Machine Learning With Google Cloud

Machine Learning With Google Cloud

GCP Basics

- Introduction to GCP
- Regions & Zones
- Create GCP Free Trial Account

Machine Learning Basics

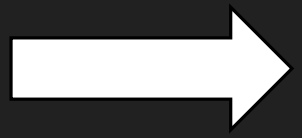
- Introduction to Machine Learning
- Machine Learning vs Traditional System of computing
- Types of Machine learning
- Machine Learning Algorithm
- Machine Learning Workflow

Introduction to Machine Learning

BY ANKIT MISTRY

Simple Mapping Problem

x	y
1	1
2	2
3	3
4	4
6	6



Can you think of mathematical relation exist between x & y.

$$y = x$$

Simple Mapping Problem Ctd...

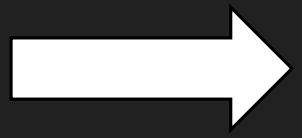
x	y
1	2
2	3
3	4
4	5
6	7

Can you think of mathematical relation exist between x & y.

$$y = x + 1$$

Simple Mapping Problem Ctd...

x	y
1	10
2	20
3	30
4	40
6	60



Can you think of mathematical relation exist between x & y.

$$y = 10 * x$$

Simple Mapping Problem Ctd...

x1	x2	y
1	2	3
2	3	5
3	4	7
4	5	9
6	7	13

Can you think of mathematical relation exist between x1, x2 & y.

$$y = x1 + x2$$

Machine Learning

x1	x2	x3	...	x1000	y
..	..	..	..	..	..
..	..	..	..	..	..
..	..	..	..	..	..
..	..	..	..	..	..
..	..	..	..	..	..

$$y = f(x1, x2, \ldots, x1000)$$

Machine Learning

$$x1, x2, x3, \ldots, x1000$$

$$\begin{pmatrix} 0 & 3 & 1 & 0 & 2 & 3 & 8 & 1 & 1 & 3 \\ 1 & 1 & 0 & 0 & 7 & 1 & 2 & 2 & 3 & 3 \\ 1 & 2 & 2 & 0 & 0 & 6 & 7 & 1 & 2 & 2 \\ 1 & 2 & 3 & 10 & 0 & 4 & 6 & 1 & 0 & 5 \\ 3 & 2 & 2 & 1 & 4 & 3 & 2 & 1 & 6 & 0 \\ 7 & 4 & 4 & 5 & 3 & 9 & 6 & 1 & 6 & 1 \\ 7 & 1 & 1 & 5 & 2 & 8 & 9 & 1 & 3 & 6 \\ 5 & 0 & 1 & 6 & 2 & 0 & 0 & 0 & 1 & 5 \\ 1 & 6 & 3 & 3 & 4 & 6 & 2 & 0 & 1 & 1 \\ 1 & 2 & 2 & 4 & 1 & 1 & 3 & 0 & 8 & 2 \end{pmatrix}$$

$$y = Cat$$

$$y = f(x1, x2, \ldots, x1000)$$

Machine Learning

- Machine Learning is finding such complex mathematical relation between xs and ys.
- Machine Learning helps to find hidden insight about data without doing explicit programming
- Input to output mapping
- xs to ys
- X is input data – feature vector
- Y is output - label

Machine Learning Formally

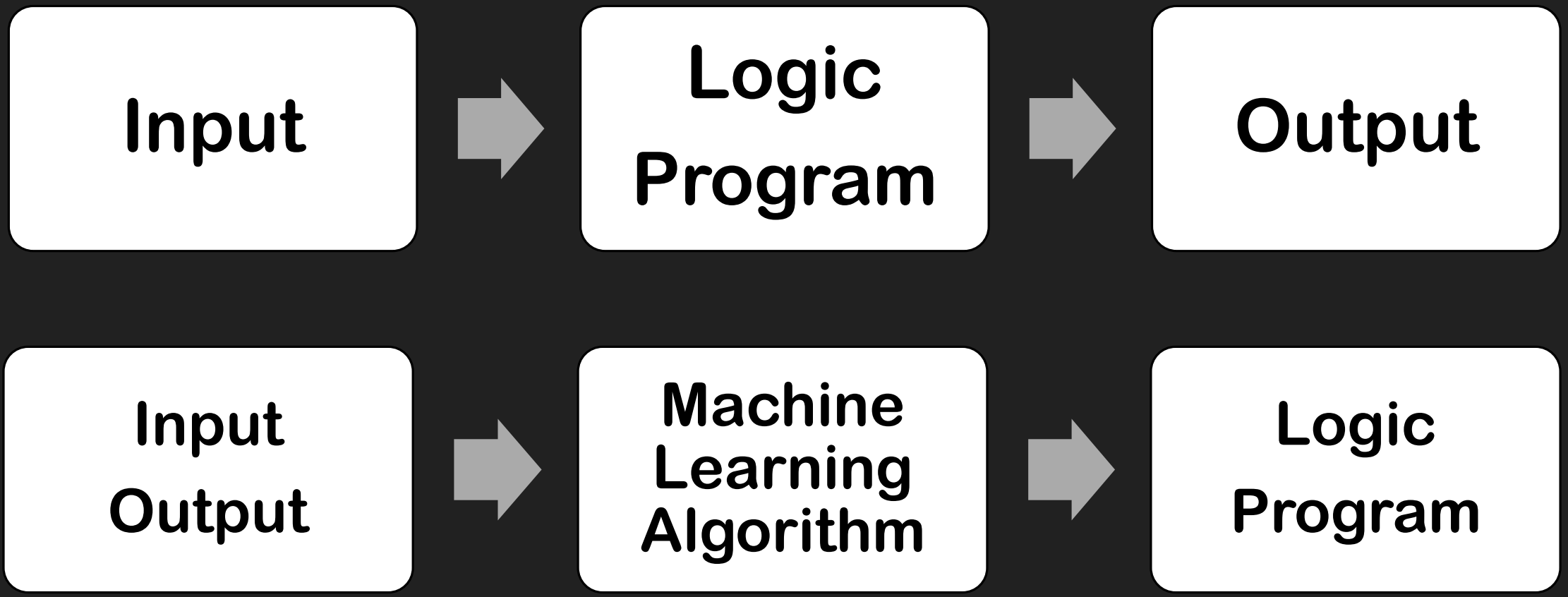
In 1959, Arthur Samuel defined machine learning as a

"Field of study that gives computers the ability to learn without being explicitly programmed".

Machine Learning vs Traditional System of computing

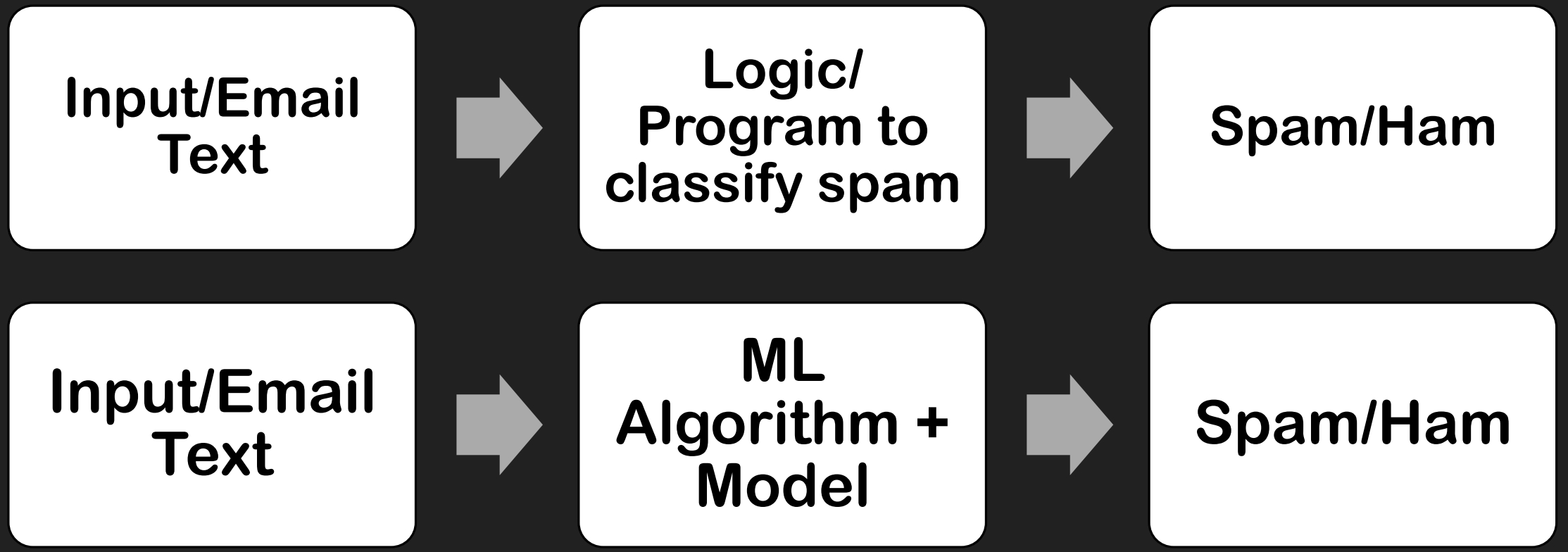
BY ANKIT MISTRY

Traditional system vs ML



Example

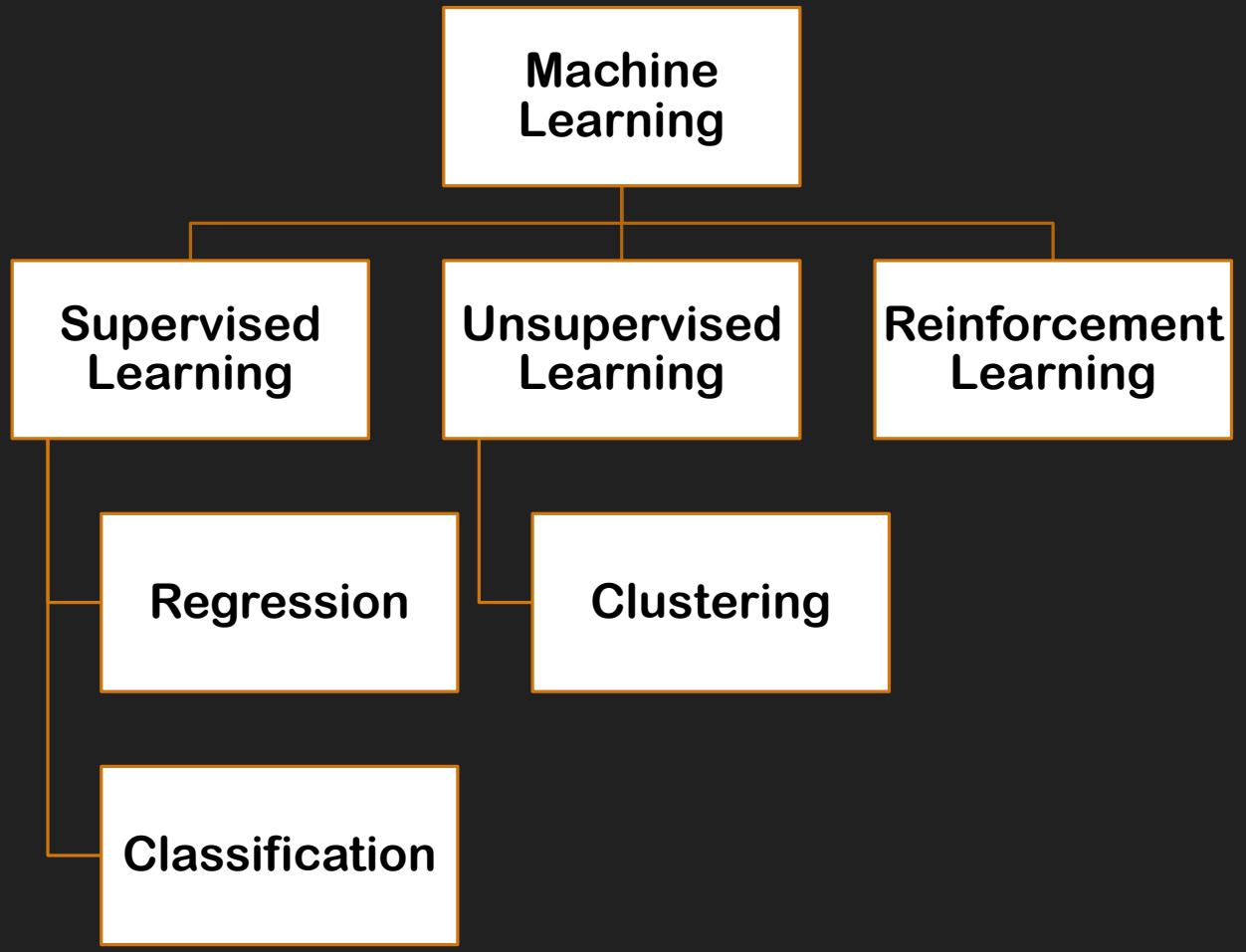
Spam Email Classification



Types of Machine learning

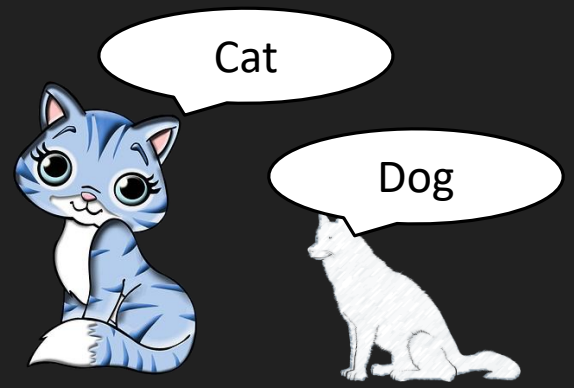
BY ANKIT MISTRY

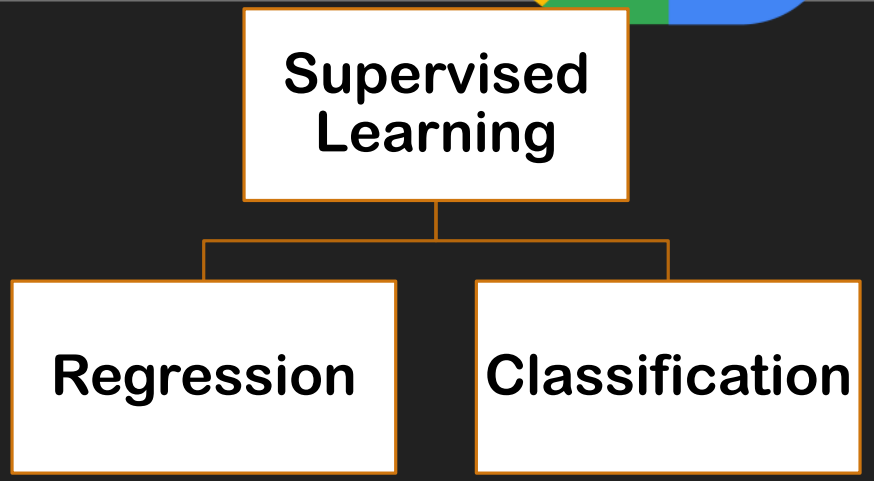
Types of ML System



Supervised Learning

Output label is given.



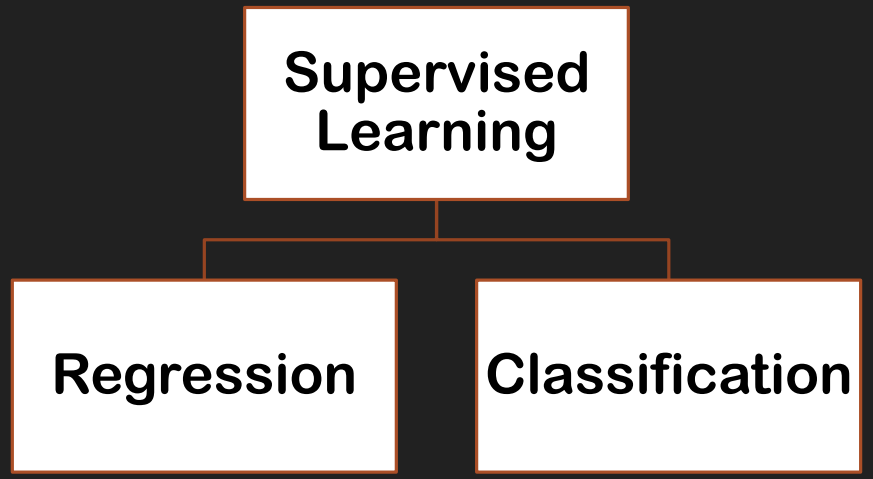


$$y = f(x): \;\; y \;\&\; x \; both \; are \; given$$

Regression & Classification

Regression

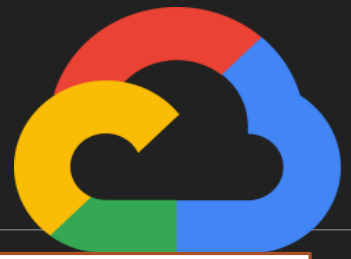
- Output is **continuous**
- Example :
  - Predict House Price
  - Predict Age of person



Classification

- Output is **discrete** : Finite number of category
- Example :
  - Predict Male or Female
  - Predict transaction is fraud or not
  - Predict Dog's breed

Unsupervised Learning

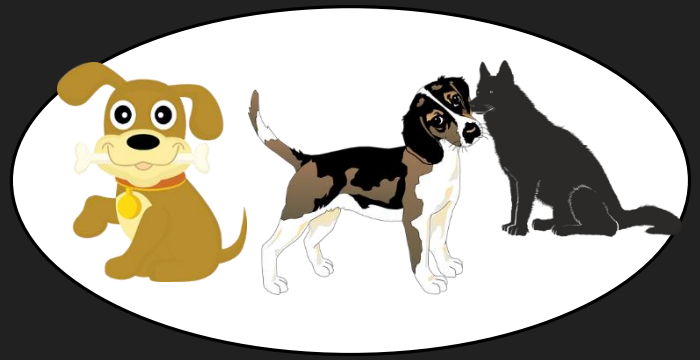


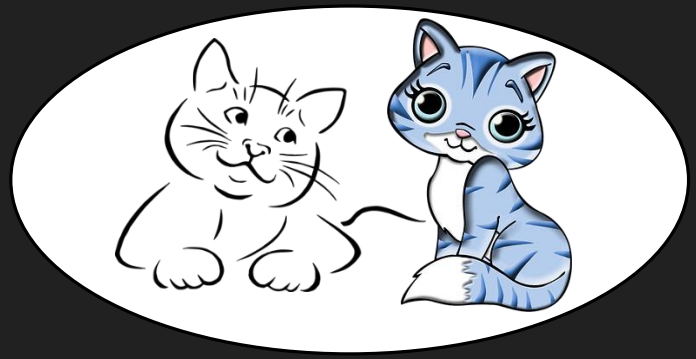
Unsupervised Learning

Clustering

Output label is **not** given.

$$y = f(x): \ \ only\ x\ is\ given$$

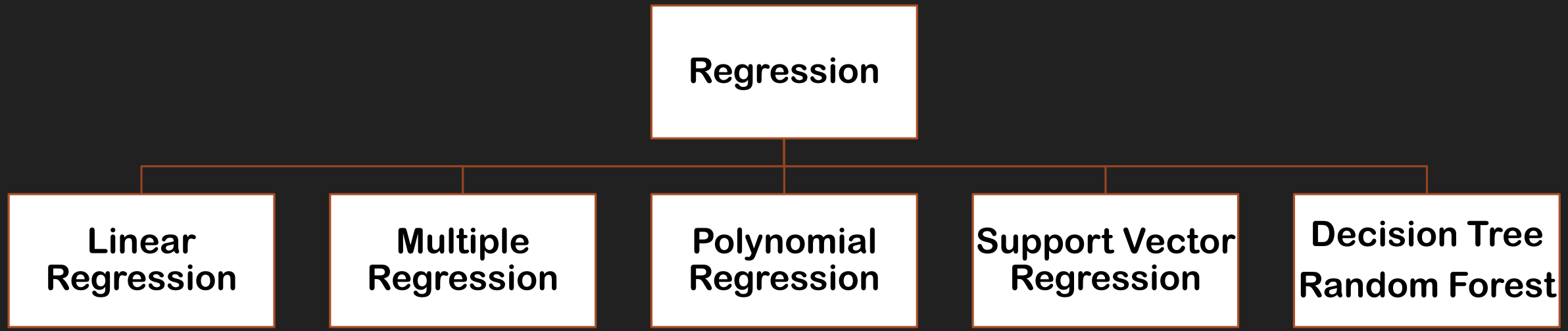




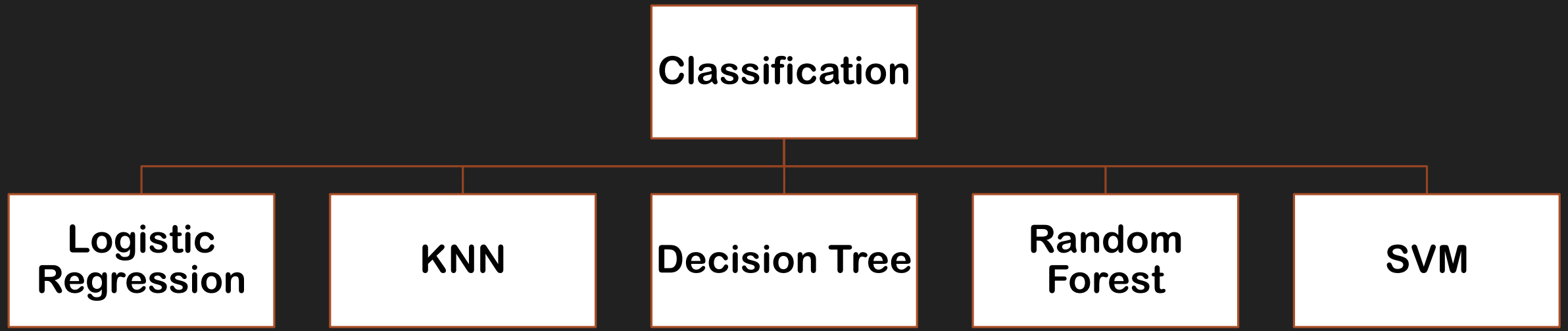
Machine Learning Algorithm

BY ANKIT MISTRY

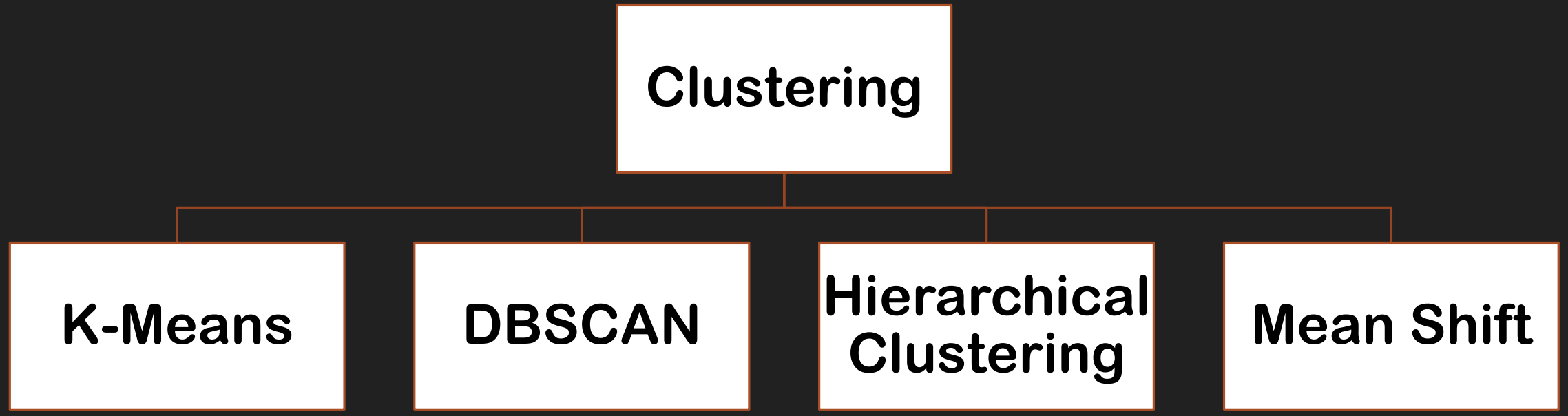
Regression



Classification



Clustering



Machine Learning Workflow

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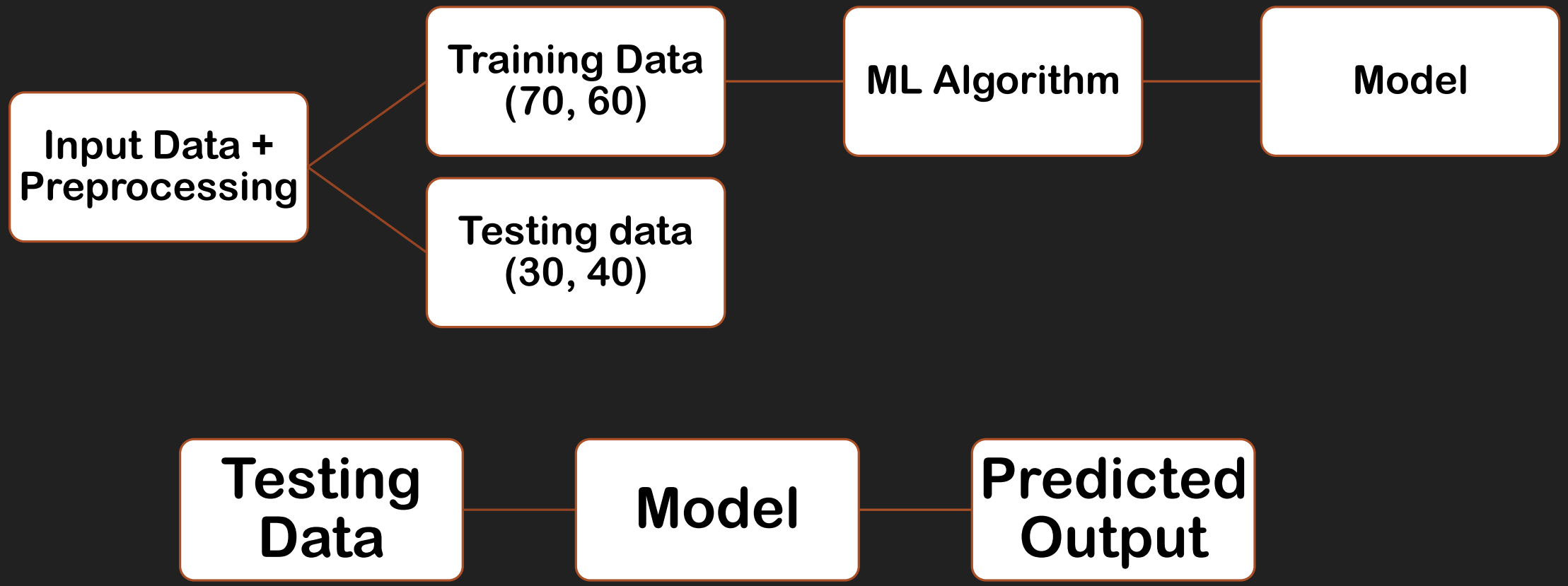
Machine Learning Process



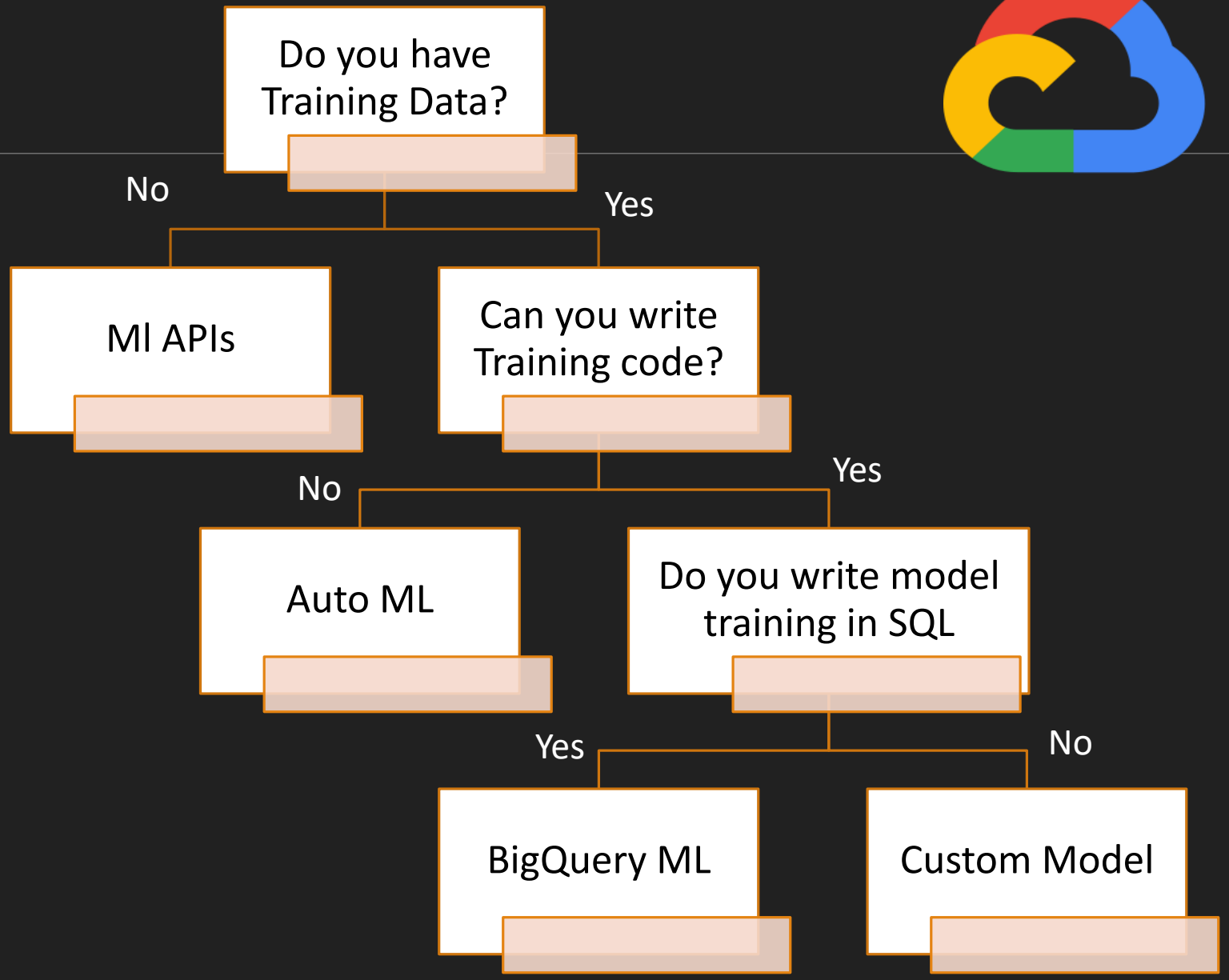
Helper GCP Services for Machine Learning

- Google Compute Engine
- Identity & access management – IAM
- Google Cloud Storage

GCP Product for ML

- ML API – pre-built API for some common use case
- Auto ML
- Custom Machine Learning
- Different Vertex AI Features
- BigQuery ML

Which Machine Learning service to use When



Google Machine Learning API (Pre Built Model)

BY ANKIT MISTRY

Pre-Trained Model

- Google has huge amount of data
- Google has already trained ML/AI algorithm to build model
- For generic use case like
  - Object recognition/detection – Vision API
  - OCR
  - Speech to Text
  - Language Translation
  - NLP API – to get insight from natural language

Vision API	Natural Language API	Speech <-> Text API	Translation API	Video API

- You can take advantage of pre-built model.
- No Training required from customer
- Use already built Rest API for above use cases

Google Vision API

BY ANKIT MISTRY

Google Vision API

- Vision API offers powerful pre-trained machine learning models through REST and RPC APIs.
- Assign labels to images and quickly classify them into millions of predefined categories.
- Vision API can
  - Text, Landmark, Logo, Label detection,
  - Object localization, Crop hint detection, Safe Search, Face detection
- If your requirement is from above use case – Vision API is best go for it.
- You want to predict, classify on your custom images - Vision API is not right solution
  - Flower Type classification
  - Dog Breed Classification
- Pricing – Let's explore
  - https://cloud.google.com/vision/pricing

Access Vision API

- Label Detection from Image
  - Try in Browser - https://cloud.google.com/vision/docs/drag-and-drop
  - API Explorer - https://cloud.google.com/vision/docs/detect-labels-image-api
  - Raw Rest API – with curl utility
  - gcloud tool
  - Python code
- Let’s check each Feature one by one.
  - Text detection from Image, Document
  - Landmark detection
  - Logo detection, Label detection
  - Image properties
  - Object localization
  - Crop hint detection
  - Web entities and pages
  - Safe Search
  - Face detection

Natural Language API

BY ANKIT MISTRY

Natural Language API

- Natural Language API offers powerful pre-trained machine learning models
- Natural Language API can
  - Analyzing Sentiment, Entities, Syntax, Entity Sentiment, content classification
- If your requirement is from above use case – Natural Language API is best go for it.
- You want to classify text on custom text - Natural Language API is not right solution- Need to go for custom training
  - Custom text – your organization internal document
- Pricing – Let’s explore
- https://cloud.google.com/natural-language/pricing

Access Natural Language API

- Entity analysis from text
  - Try in Browser
  - gcloud tool
  - API Explorer – Raw Rest API
  - Python code
    - pip install google-cloud-language

Feature Type	Description
Entity Analysis	Identify entities and label by types such as person, organization, location, events, products and media.
Sentiment Analysis	Understand the overall sentiment expressed in a block of text.
Entity Sentiment Analysis	Understand the sentiment for entities identified in a block of text.
Syntax Analysis	Extract tokens and sentences, identify parts of speech (PoS) and create dependency parse trees for each sentence.
Content Classification	Identify content categories that apply to a block of text.

Speech ⇔ Text API

- Speech to Text API
  - Accurately convert speech into text using an API powered by Google's AI technologies.
  - 125 languages support
  - Streaming speech recognition
  - Content filtering
  - Automatic punctuation
  - https://cloud.google.com/speech-to-text#section-2
- Text to Speech API
  - Convert text into natural-sounding speech using an API powered by Google's AI technologies.
  - https://cloud.google.com/text-to-speech#section-2

Auto Machine Learning

- AutoML – Auto Machine Learning
- Your use case is not generic
- You have some custom requirement
- Vision API – recognize shoes
- Auto ML – Different types of shoes detection
  - Adidas, Nike shoes
- Throw your data & GCP will create best model for you
- State-of art Transfer learning technology
- Throw your data & Google AI will create model

Auto ML Vision

- Image Classification
- Shoe vs Sandal vs Boot Dataset
- https://www.kaggle.com/datasets/hasibalmuzdadid/shoe-vs-sandal-vs-boot-dataset-15k-images
- 3 Class classification



- 100 Images per class for training
- Prepare Data, Training, Deploy & Test

Auto ML on Text data

BY ANKIT MISTRY

Auto ML on Tabular data

BY ANKIT MISTRY

Custom Training

BY ANKIT MISTRY

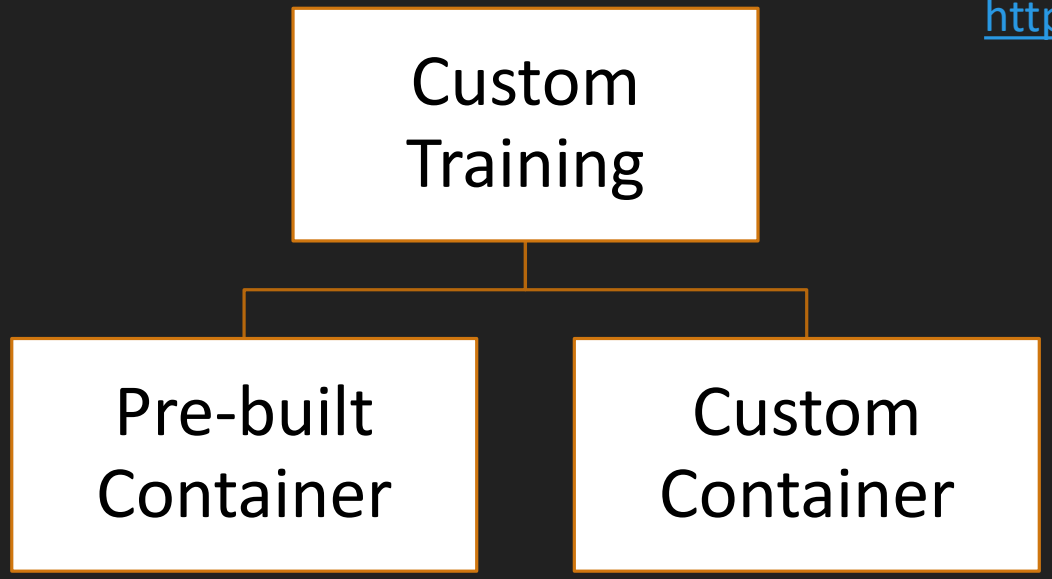
Custom Training

- You have your own dataset
- You want to train your own model
- You have team of data scientist
- They want to write own algorithm based on
  - Scikit-learn, XGBoost
  - Tensorflow
  - PyTorch Framework
- How to do
  - Spin Notebook instance with vertex AI workbench
- Two ways Custom Training can be done

Custom Training

- There are Pre-built container for Scikit-learn, XGBoost, Tensorflow, PyTorch Framework
- If your use case satisfy above requirement, & perform training in Python go for Pre-built container
- You want to preform training other than python or from above framework, custom container is solution.

https://cloud.google.com/vertex-ai/docs/training/pre-built-containers



Choose Training method

AutoML vs Custom Training

https://cloud.google.com/vertex-ai/docs/start/training-methods

Vertex AI

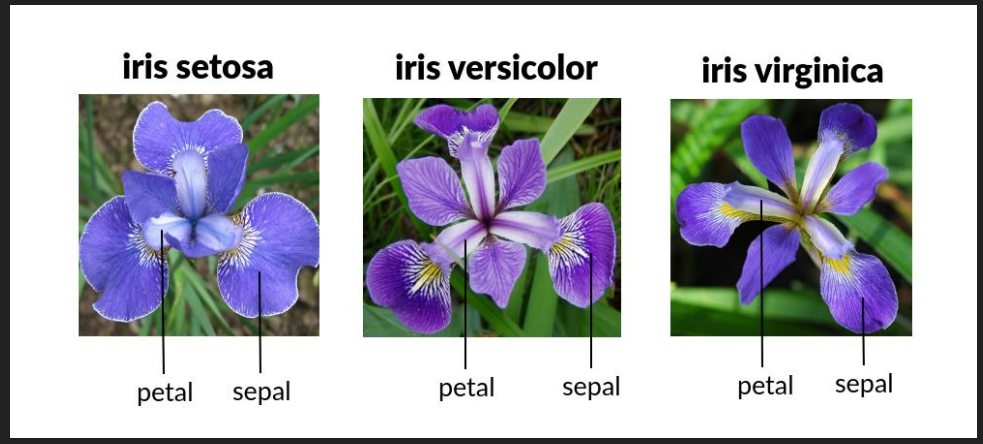
BY ANKIT MISTRY

Vertex AI

- Unified Platform to Build, deploy, and scale machine learning (ML) models inside GCP
- https://cloud.google.com/vertex-ai

Dataset for Custom Training

- Iris Flower dataset
- 4 features
  - sepal length, sepal width, petal length, petal width
- Prediction – 3 types of flower
  - setosa, virginica, verci-color
- 150 samples
- https://www.kaggle.com/datasets/arshid/iris-flower-dataset
- Training
  - with custom container way
  - with Pre-built container



Custom Container

- Dataset – Explore
- Setup Cloud Storage bucket
- Create Notebook instance
- Upload Data to bucket
- Training code in sklearn/tensorflow (or any other framework)
- Make Docker container from code
- Push Docker image to artifact registry
- Setup Custom Training with Custom Container
- Import Model from bucket to Model registry
- Deploy to Endpoint
- Prediction

Prediction

- Online Prediction
  - When you need immediate prediction result
  - model must be deployed
- Batch Prediction
  - when you do not want immediate result
  - Run as Job – asynchronous requests
  - Handle high volume of request at a time
  - no need to deploy model
  - want to process accumulated data by using a single request

Pre-built Container

- Dataset – Explore
- Setup Cloud Storage bucket
- Create Notebook instance
- Upload Data to bucket
- Training code in sklearn/tensorflow (or any other framework)
- train.py, setup.py, __init__.py
- Setup Custom Training with Pre-built Container
- Import Model from bucket to Model registry
- Deploy to Endpoint
- Prediction

THANK YOU