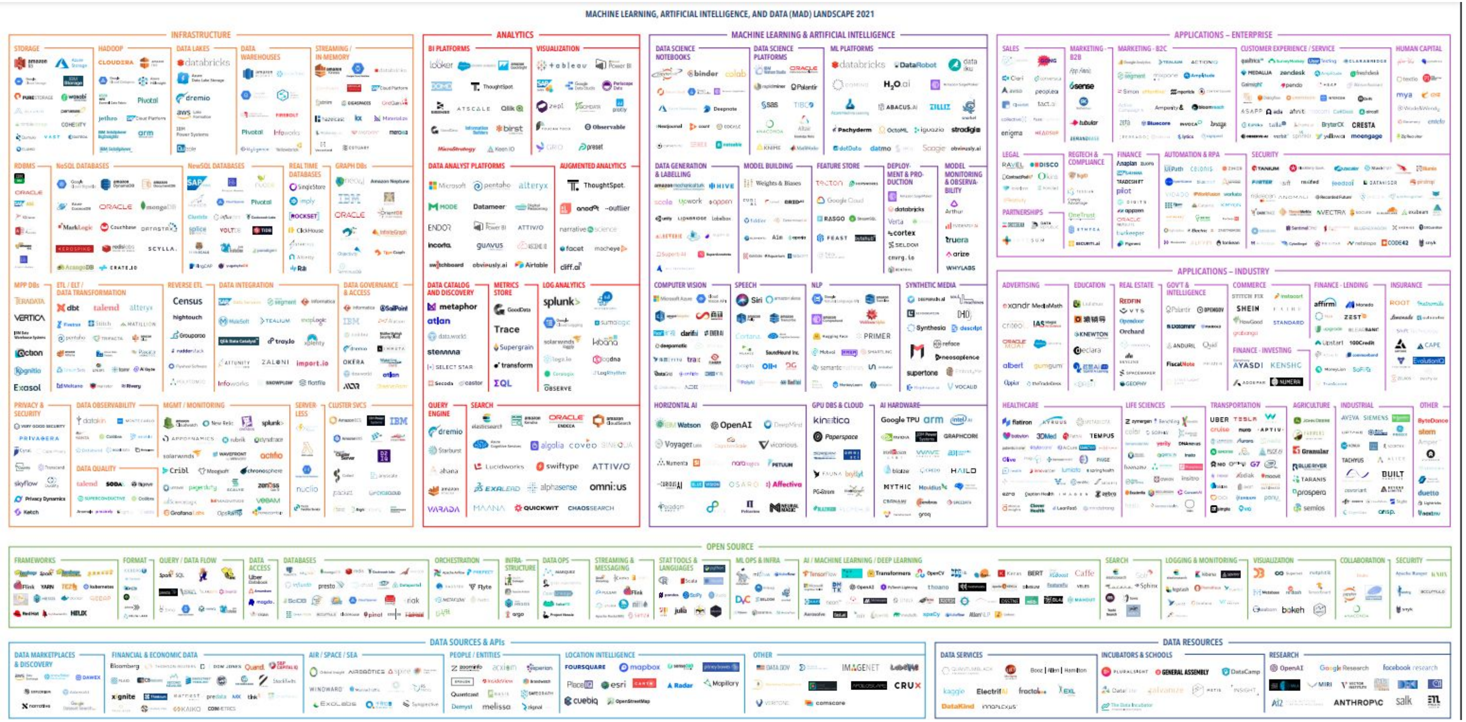
Maintenance Data

Location

Site-specific Intelligence

Technology Landscape

Technology Landscape

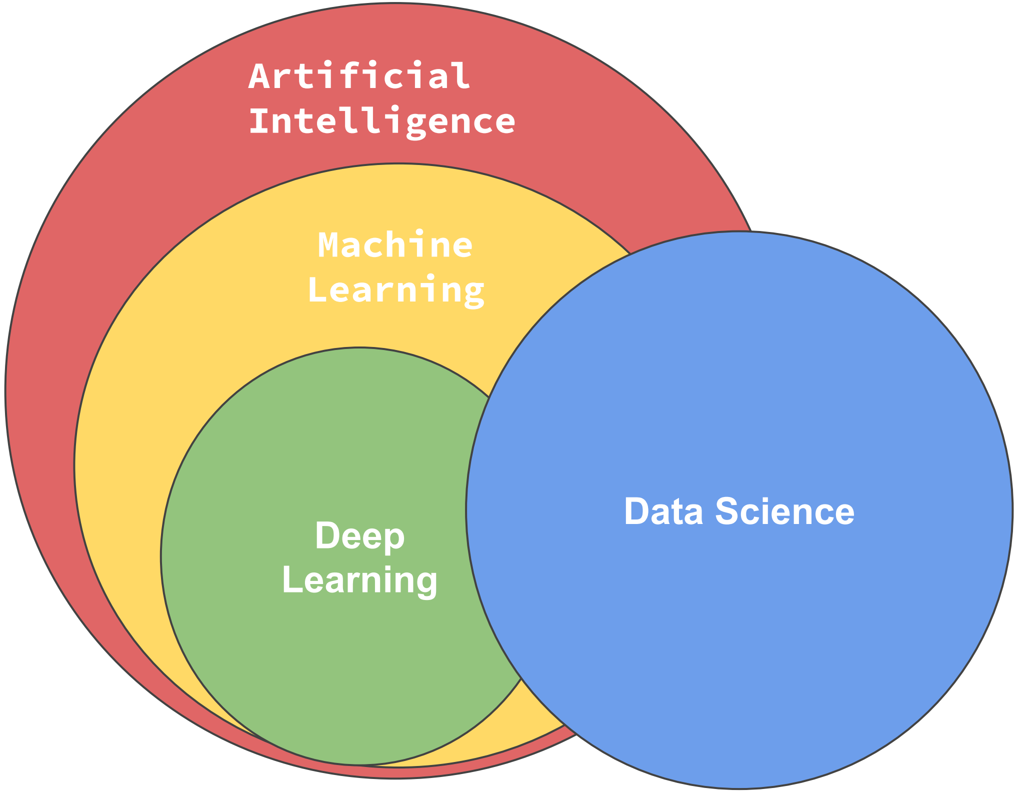


https://drive.google.com/file/d/1_JIcWLGW9ZQQjHDWOuKHhfh-XyCpK-f4/view?usp=sharing

Students Internship:

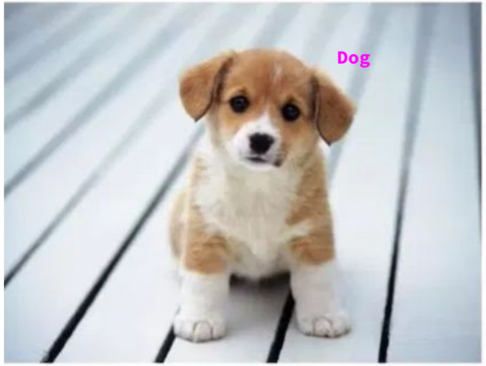
https://bit.ly/3yRwmVE

Introduction to Artificial Intelligence,Machine Learning & Data Science



Classification vs Object Detection vs Image Segmentation

Classification



Object Detection

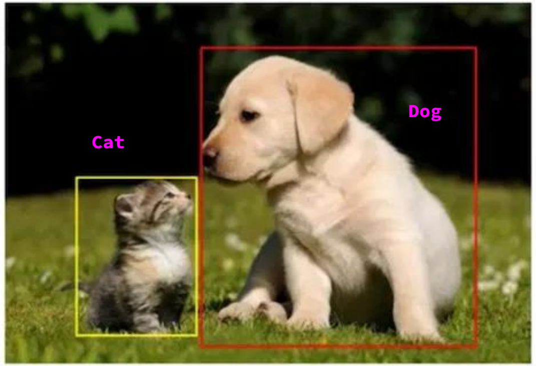
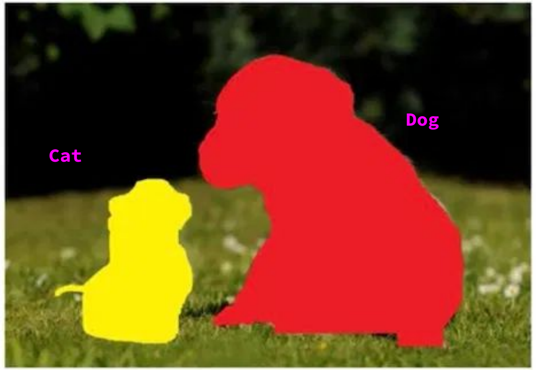
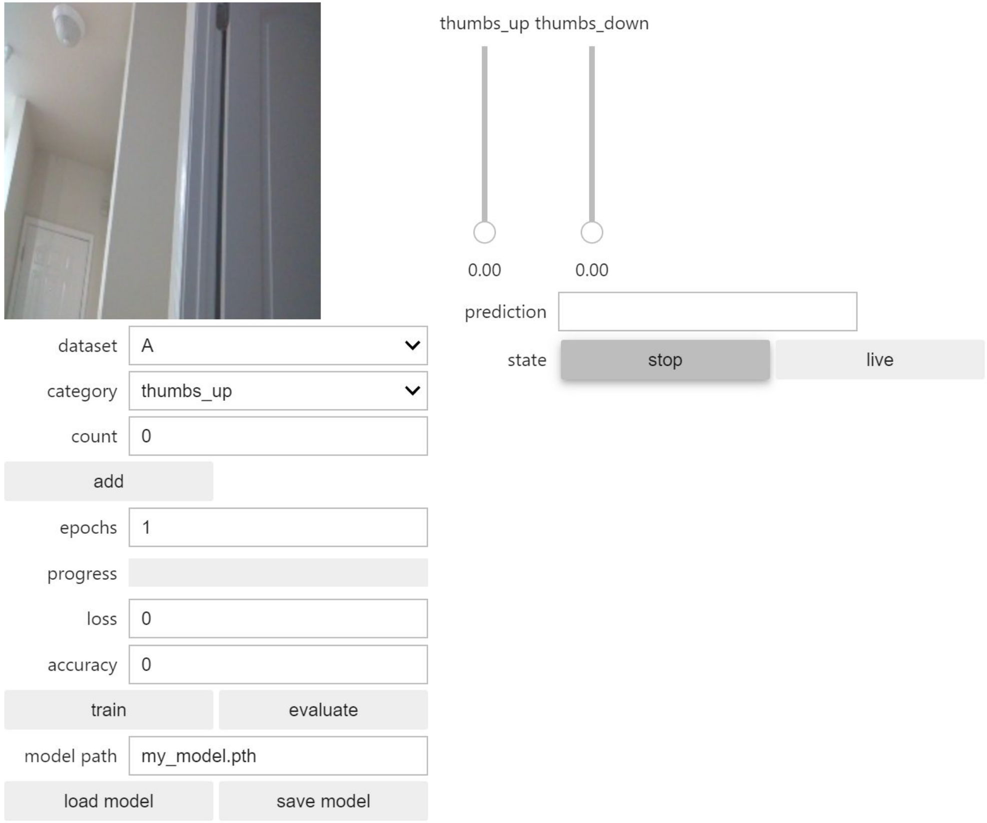


Image Segmentation



Demo 1 - Jetson Classification



prediction

state

dataset A

category thumbs_up

count 0

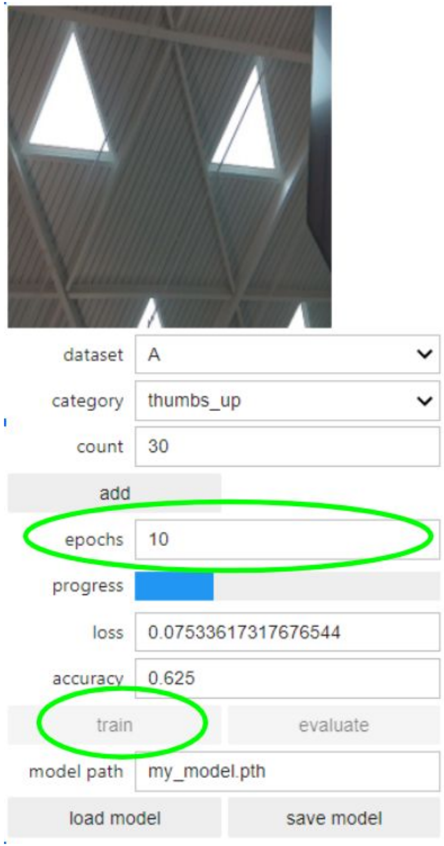
epochs 1

progress

loss 0

accuracy 0

model path my_model.pth



dataset A

category thumbs_up

count 30

epochs 10

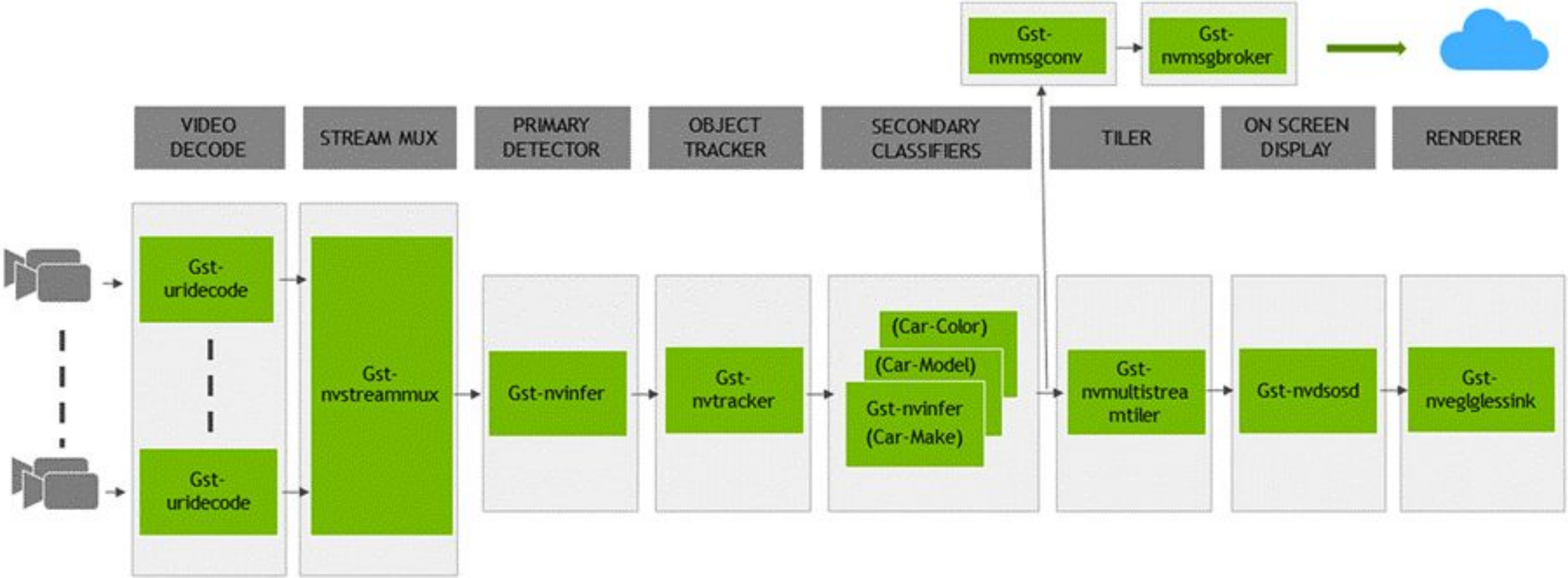
progress

loss 0.07533617317676544

accuracy 0.625

model path my_model.pth

Demo 2 - Xavier Detection



Tensors

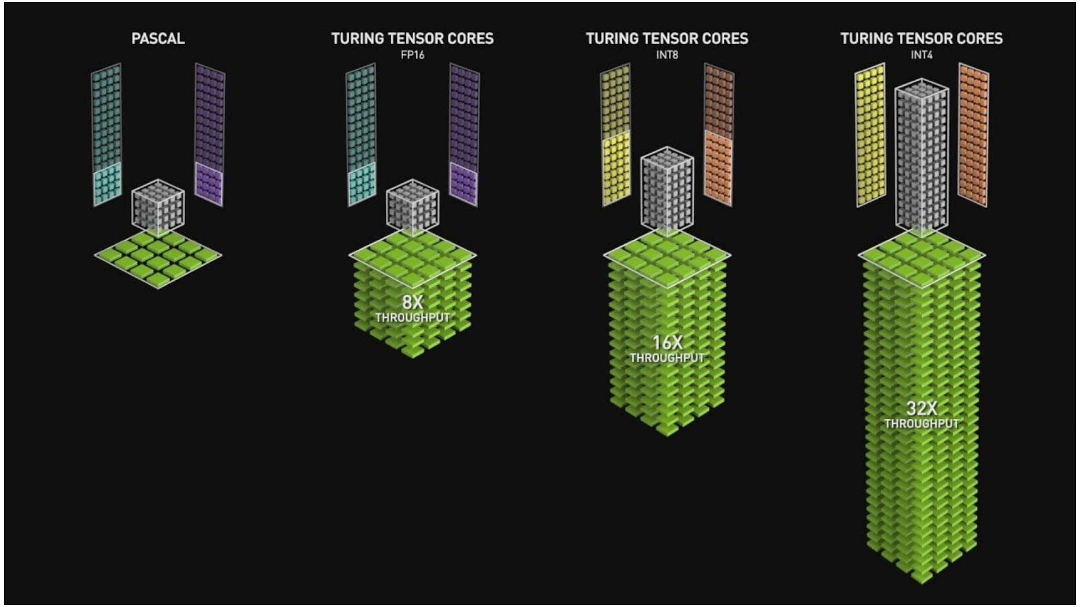
- In Machine Learning or Deep Learning, we work with multidimensional arrays. For example, an image is often represented as an array of (height, width, number of color channels).
- In scientific computing, these multidimensional arrays are called ‘Tensors’. So instead of calling an image a multidimensional array, it is just called a tensor!

https://storage.googleapis.com/nexttpu/index.html

Tensor Processing Unit

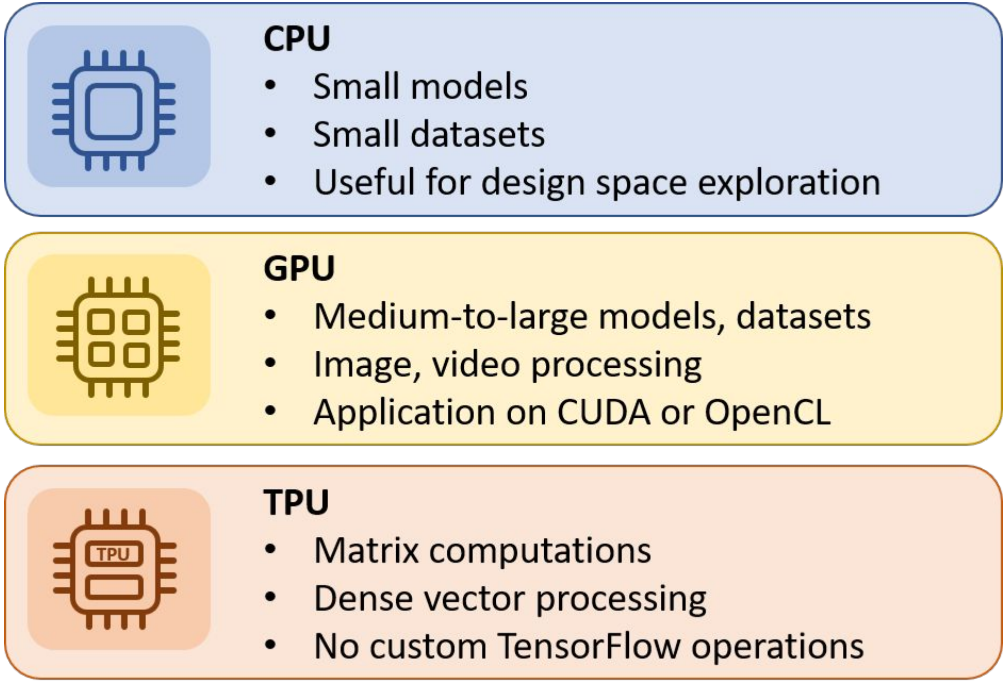
Designed for fast and affordable AI

Tensor Cores



Youtube Link : https://youtu.be/yyR0ZoCeBO8

CPU vs GPU vs TPU



CPU

- Small models
- Small datasets
- Useful for design space exploration

GPU

- Medium-to-large models, datasets
- Image, video processing
- Application on CUDA or OpenCL

TPU

- Matrix computations
- Dense vector processing
- No custom TensorFlow operations

Colab Link : https://colab.research.google.com/drive/1eqHV9JgUchATl3Fb7BJ99Lsh8EgCgyXB?usp=sharing

Hands On Session - Python Basics

- **Variables,Functions,Lambda Functions**

  https://colab.research.google.com/drive/194F9DeHWN2CA8fxg44HAwFZdIkOD4P-G?usp=sharing
- **Classes and Object Fetch Data from API**

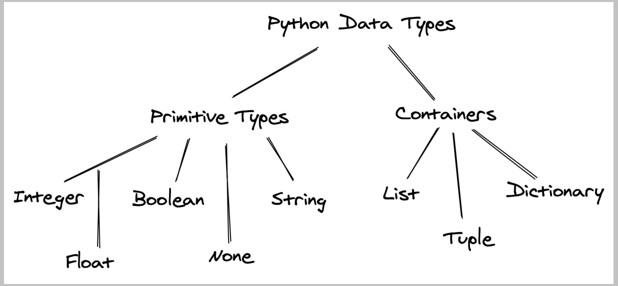
  https://colab.research.google.com/drive/1XyzyEzzoqIM4f6MYX5dRhQpqtQPp4bBp?usp=sharing
- **Modules & Packages,Numpy,Pandas**

  https://colab.research.google.com/drive/1viX334W0VS_GHL1T_SnG_cSQvfgLCW1B?usp=sharing
- **Tensors,Reshaping,squeezing,Un Squeezing**

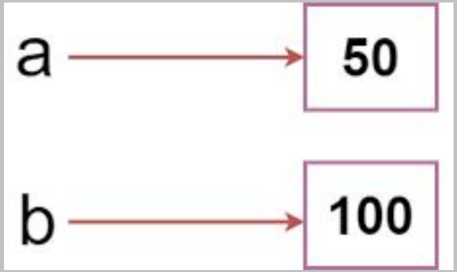
  https://colab.research.google.com/drive/1eqHV9JgUchATI3Fb7BJ99Lsh8EgCgyXB?usp=sharing

Python Basics

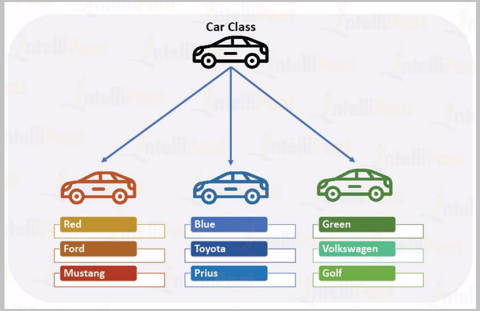
Data Types



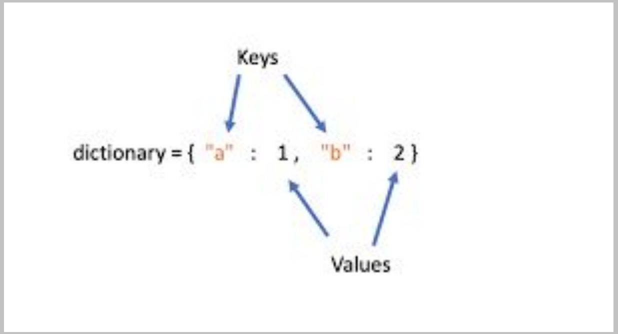
Variables



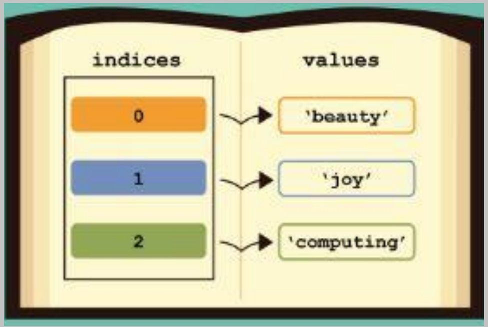
Classes & Objects



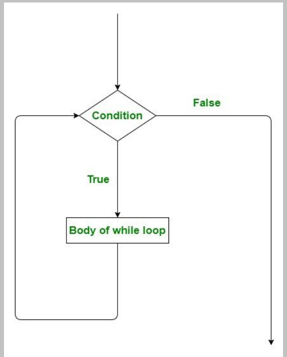
Dictionaries



Lists



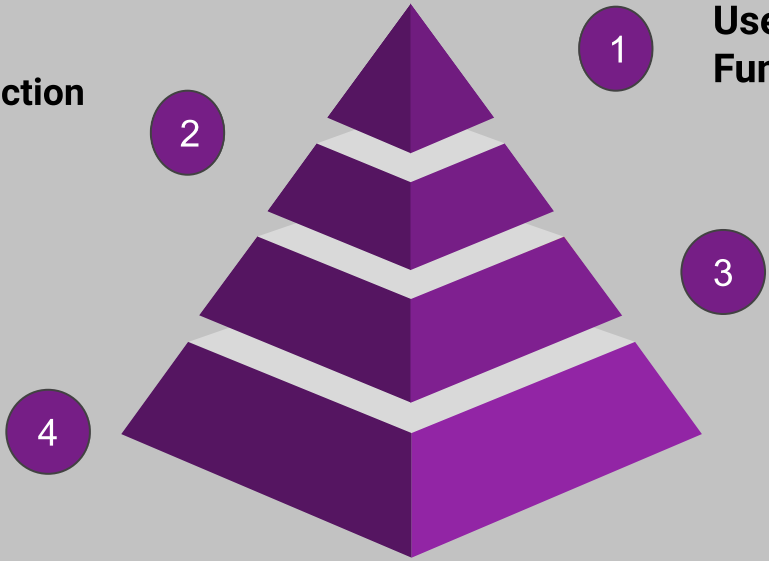
Loops



Functions

- x - input
- f - function
- y - output

```
y = f(x)
```



1 User Defined Function

2 Build-in Function

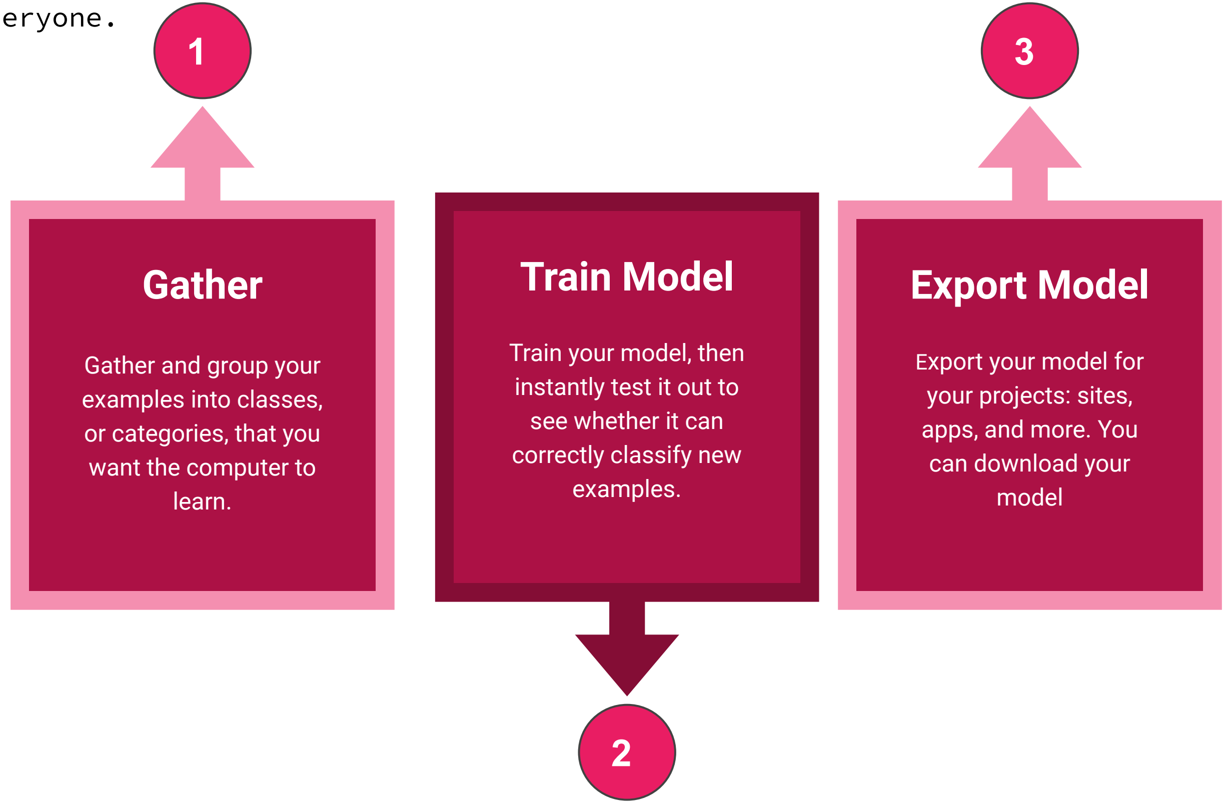
3 Lambda Function

4 Recursion Function

```
f = lambda a:a*a
```

Demo 3 - Teachable Machine - Image Classification

Teachable Machine is a web-based tool that makes creating machine learning models fast, easy, and accessible to everyone.



Gather

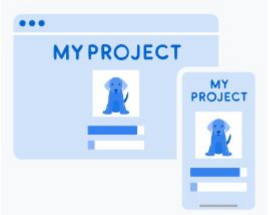
Gather and group your examples into classes, or categories, that you want the computer to learn.

Train Model

Train your model, then instantly test it out to see whether it can correctly classify new examples.

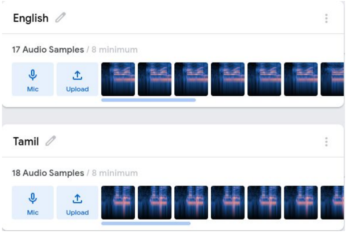
Export Model

Export your model for your projects: sites, apps, and more. You can download your model



Demo 4 - Teachable Machine - Audio Classification

`Teach a model to classify audio by recording short sound samples.`

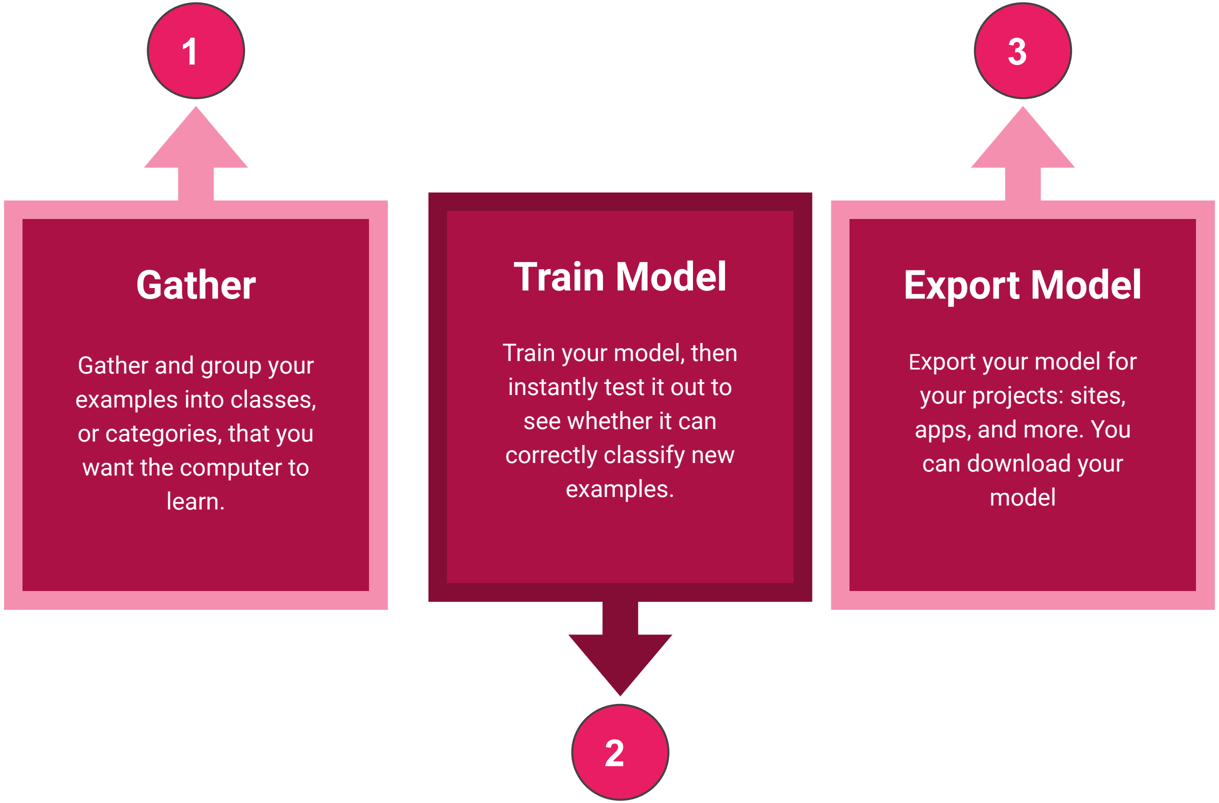


English

17 Audio Samples / 8 minimum

Tamil

18 Audio Samples / 8 minimum



1

Gather

Gather and group your examples into classes, or categories, that you want the computer to learn.

2

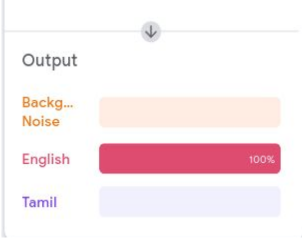
Train Model

Train your model, then instantly test it out to see whether it can correctly classify new examples.

3

Export Model

Export your model for your projects: sites, apps, and more. You can download your model

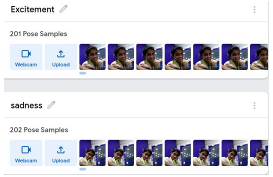


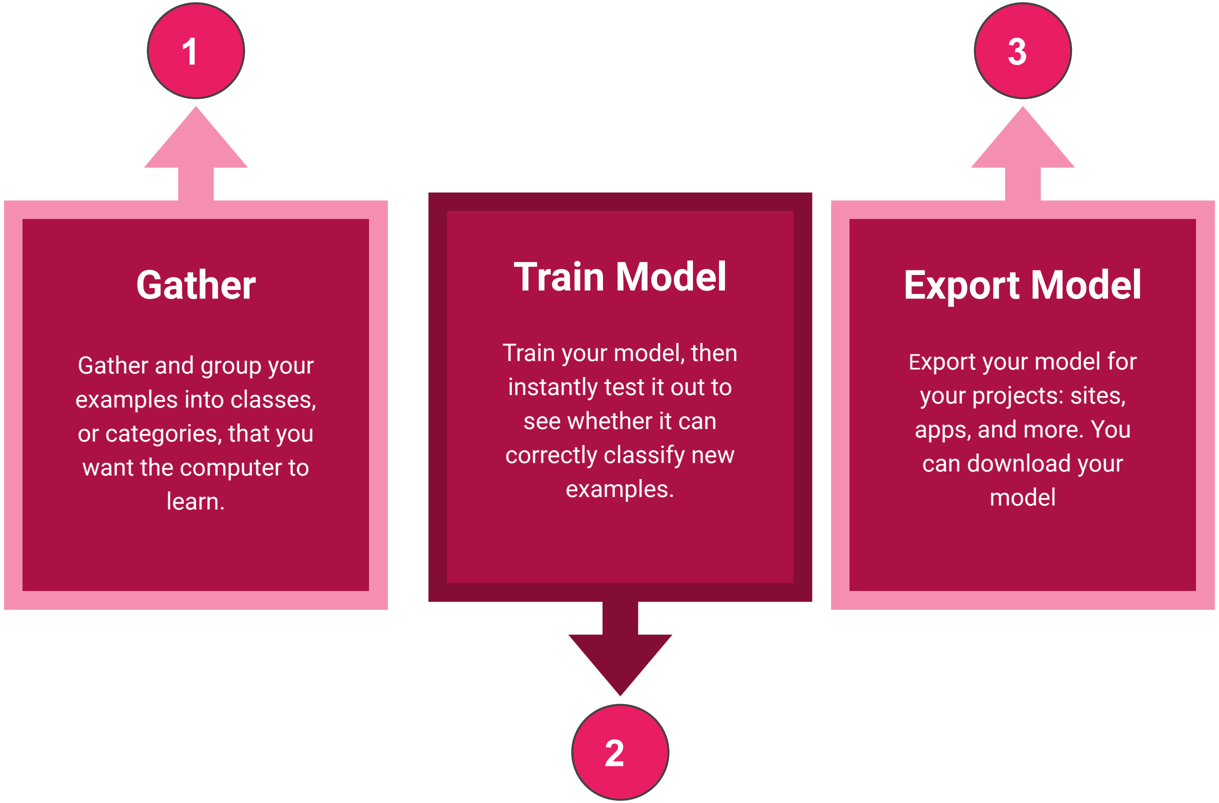
Output

Backg... Noise	
English	100%
Tamil	

Demo 5 - Teachable Machine - Pose Estimation

`Teach a model to classify body positions using files or striking poses in your webcam.`





1

Gather

Gather and group your examples into classes, or categories, that you want the computer to learn.

2

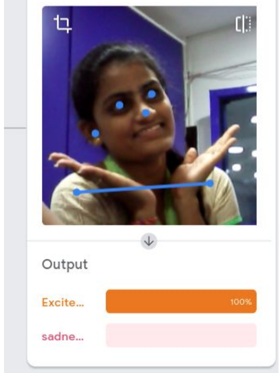
Train Model

Train your model, then instantly test it out to see whether it can correctly classify new examples.

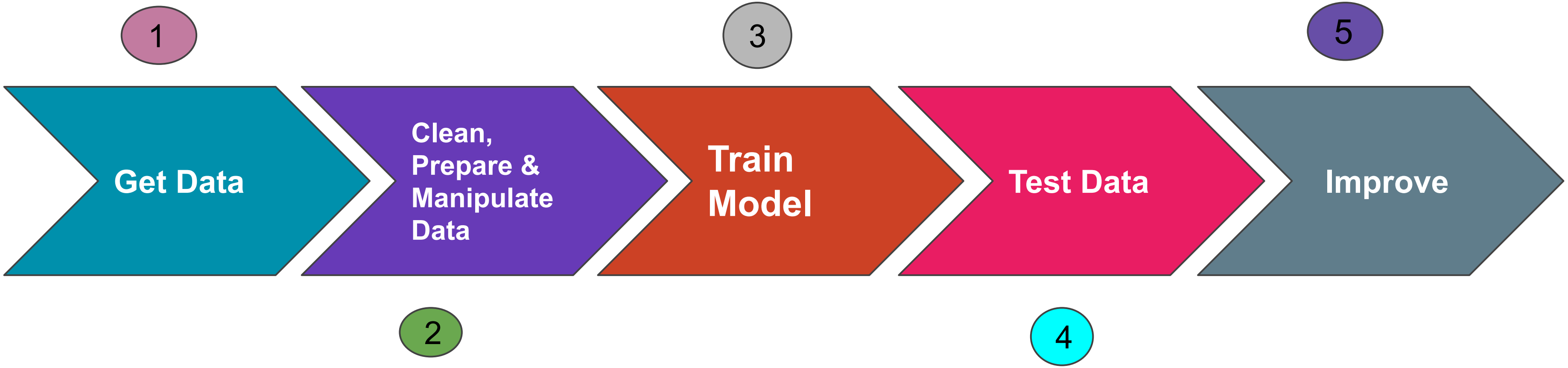
3

Export Model

Export your model for your projects: sites, apps, and more. You can download your model



Machine Learning Cycle:



1 Get Data

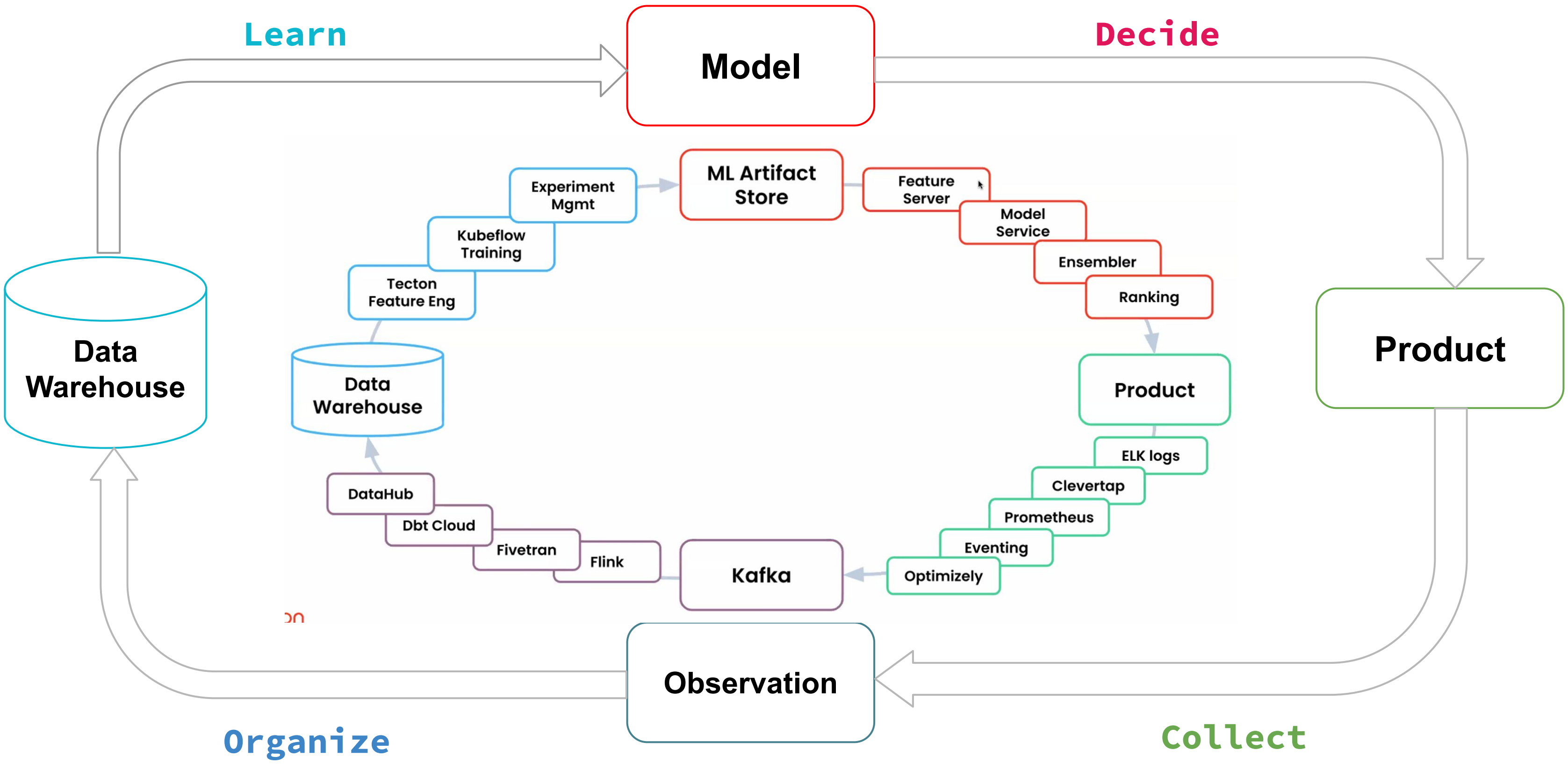
2 Clean, Prepare & Manipulate Data

3 Train Model

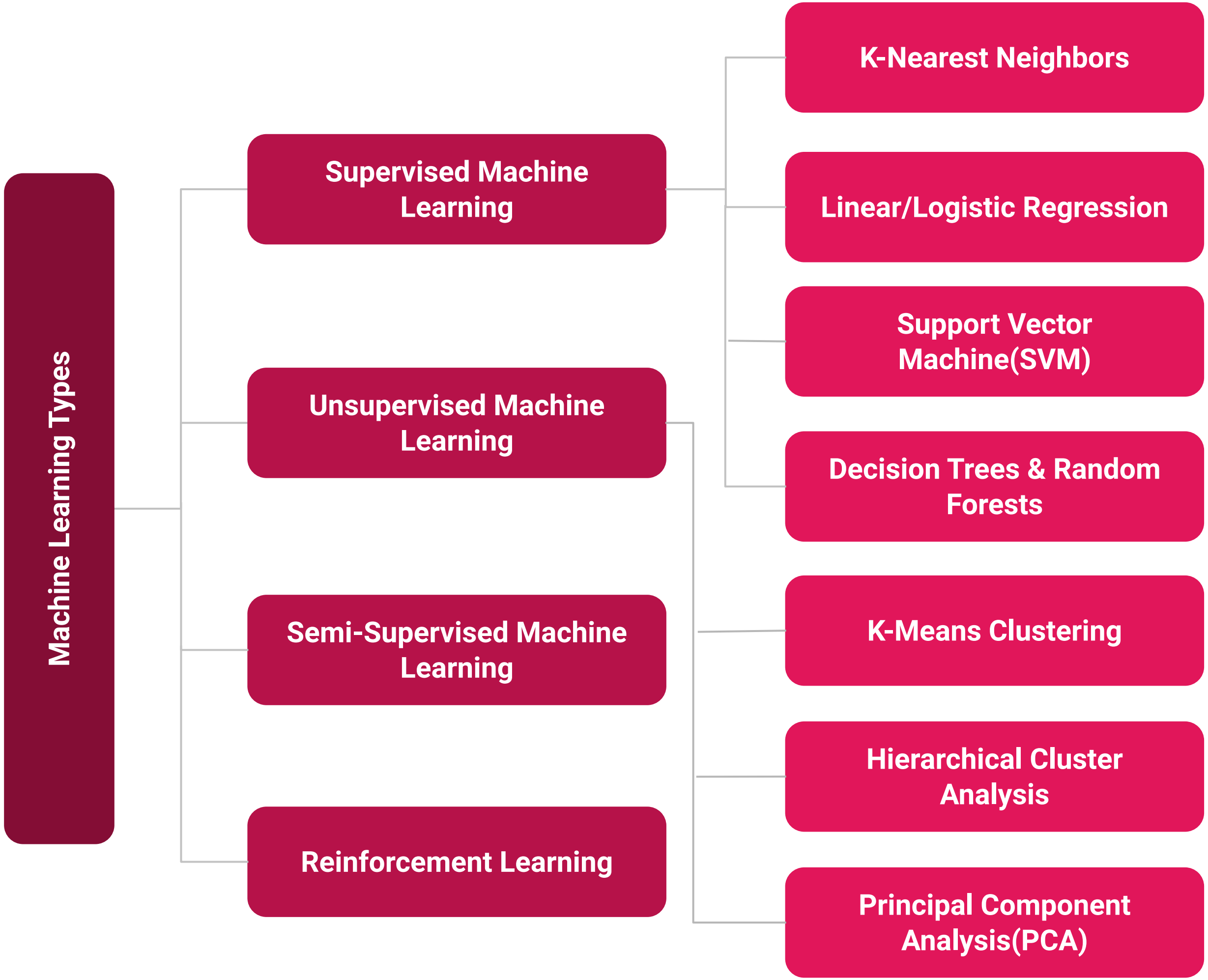
4 Test Data

5 Improve

The Machine Learning Flywheel



Types



Machine Learning Types

Supervised Machine Learning

Unsupervised Machine Learning

Semi-Supervised Machine Learning

Reinforcement Learning

K-Nearest Neighbors

Linear/Logistic Regression

Support Vector Machine(SVM)

Decision Trees & Random Forests

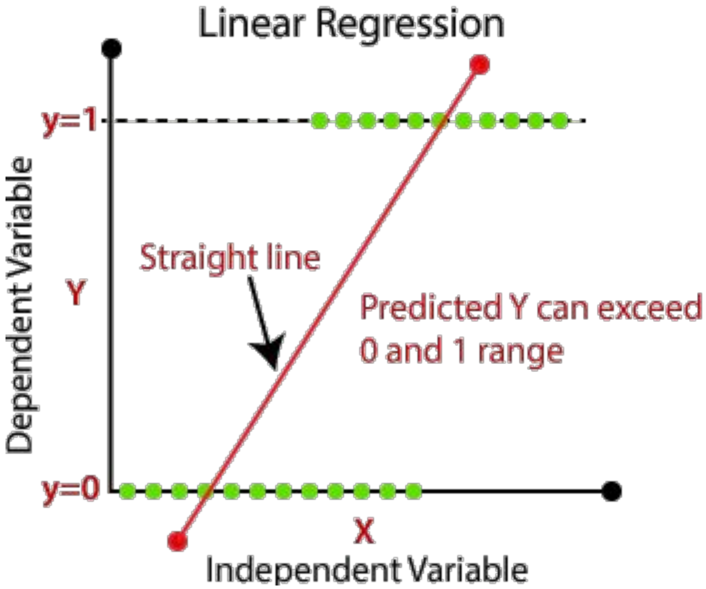
K-Means Clustering

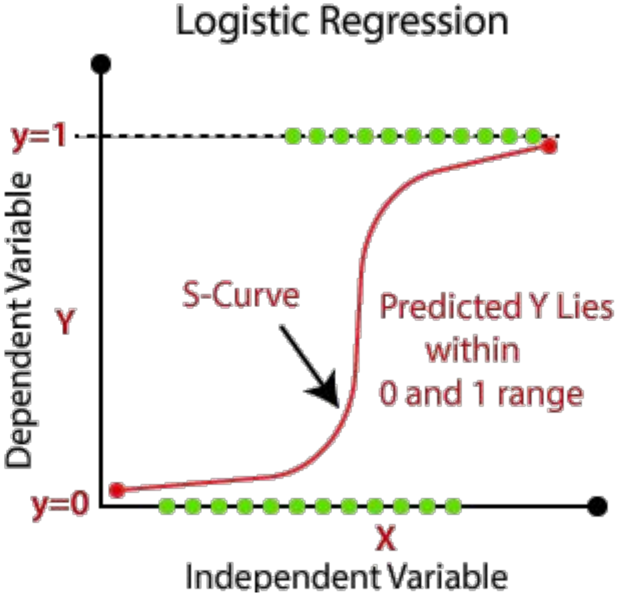
Hierarchical Cluster Analysis

Principal Component Analysis(PCA)

Linear Regression and Logistic Regression

The Linear Regression is used for solving Regression problems whereas Logistic Regression is used for solving the Classification problems.





K- Nearest Neighbor(KNN)

Step-1: Select the number K of the neighbors

Step-2: Calculate the Euclidean distance of **K number of neighbors**

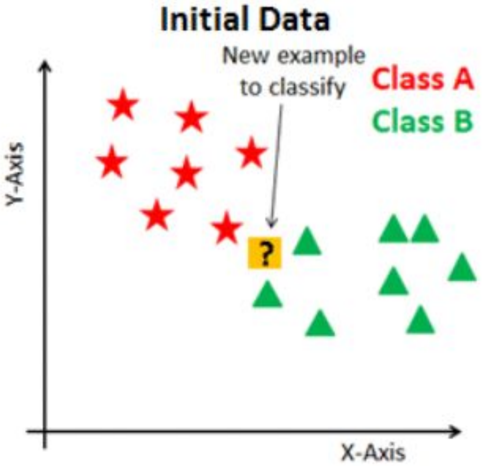
Step-3: Take the K nearest neighbors as per the calculated Euclidean distance.

Step-4: Among these k neighbors, count the number of the data points in each category.

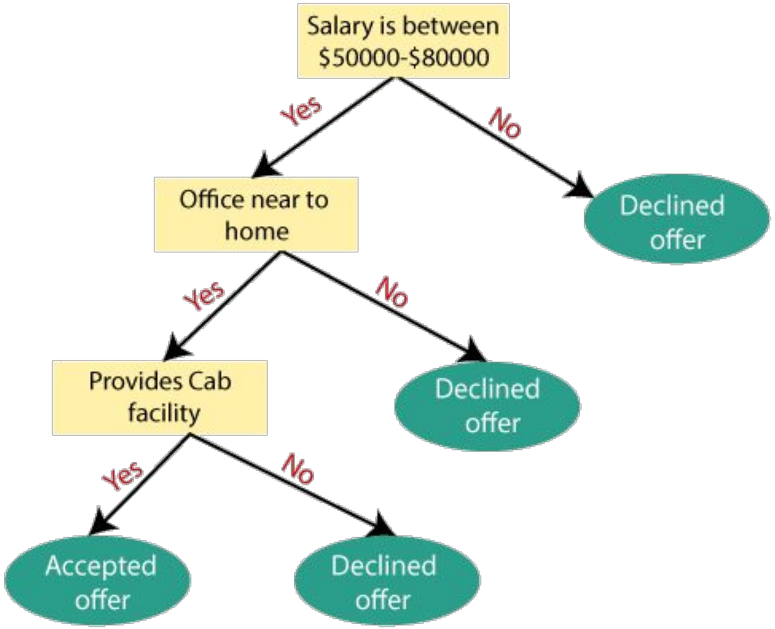
Step-5: Assign the new data points to that category for which the number

of the neighbor is maximum.

Step-6: Our model is ready.



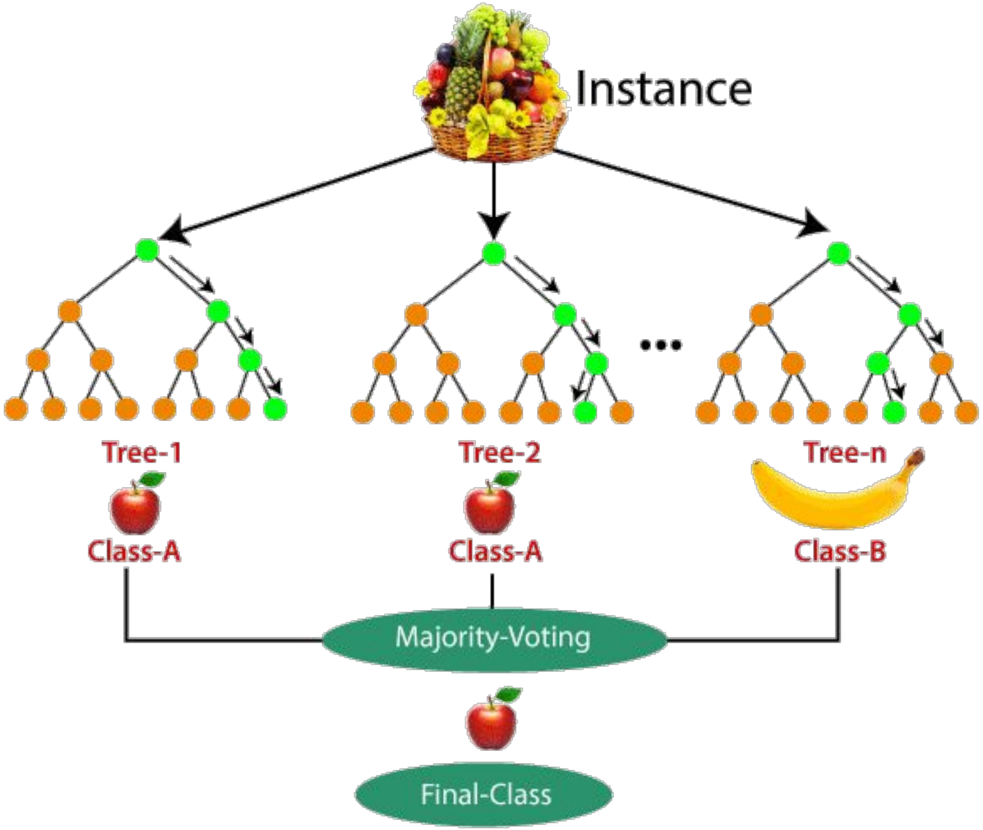
Decision Tree Algorithm



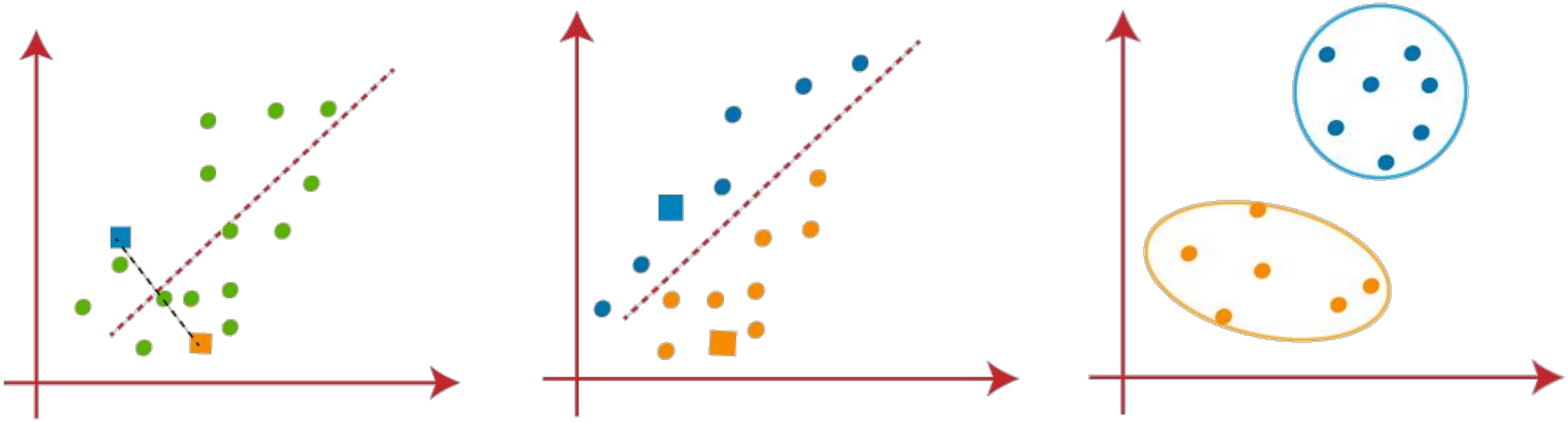
Example:

Suppose there is a candidate who has a job offer and wants to decide whether he should accept the offer or Not. So, to solve this problem, the decision tree starts with the root node (Salary attribute by ASM). The root node splits further into the next decision node (distance from the office) and one leaf node based on the corresponding labels. The next decision node further gets split into one decision node (Cab facility) and one leaf node. Finally, the decision node splits into two leaf nodes (Accepted offers and Declined offer).

Random Forest Algorithm



K-Means Clustering



Hands On Session

- **Linear Regression - Per Capita Income :**

  https://colab.research.google.com/drive/1wjvAPV_WiiRhVd5o36HX8YU-CmzCnqcg?usp=sharing

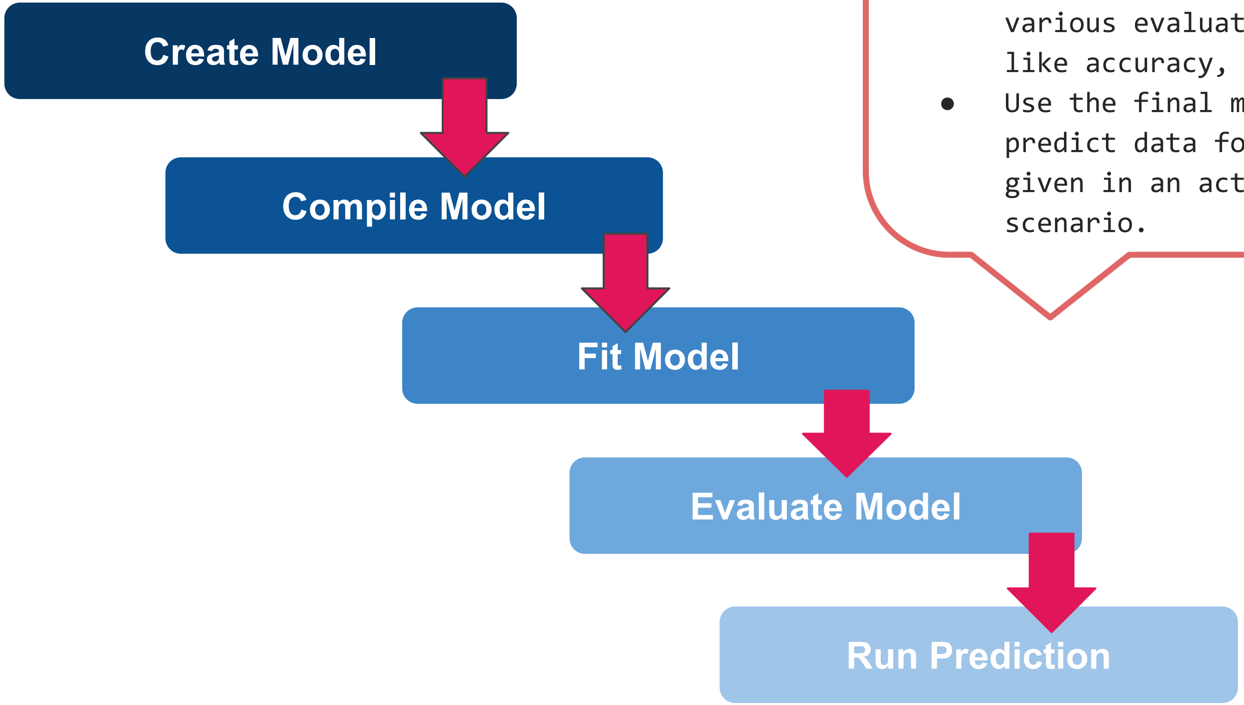
- **Linear Regression - BMI Prediction:**

  https://colab.research.google.com/drive/1AN7bpxptWwlyBFHe-dwtZe_br46xkj-W?usp=sharing

- **Support Vector Machine - Digit Recognition :**

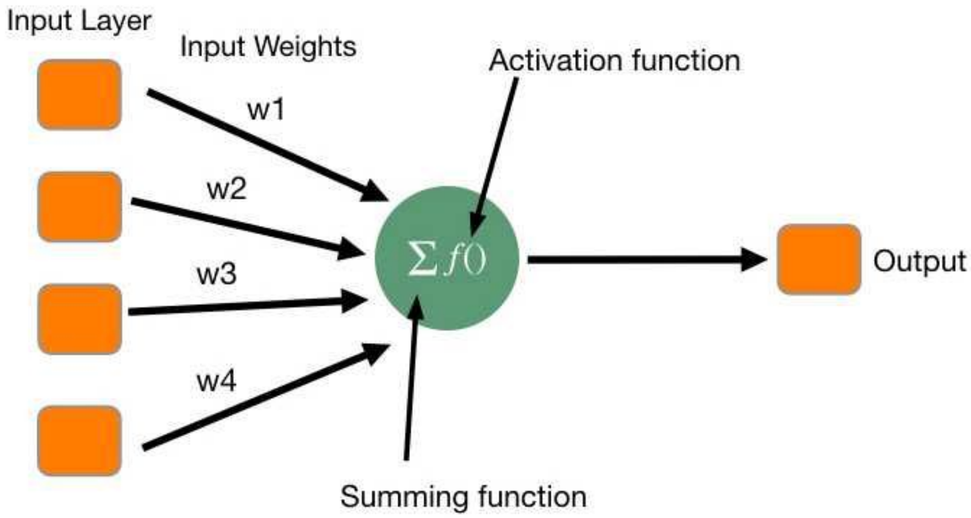
  https://colab.research.google.com/drive/149w88j03vnvbUnKWoteSTTHZdd7PjCBn?usp=sharing

Pytorch as Deep Learning Framework



- Define a model using the Sequential
- Compile the model using model.compile()
- Use the model.fit()
- After training, calculate various evaluation metrics like accuracy, loss, etc.
- Use the final model to predict data for the task given in an actual scenario.

Perceptron



create a very simple neural network with one input layer and one output layer. Such a neural network is called a perceptron.

- Forward Pass
- Backward Pass

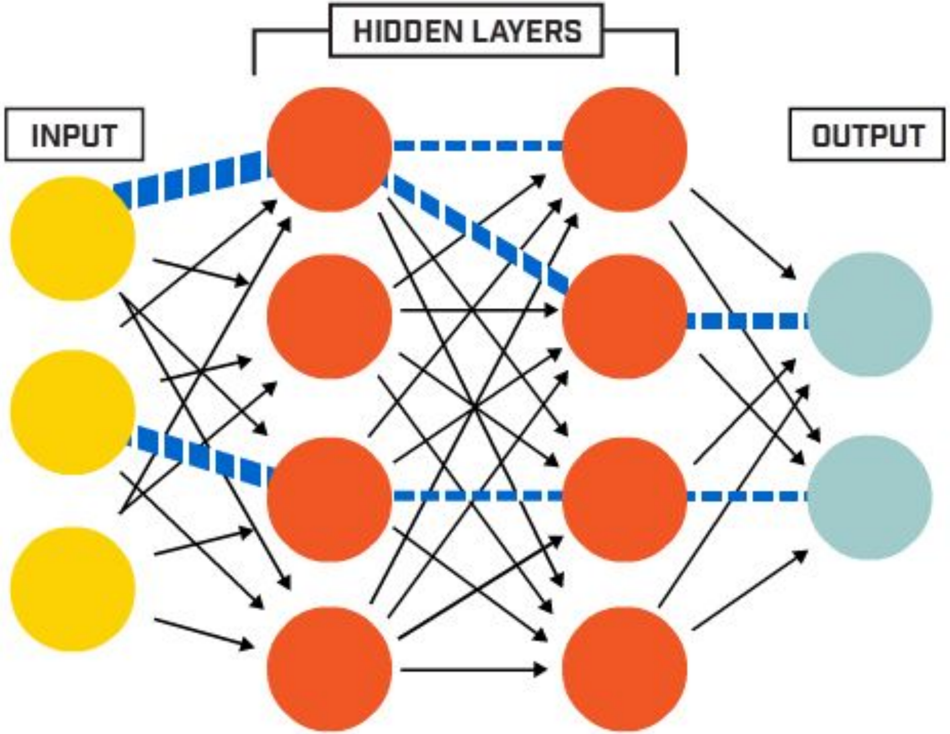
Building Perceptron From Scratch

Person	Smoking	Obesity	Exercise	Diabetic
Person 1	0	1	0	1
Person 2	0	0	1	0
Person 3	1	0	0	0
Person 4	1	1	0	1
Person 5	1	1	1	1

Colab Link :
https://colab.research.google.com/drive/1KybyqKePSsL0TgdCMjjXdqwDb5JCUxBb?usp=sharing

Neural Networks

Forward Pass



Backward Pass

Hands On Session

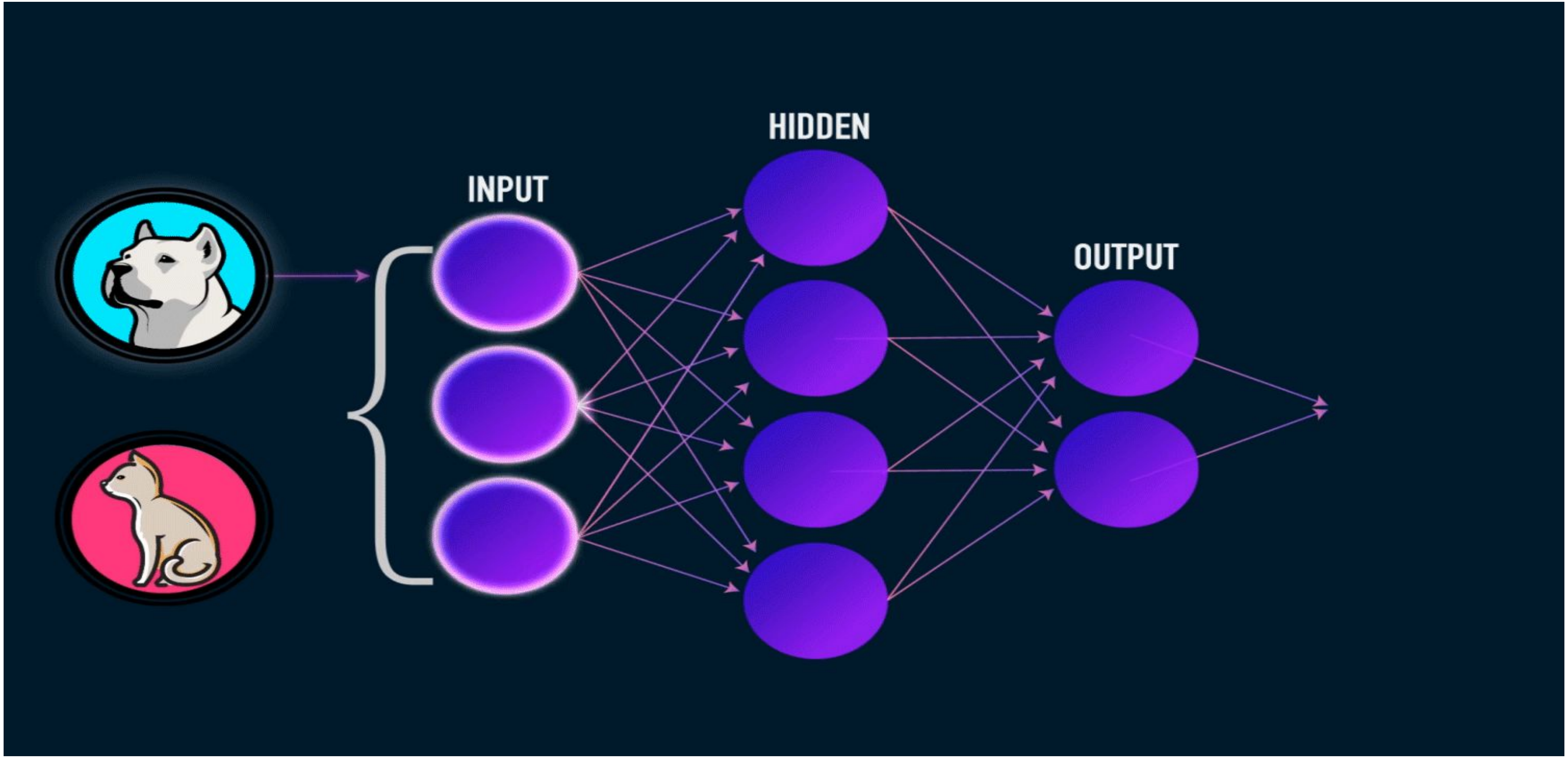
- **Perceptron Example - Diabetic or not:**

  https://colab.research.google.com/drive/1KybyqKePSsL0TgdCMjjXdqwDb5JCUxBb?usp=sharing

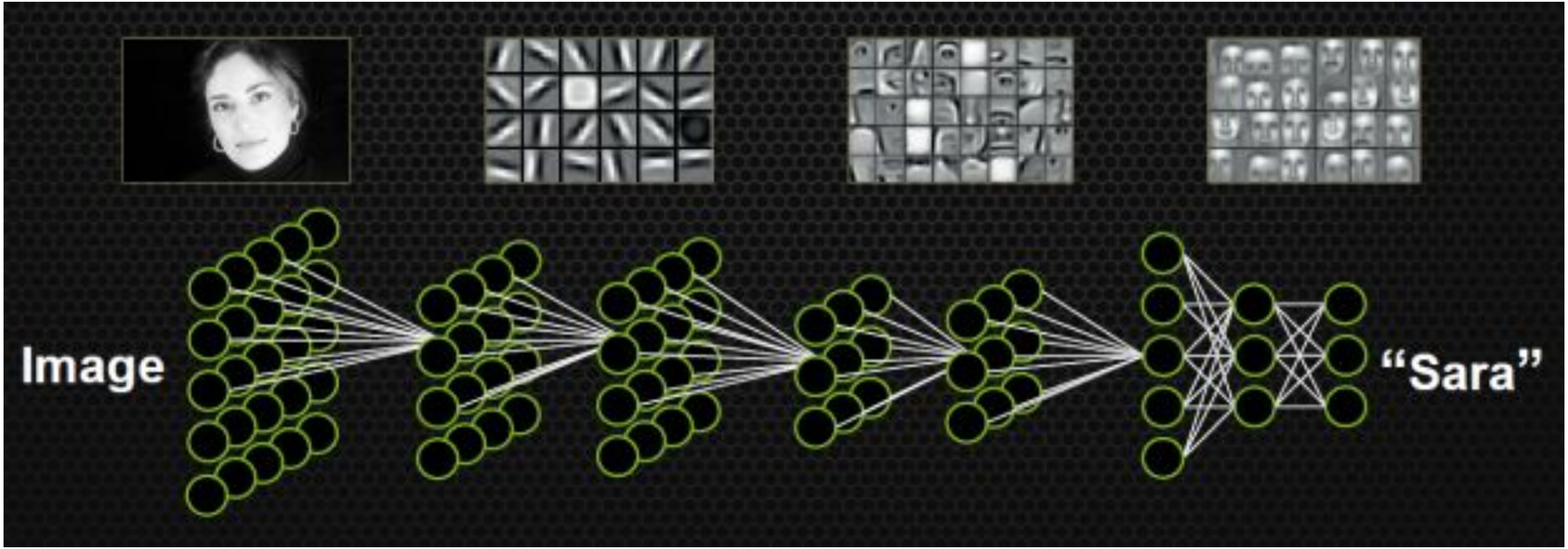
- **Fashion MNIST with UI:**

  https://colab.research.google.com/drive/1hNiZWcK-YxMAHX2e_DRH8nttKolyLWw5?usp=sharing

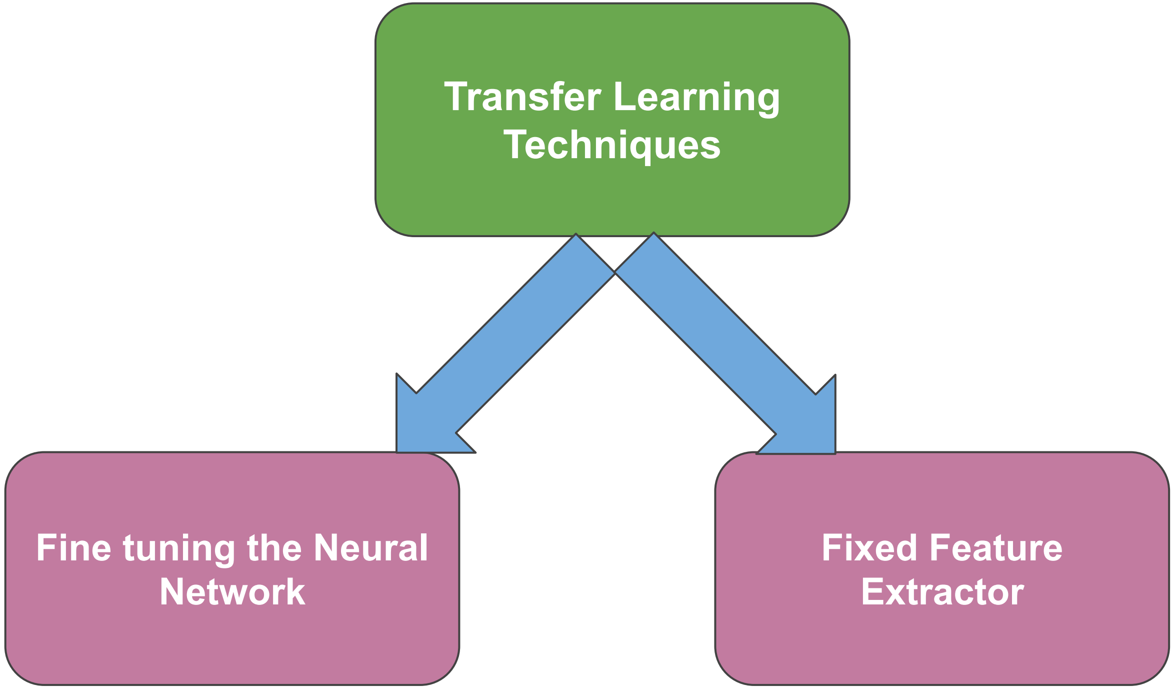
Convolutional Neural Network



Artificial Neural Network



Transfer Learning Techniques



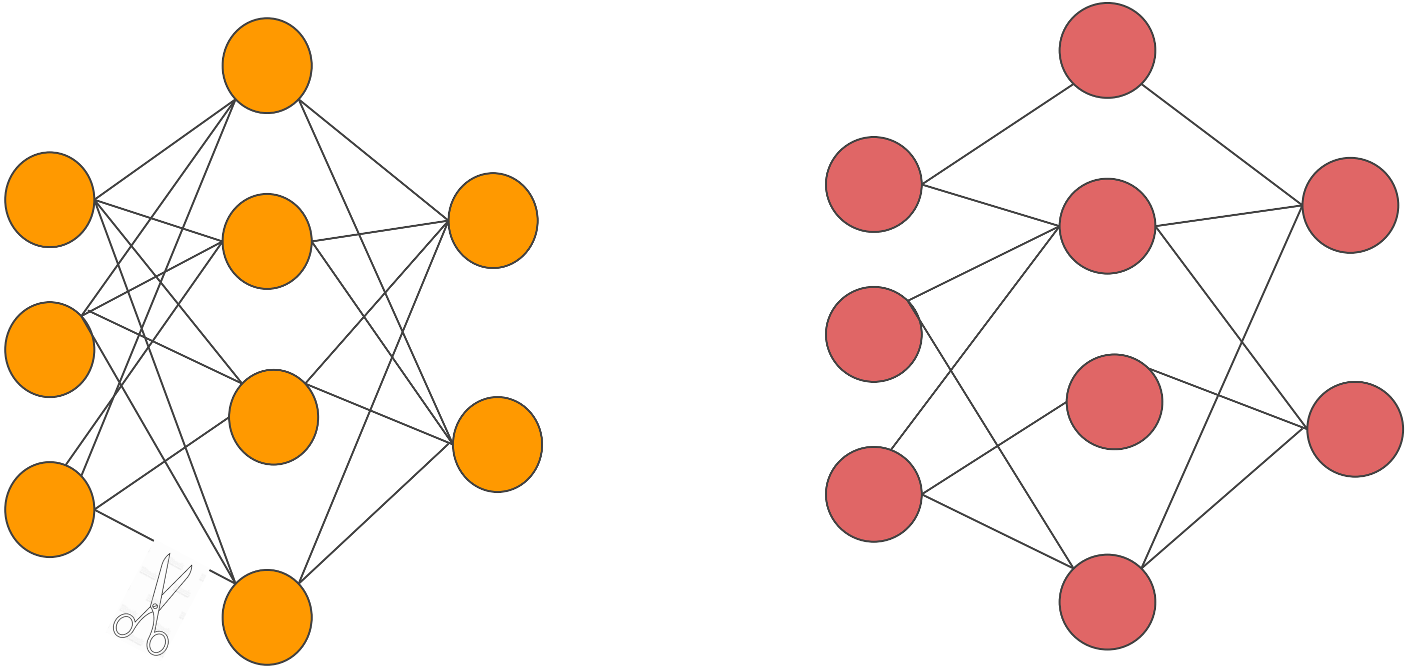
Transfer Learning Techniques

Fine tuning the Neural Network

Fixed Feature Extractor

Pruning

https://colab.research.google.com/github/pytorch/tutorials/blob/gh-pages/_downloads/f40ae04715cdb214ecba048c12f8dddf/pruning_tutorial.ipynb



Hands On Session

- **Transfer Learning - Fine Tuning:**

  https://colab.research.google.com/drive/1YQhS1vXOXPdTEP0XSXpQ7PRvYYLgKH6K?usp=sharing

- **Transfer Learning Fixed Feature Extractor:**

  https://colab.research.google.com/drive/1d0T00Dfdq-frLnI5s2vlcLw2iXNWizH0?usp=sharing

- **Pre-Trained VGG Model to Classify Objects:**

  https://colab.research.google.com/drive/13V0gWOc2ImOBRlnig-hC_o56veJHhee0?usp=sharing

- **Pruning Example:**

  https://colab.research.google.com/github/pytorch/tutorials/blob/gh-pages/_downloads/f40ae04715cdb214ecba048c12f8dddf/pruning_tutorial.ipynb

NLP UseCases

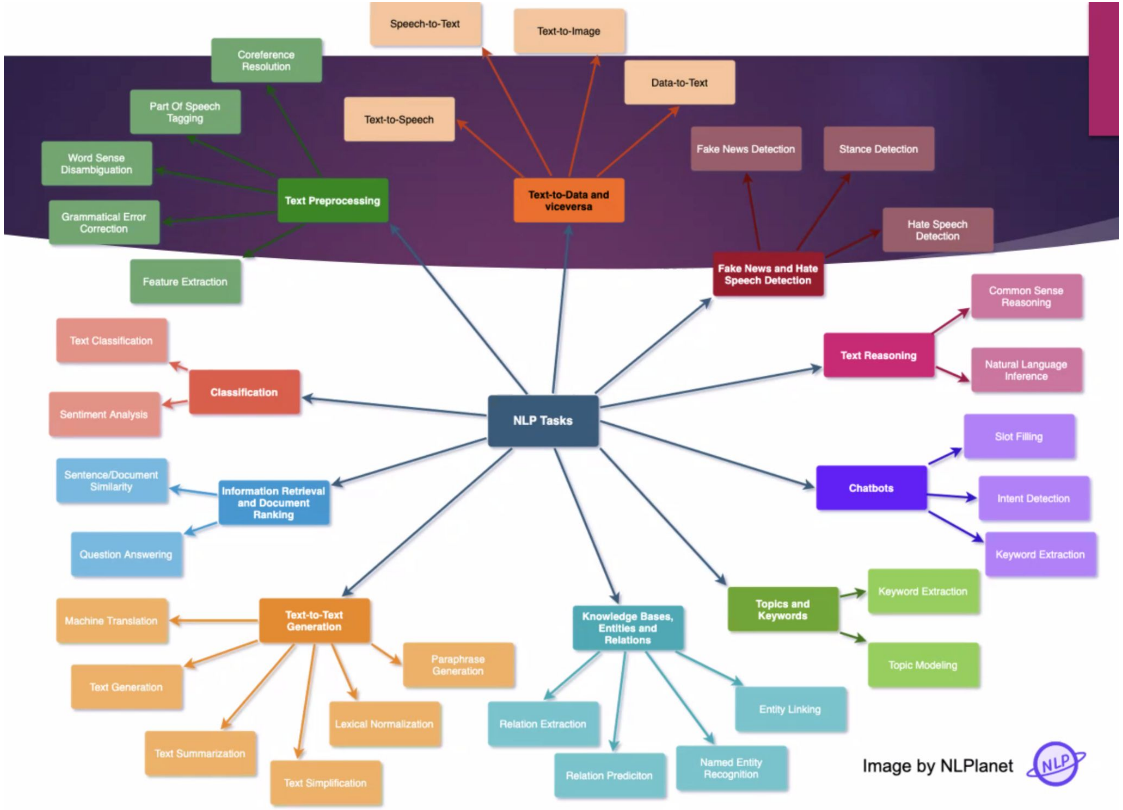
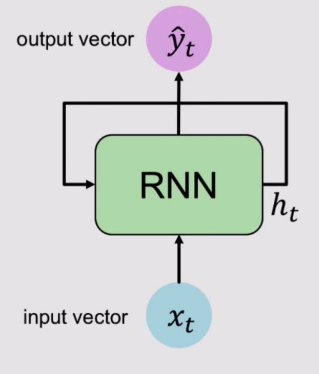
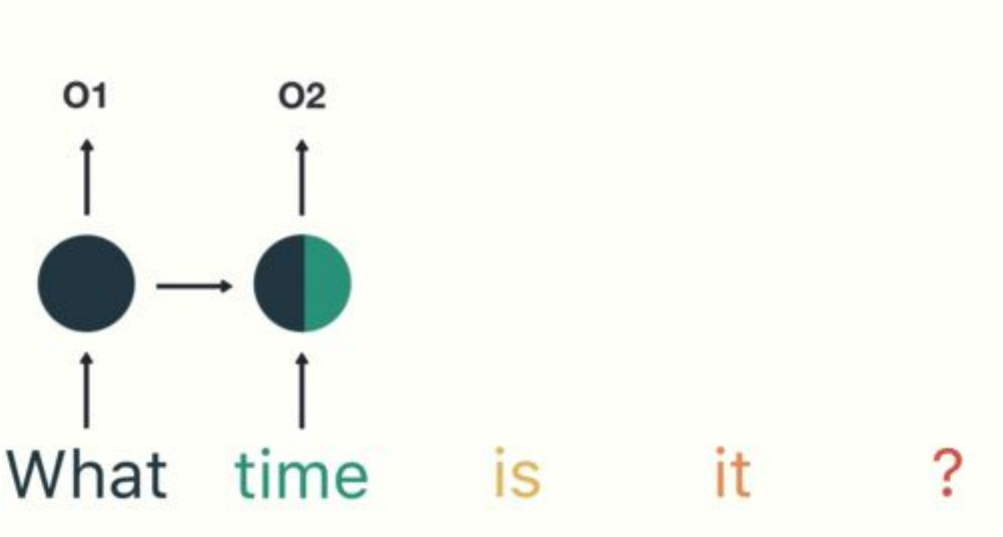


Image by NLPlanet

Recurrent Neural Network

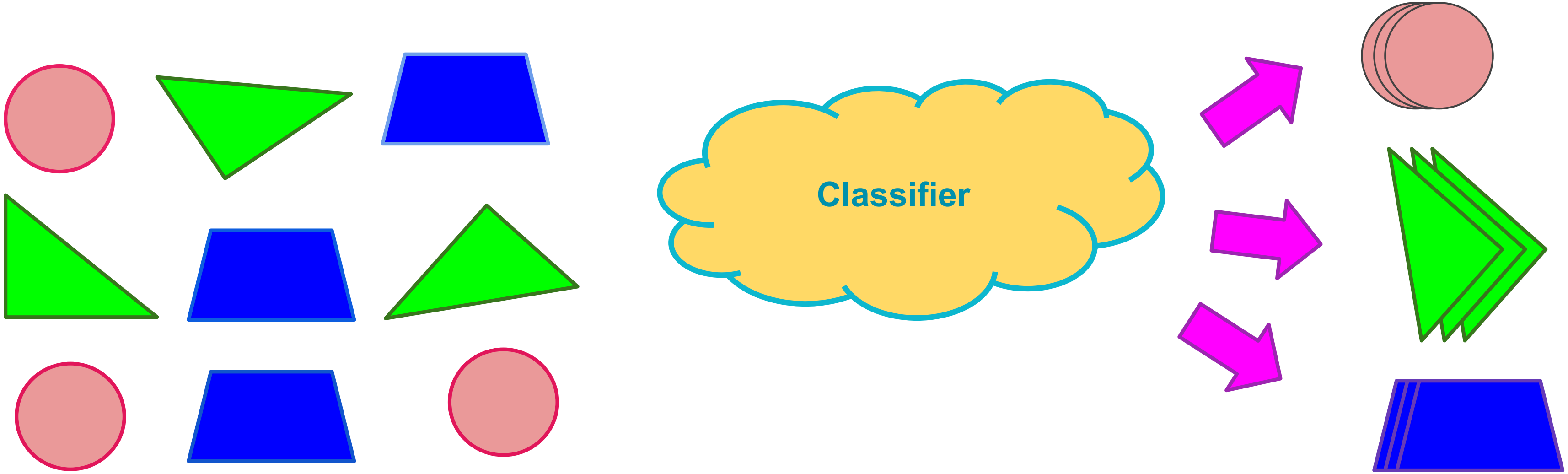
- RNN captures the sequential information present in the input data i.e. dependency between the words in the text while making predictions
- We can use recurrent neural networks to solve the problems
    1. Text Series Data
    2. Text Data
    3. Audio Data



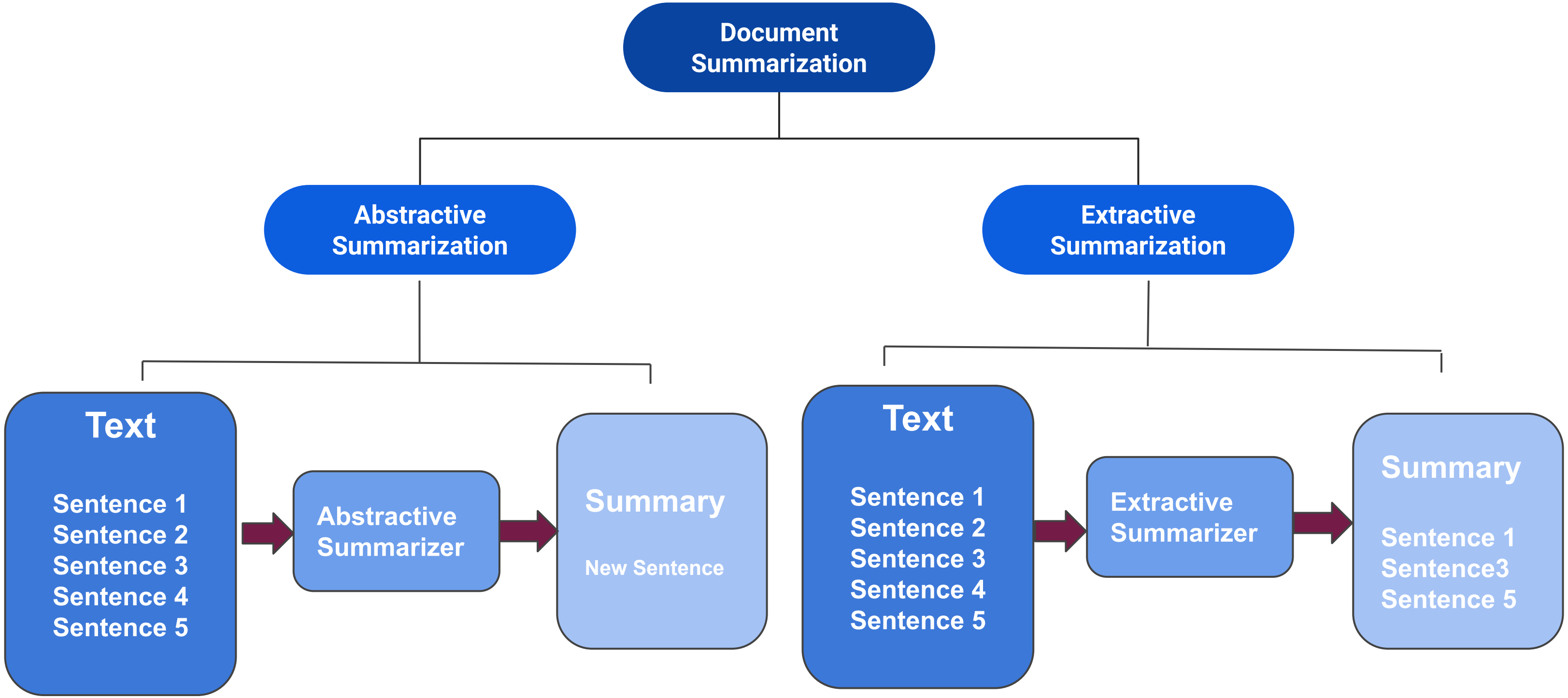


Naive Bayes Classifier

- It is a probabilistic classifier, which means it predicts on the basis of the probability of an object.
- Some popular examples of Naïve Bayes Algorithm are
  a. Spam Filtration
  b. Sentimental Analysis
  c. classifying articles.



Document Summarization



Document Summarization

Abstractive Summarization

Extractive Summarization

Text

Sentence 1
Sentence 2
Sentence 3
Sentence 4
Sentence 5

Abstractive Summarizer

Summary

New Sentence

Text

Sentence 1
Sentence 2
Sentence 3
Sentence 4
Sentence 5

Extractive Summarizer

Summary

Sentence 1
Sentence3
Sentence 5

Hands On Session - NLP

- **Text Classification :**

  https://colab.research.google.com/drive/1XFOKQrLRQccOQqM9U6EOfu0lhMH-jGia

- **Supervised Classification :**

  https://colab.research.google.com/drive/1-xP3cfve_WB1VF4gv03Eu4hJOs9rs8pk?usp=sharing#scrollTo=p4sMTQMYe93N

- **Document Summarization :**

  https://colab.research.google.com/drive/1e63vED6sIXd2njFnWhgLo05uW8-CzvG8#scrollTo=nlc2xSt-GadN

- **Language Detection :**

  https://colab.research.google.com/drive/1S5xolB8NNFnwEHvvoRP2YWy2i3nUHLFO

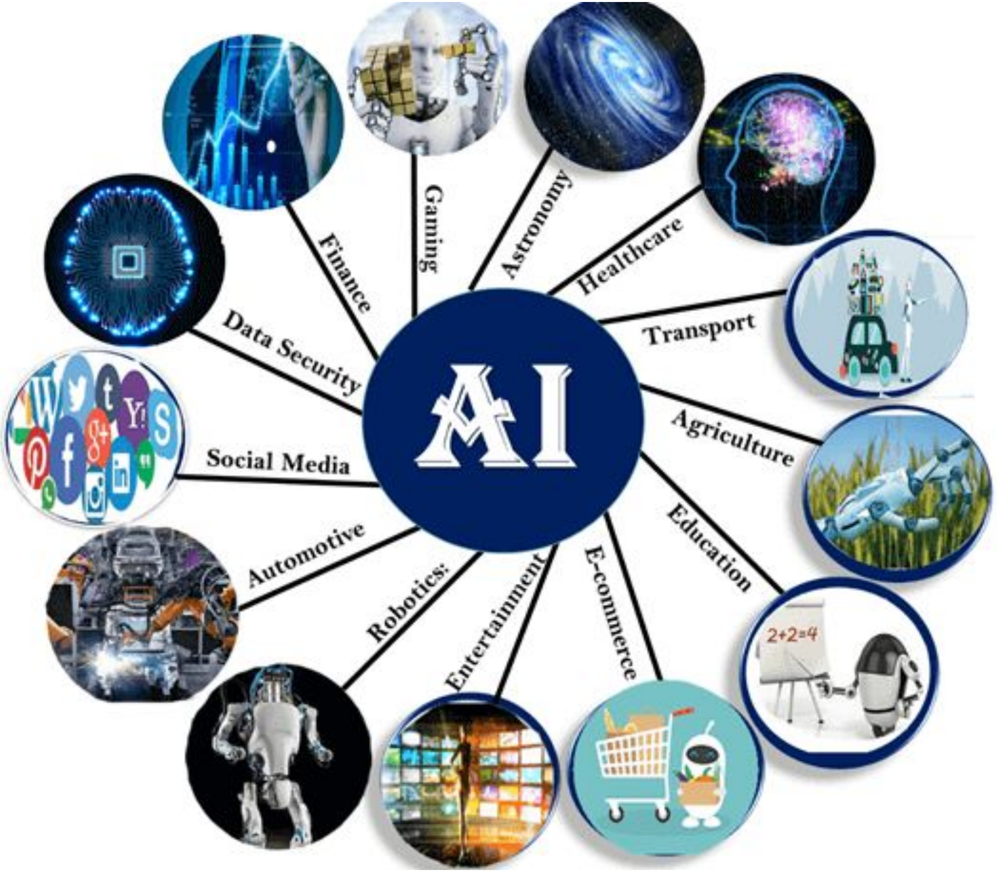
- **Sentence Similarity :**

  https://colab.research.google.com/drive/1R-Xh8XPMq7fBrWnySPejsHJ6pYwLXBsz?usp=sharing

- **Question Answering :**

  https://colab.research.google.com/drive/1uY6LgbCYQqVBEg-8xDTZZNYx-GnYCrim

Applications



- PEOPLE COME UP WITH IDEAS AND DISCUSS HOW MAXELERATOR CAN HELP

Thank You