Jawaharlal Nehru Technological University Hyderabad

School of Continuing and Distance Education (DILT)

Certificate course on DS PP

Data Science with Python Programming

Session 1, 09 Oct 2023

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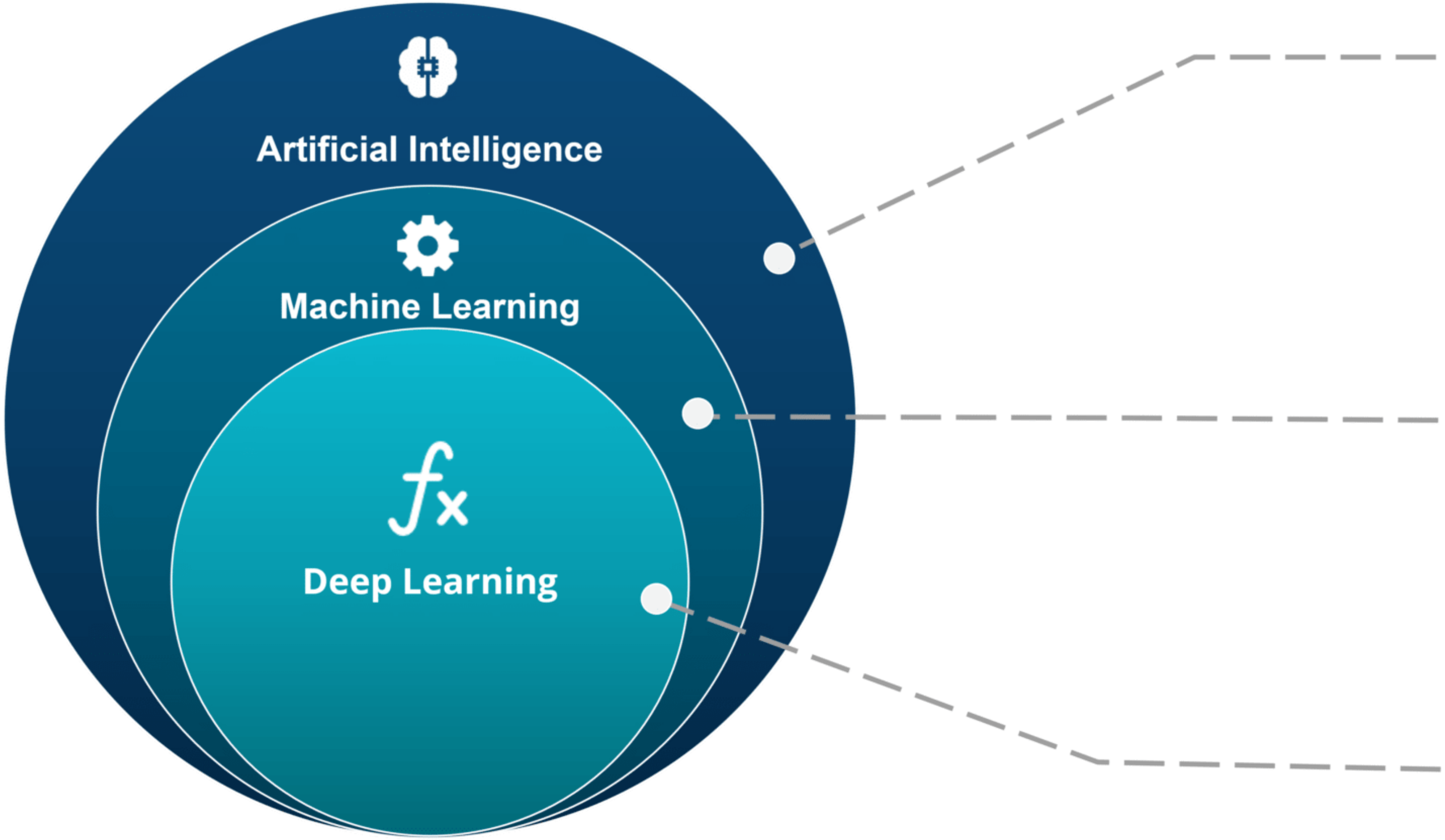
AI / ML / DL / DS

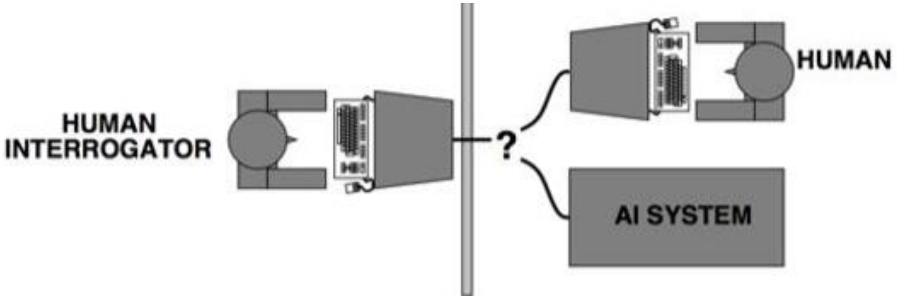


ARTIFICIAL INTELLIGENCE
A technique which enables machines to mimic human behaviour

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

Turing Test approach



- A computer passes the test of intelligence, if it can fool a human int

- The computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or not.

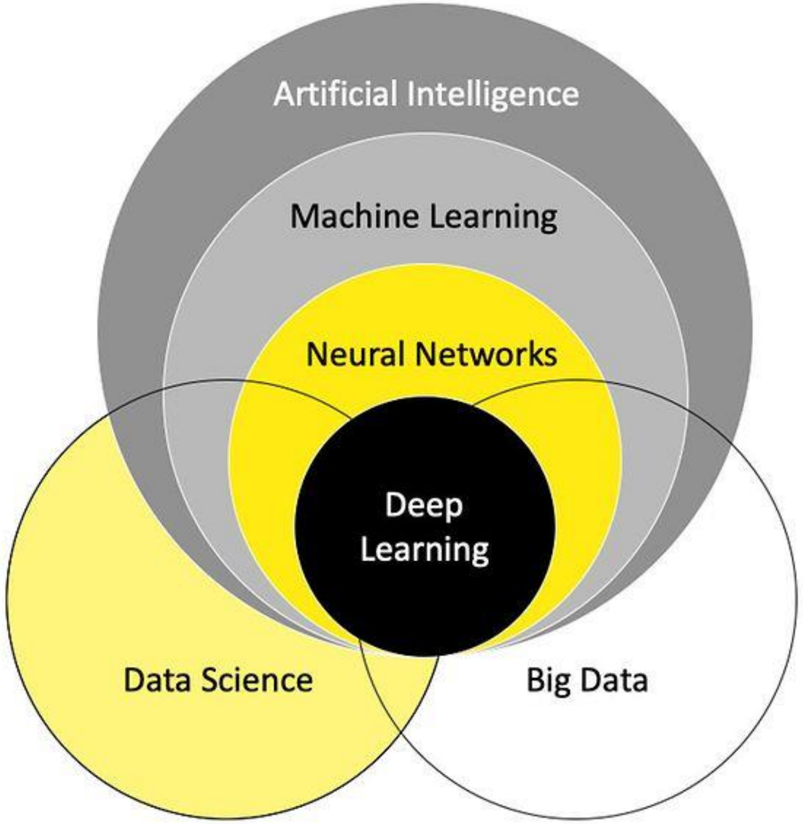
- The computer would need to possess the following capabilities:
  - ✓ **natural language processing** to enable it to communicate successfully in English,
  - ✓ **knowledge representation** to store what it knows or hears;
  - ✓ **automated reasoning** to use the stored information to answer questions and to draw new conclusions;
  - ✓ **machine learning** to adapt to new circumstances and to detect and extrapolate patterns
  - ✓ **computer vision** to perceive objects, and
  - ✓ **robotics** to manipulate objects and move about.

Result of Turing Test

- If the interrogator can not reliably distinguish the human from the computer

- Then the computer does posses artificial intelligence

Data and Data Science

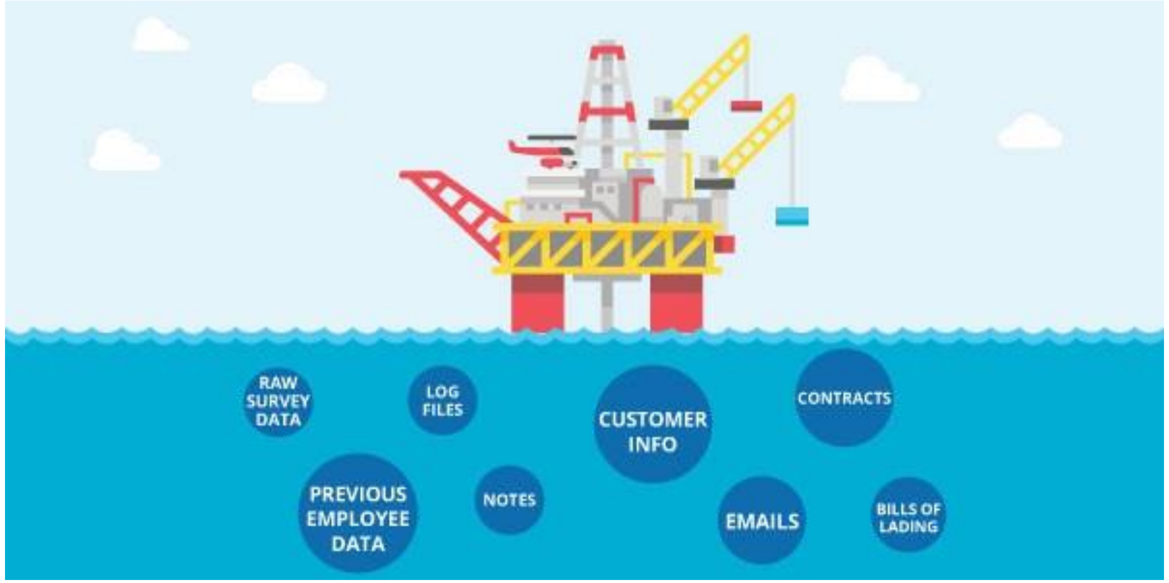


Data

- Quantities 1,2,3,…100,…1000…
- Characters A, B, C…Z, a, b, c,…z
- Symbols ! @ # $ % & * ()…
- Quantities , Characters, Symbols are stored in digital format.
- Data → plural Datum→ singular
- Data is Every Where
- Machines, Robots, Sensors, Our self are products of data.
- All roads lead to **DATA.**

Numerous kinds of data

- **Text data** (.doc, .txt, .pdf…)
- **Excel data** (.csv, .tsv)
- **HTML data**
- **XML data**
- **JSON data**
- **Relational Database** (Oracle, MySql, Sqlite…)
- **Log files / Transactional data**
- **Sensors/Web servers**
- **Social Media data** (FB, Twitter, WhatsApp, YouTube…)
- **Image / Audio / Video / Signal….**

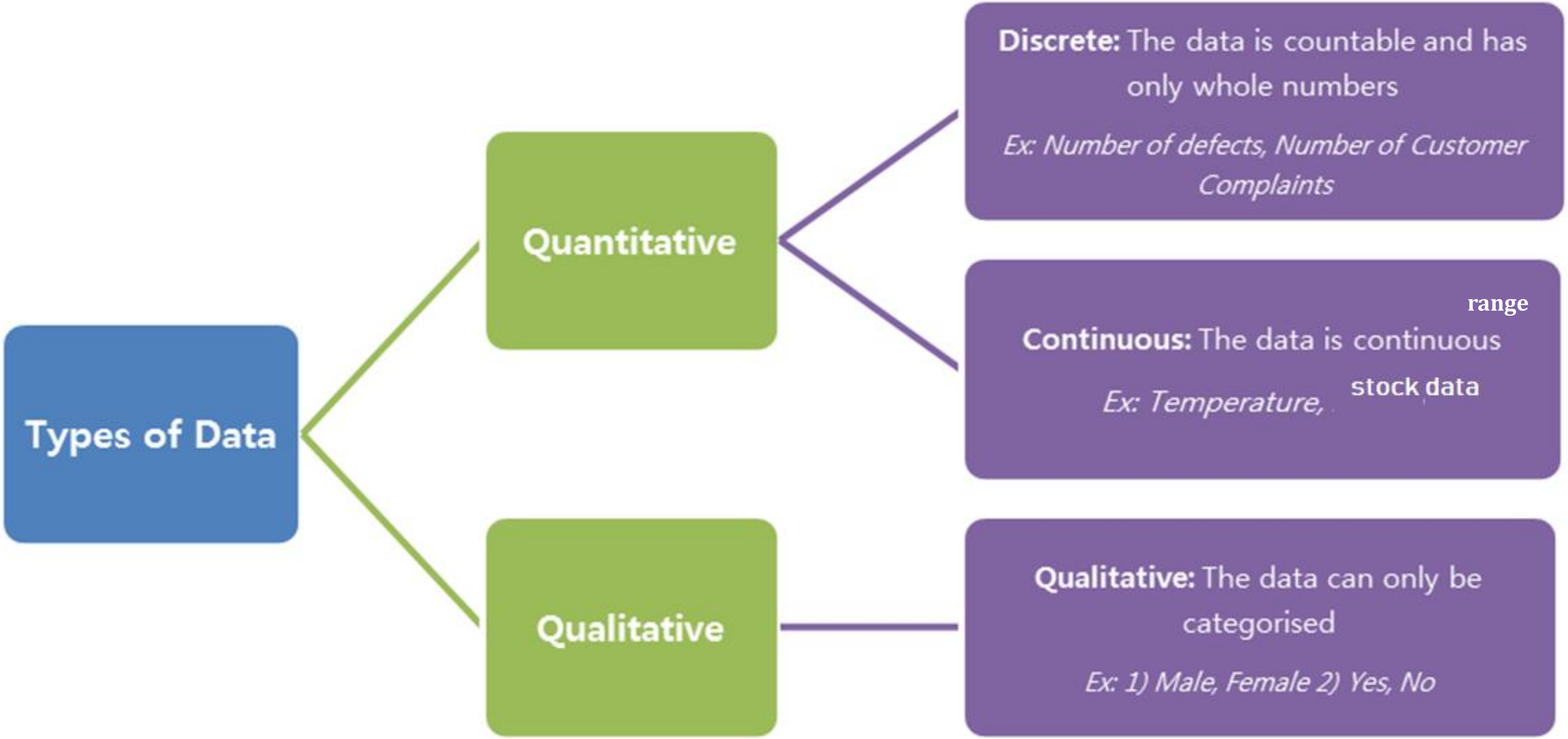


Data

Share of market activity
Changes in the activity of the active and passive market is uncertain. Established positive trends in various market segments.
Projected sales of main products in 2013
350
300
250
200
150
100
50
0
25%
75%
Passive market share

- Data is useful in a refined form.
  - Data to Information
  - Information to Knowledge

    (hidden knowledge/pattern/relationships/insights)
  - Knowledge to Decision making
  - Decision making to Result cycle.



Types of Data

Quantitative

Qualitative

Discrete: The data is countable and has only whole numbers

Ex: Number of defects, Number of Customer Complaints

range

Continuous: The data is continuous

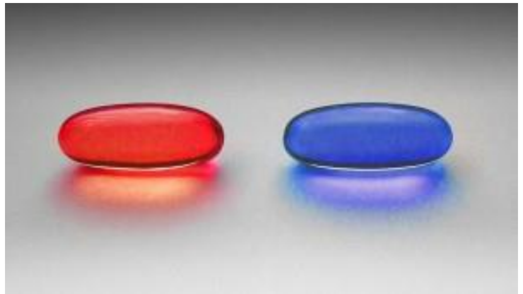
Ex: Temperature, stock data

Qualitative: The data can only be categorised

Ex: 1) Male, Female 2) Yes, No

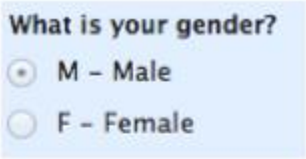
Qualitative data

Binary Data



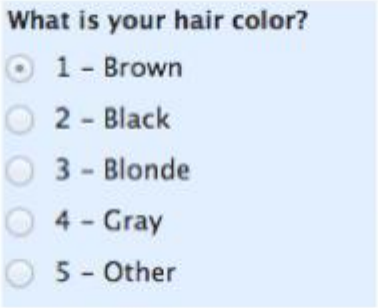
0 or 1
Toss of a coin
Switch on/off

Nominal Data



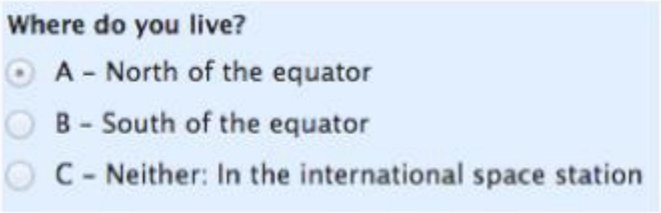
What is your gender?

● M – Male
○ F – Female



What is your hair color?

● 1 – Brown
○ 2 – Black
○ 3 – Blonde
○ 4 – Gray
○ 5 – Other

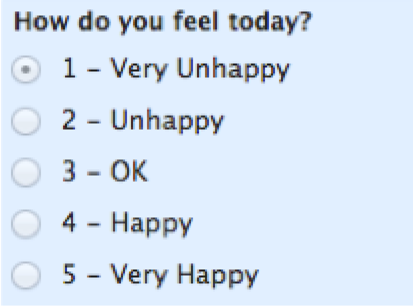


Where do you live?

● A – North of the equator
○ B – South of the equator
○ C – Neither: In the international space station

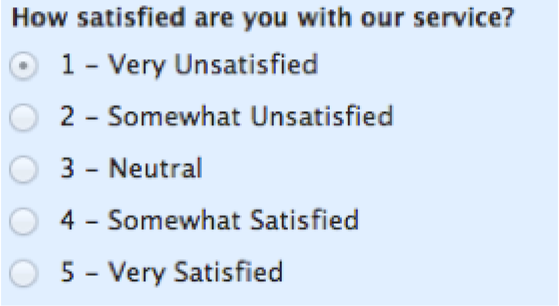
Data is not ordered.
cannot perform any quantitative mathematical operations, such as addition or division.

Ordinal Data



How do you feel today?

● 1 – Very Unhappy
○ 2 – Unhappy
○ 3 – OK
○ 4 – Happy
○ 5 – Very Happy



How satisfied are you with our service?

● 1 – Very Unsatisfied
○ 2 – Somewhat Unsatisfied
○ 3 – Neutral
○ 4 – Somewhat Satisfied
○ 5 – Very Satisfied

Data is ordered.
Typically measures of non-numeric concepts like satisfaction, happiness, discomfort, etc.

Types of Data

- **Structured data**
- **Unstructured data**
- **Semi Structured data**

Types of Data

Structured Data	Unstructured Data
Structured data is quantitative and is often displayed as numbers, dates, values, and strings.	Unstructured data is qualitative data and includes text, video, audio, images, and more.
Structured data is stored in rows and columns.	Unstructured data is stored as audio, text, and video files, or NoSQL databases.
Estimated 20% of business data.	Estimated 80% of business data
Stored in data warehouses.	Stored in applications, NoSQL databases, data lakes, and data warehouses.
Reveals patterns and trends that show you what’s happening.	Reveals patterns and trends that explain why something is happening.
Requires less storage space.	Needs more storage space.
Easy to analyze with tools like Excel.	Hard to analyze without AI tools.

Students for AI ML course

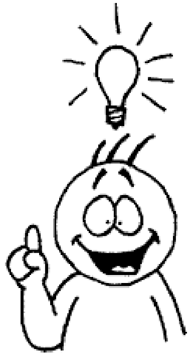
USA	China	USA	Sweden	China
Canada	China	Japan	Mexico	USA
China	Germany	India	India	Japan
USA	USA	USA	China	China
India	Japan	England	India	Japan
Englad	India	China	Mexico	USA
Mexico	USA	Canada	Pakistan	India
Japan	China	USA	Japan	Germany
China	India	India	China	China
Germany	Japan	China	USA	Japan

Think?

Students for AI ML course

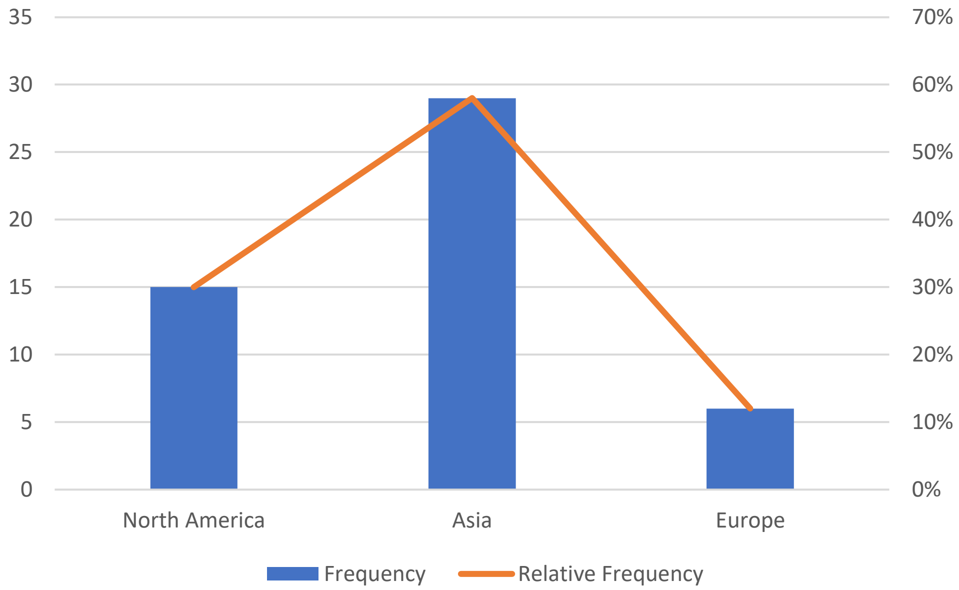
Country	Frequency	Proportion	Percent
Canada	2	0.04	4
China	12	0.24	24
England	2	0.04	4
Germany	3	0.06	6
India	8	0.16	16
Japan	8	0.16	16
Mexico	3	0.06	6
Pakistan	1	0.02	2
Sweden	1	0.02	2
USA	10	0.2	20
Total	**50**	**1**	**100**

Analyze?



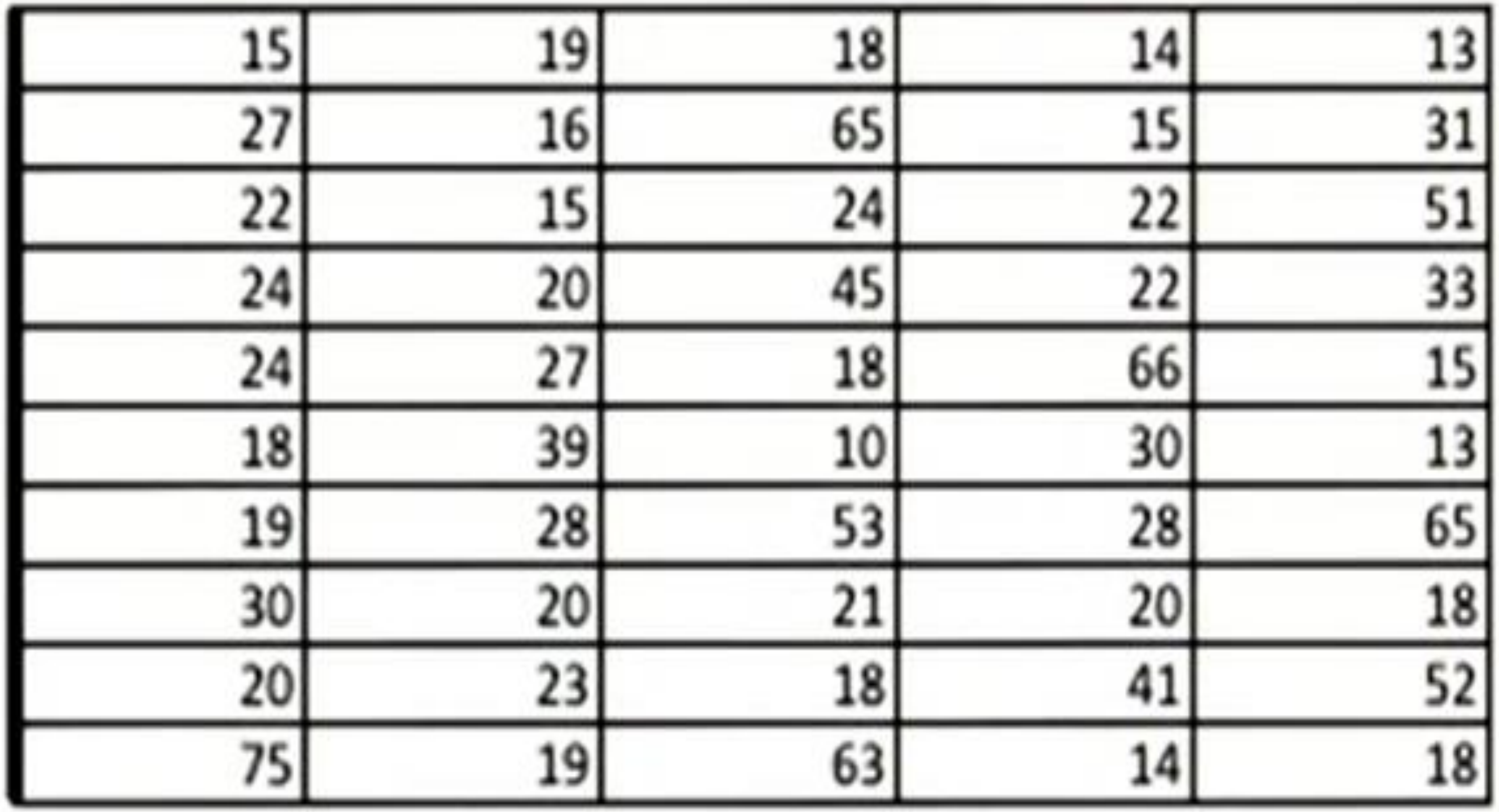
Students for a DS course

Continent	Frequency	Relative Frequency
North America	15	30%
Asia	29	58%
Europe	6	12%



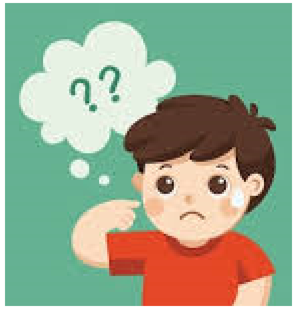
Interpret ?

Sample Student Ages



15	19	18	14	13
27	16	65	15	31
22	15	24	22	51
24	20	45	22	33
24	27	18	66	15
18	39	10	30	13
19	28	53	28	65
30	20	21	20	18
20	23	18	41	52
75	19	63	14	18

Think?

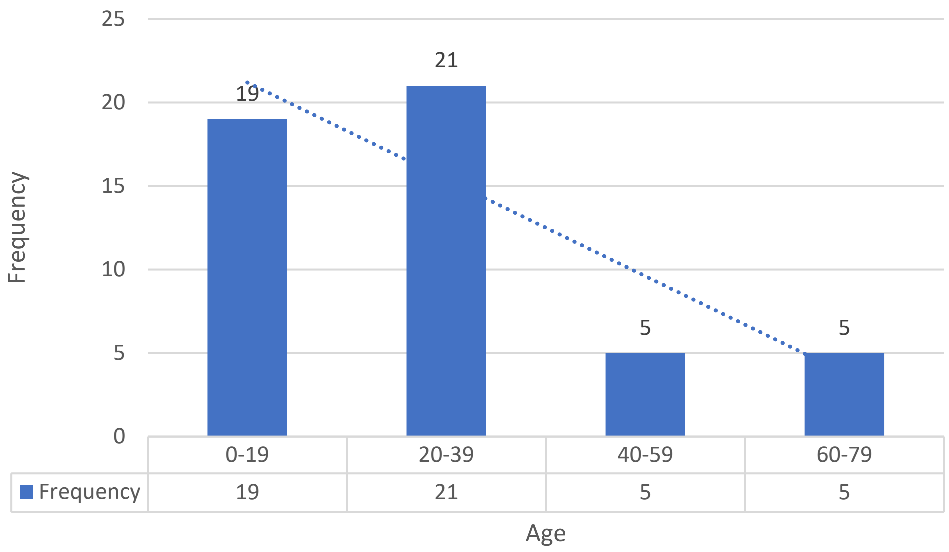


Sample Student Ages

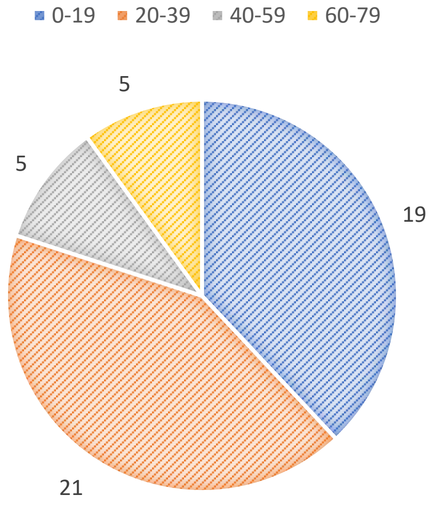
Age	Frequency
0-19	19
20-39	21
40-59	5
60-79	5

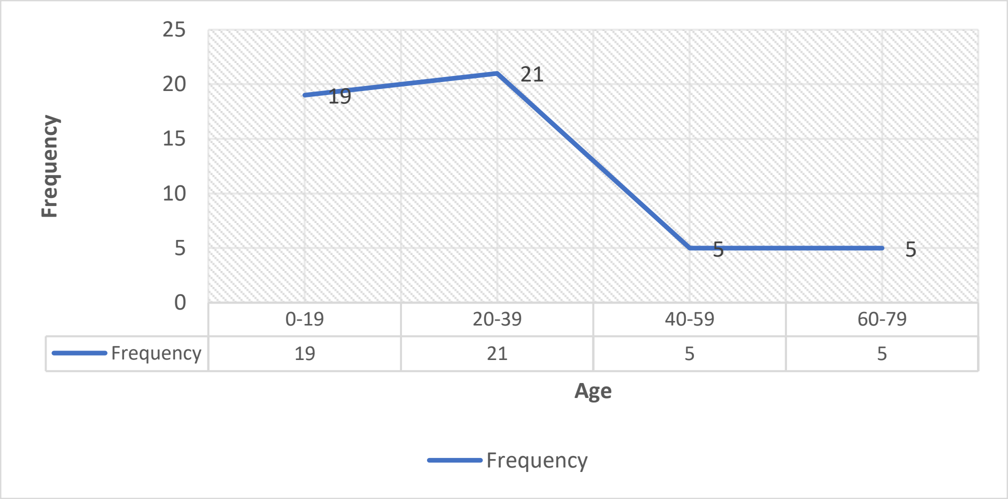
Analyze?

Sample Student Ages



	0-19	20-39	40-59	60-79
■ Frequency	19	21	5	5





	0-19	20-39	40-59	60-79
Frequency	19	21	5	5

Interpret ?

Data Analytics

- Analytics : Exploring and analyzing large datasets to find hidden pattern/ unseen trends / discover correlations / derive valuable insights to make business predictions, it improves speed and efficiency of business.

- Analytics is the transformation of data into insights

- Analytics involves
  - Understanding the **past and current performance to predict future performance**
  - Understanding the **relations**, identifying **patterns** and **translating them to meaningful, useful and relevant business insights and intelligent strategies**
  - Laying foundation for a data driven **decision making process** in an enterprise.

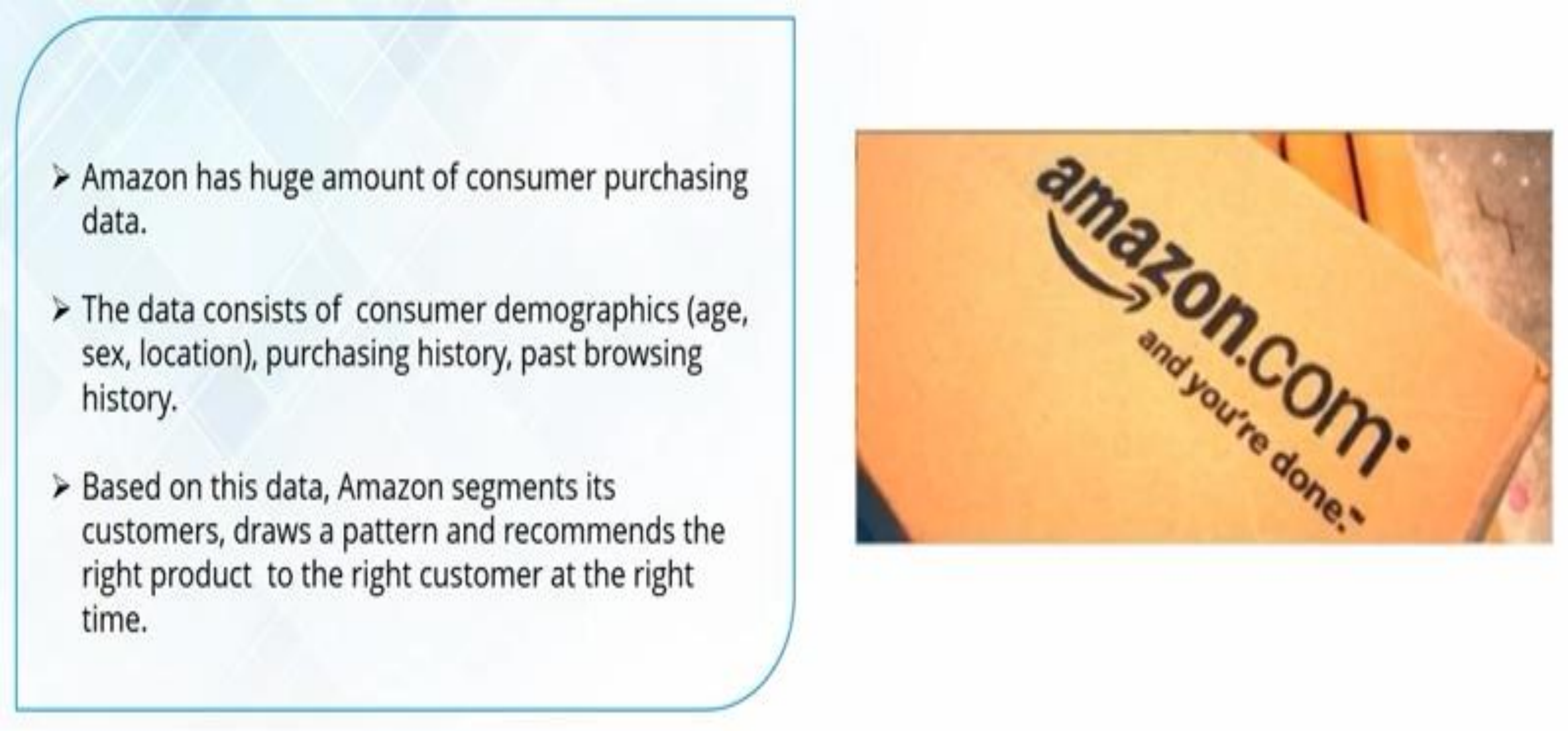
Data Science

- **“The ability to extract knowledge and insights from large and complex data sets.”**

  [D J Patil]

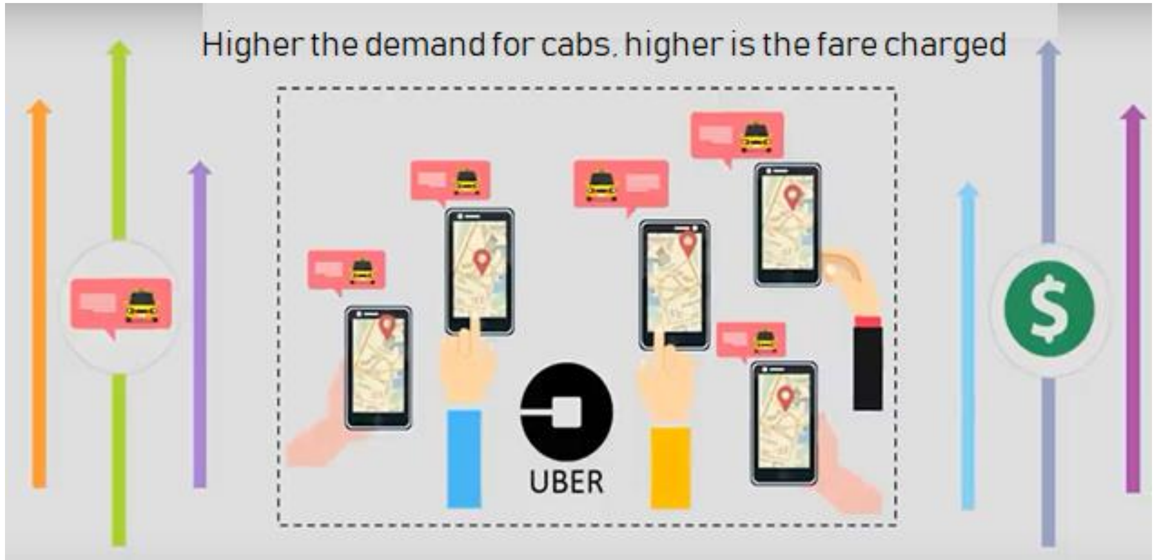
- Data scientists combine statistics, mathematics, programming, problem-solving, capturing data in ingenious ways, the ability to look at things differently to **find patterns**, along with the activities of **cleansing, preparing, and aligning** the data.

Applications

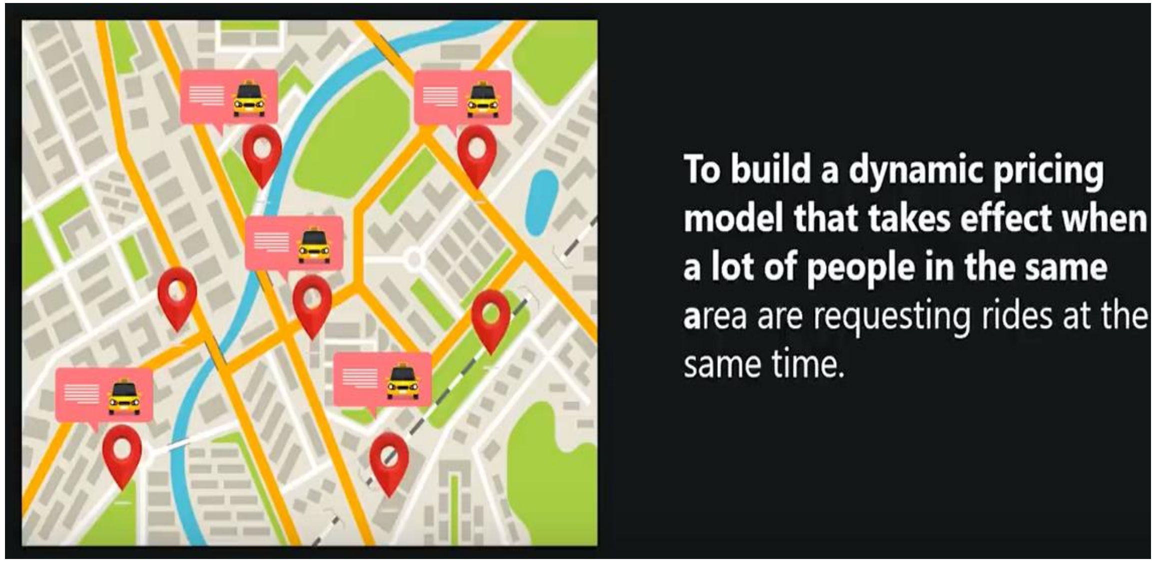


- Amazon has huge amount of consumer purchasing data.
- The data consists of consumer demographics (age, sex, location), purchasing history, past browsing history.
- Based on this data, Amazon segments its customers, draws a pattern and recommends the right product to the right customer at the right time.

amazon.com
and you're done.

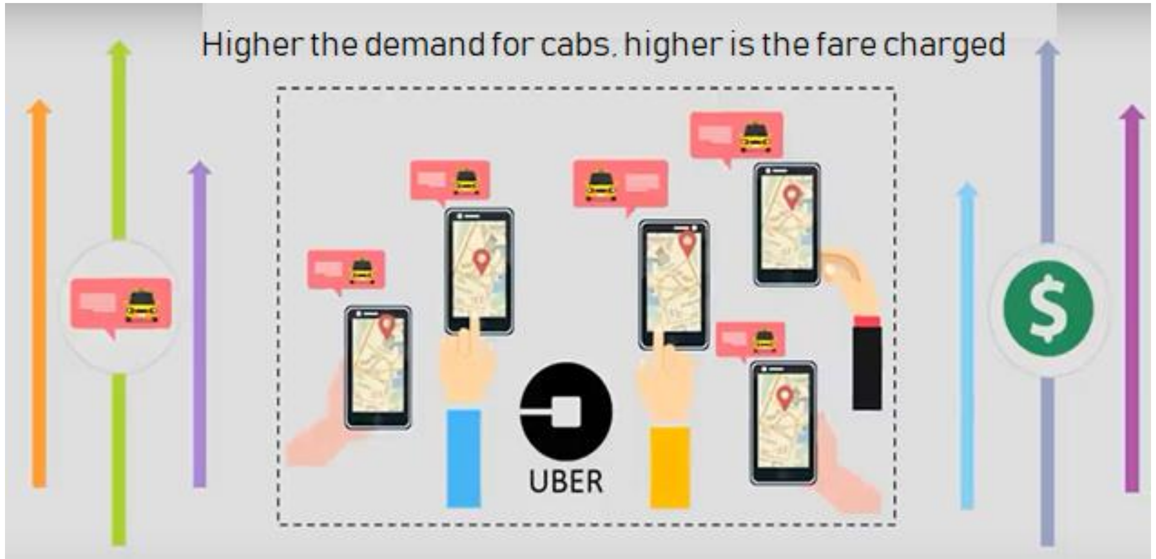


Higher the demand for cabs, higher is the fare charged

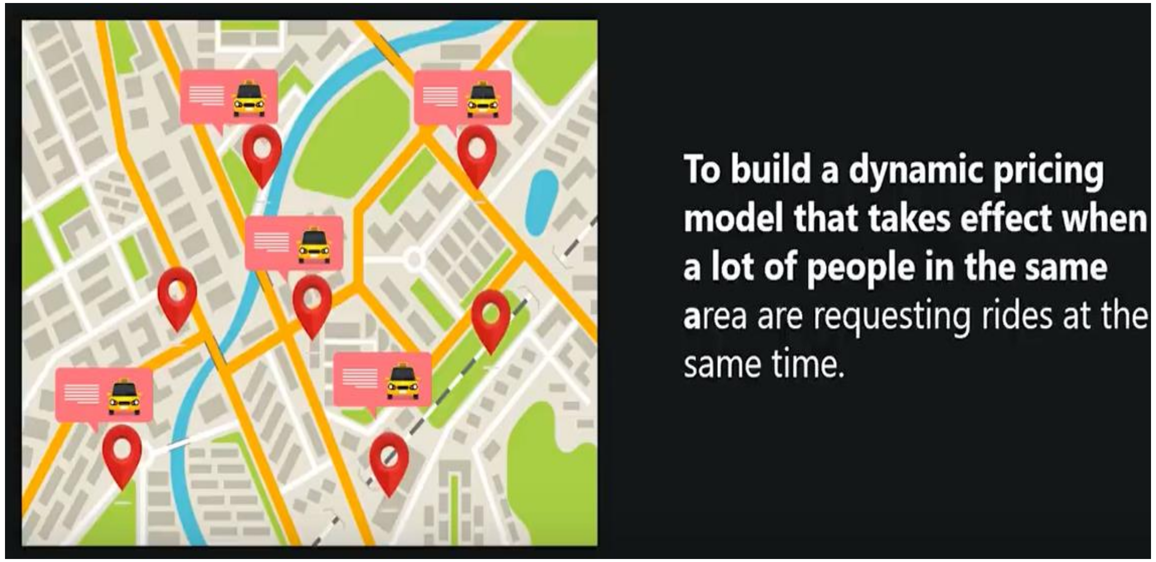


To build a dynamic pricing model that takes effect when a lot of people in the same area are requesting rides at the same time.

UBER



Higher the demand for cabs. higher is the fare charged



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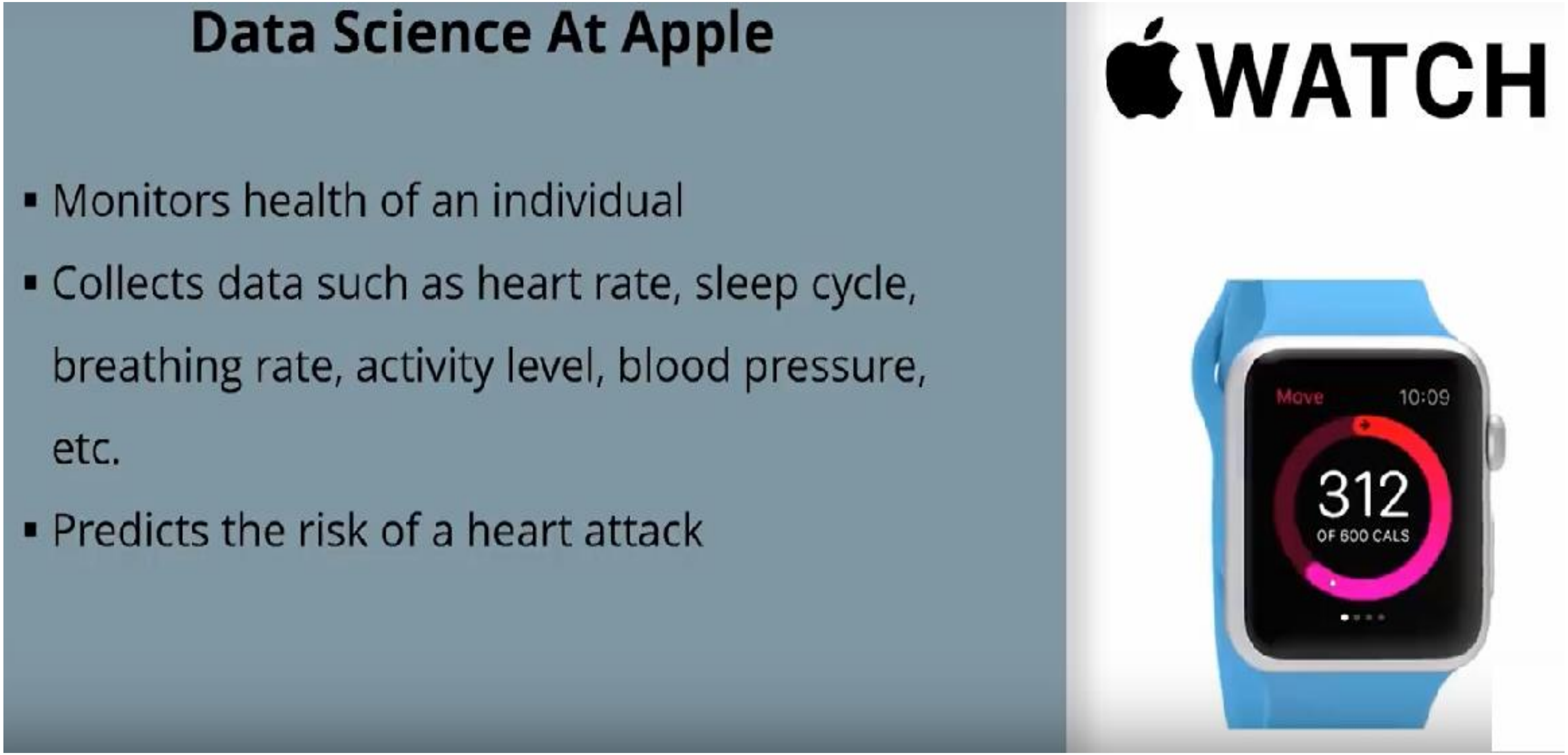
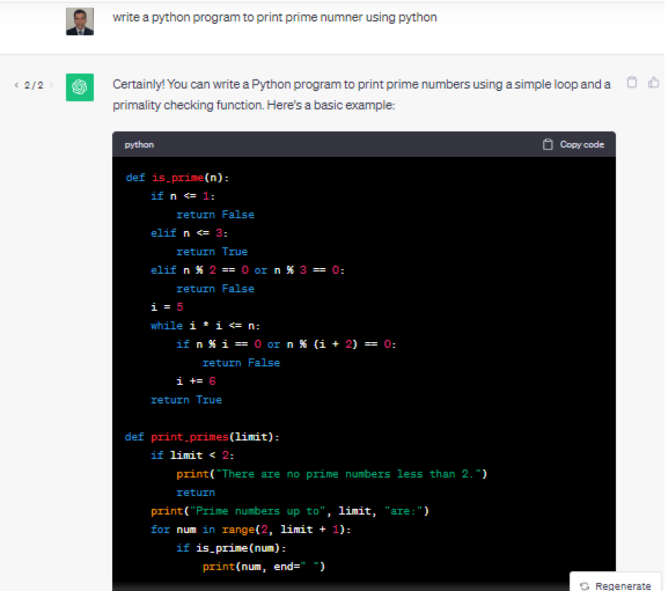


Data Science At Apple

- Monitors health of an individual
- Collects data such as heart rate, sleep cycle, breathing rate, activity level, blood pressure, etc.
- Predicts the risk of a heart attack

chatGPT

- ChatGPT, which stands for Chat Generative Pre-trained Transformer, is a large language model-based chatbot developed by OpenAI.
- Enables users to refine and steer a conversation towards a desired length, format, style, level of detail, and language.
- Successive prompts and replies, known as prompt engineering, are considered at each conversation stage as a context.

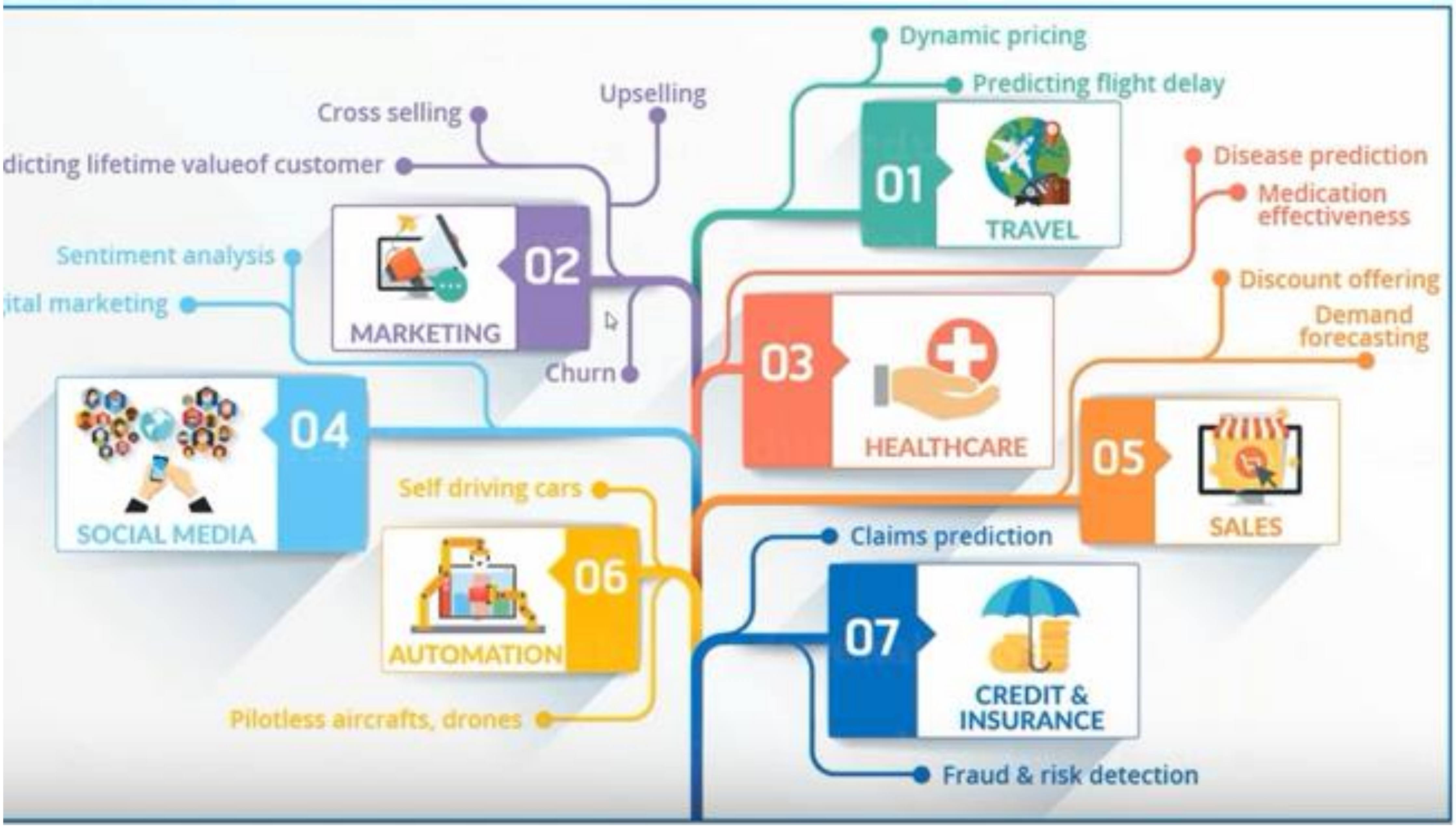


write a python program to print prime numner using python

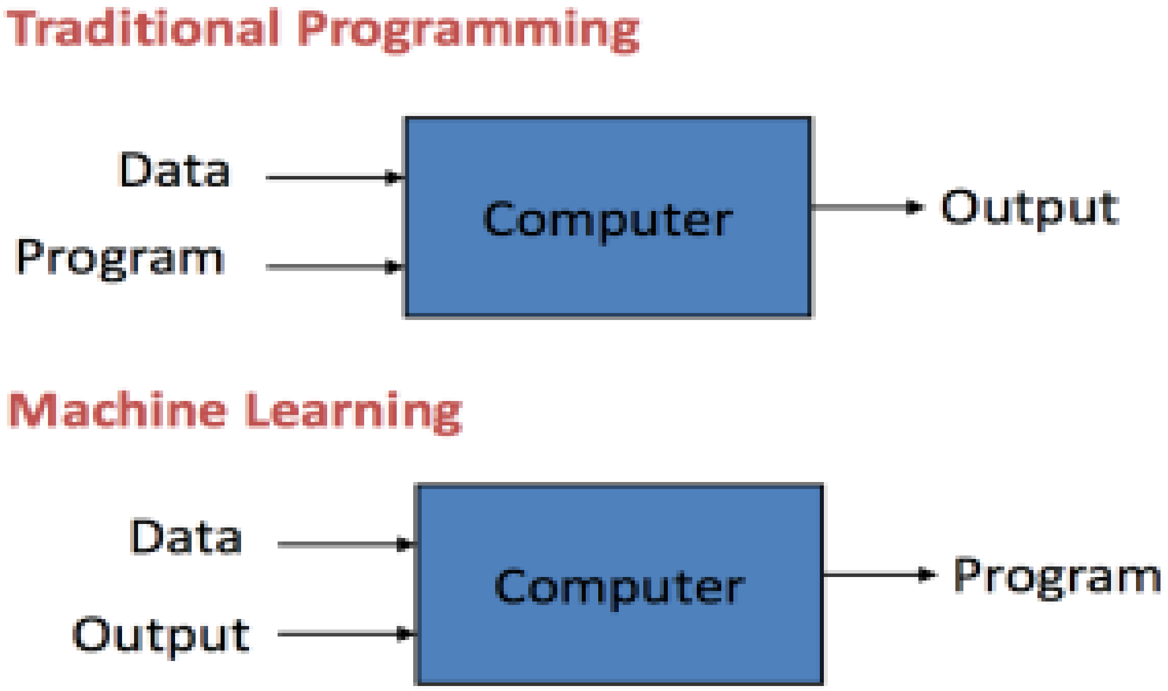
Certainly! You can write a Python program to print prime numbers using a simple loop and a primality checking function. Here's a basic example:

```python
def is_prime(n):
    if n <= 1:
        return False
    elif n <= 3:
        return True
    elif n % 2 == 0 or n % 3 == 0:
        return False
    i = 5
    while i * i <= n:
        if n % i == 0 or n % (i + 2) == 0:
            return False
        i += 6
    return True

def print_primes(limit):
    if limit < 2:
        print("There are no prime numbers less than 2.")
        return
    print("Prime numbers up to", limit, "are:")
    for num in range(2, limit + 1):
        if is_prime(num):
            print(num, end=" ")
```


Dynamic pricing
Predicting flight delay
01
TRAVEL
Upselling
Cross selling
dicting lifetime valueof customer
02
MARKETING
Churn
Sentiment analysis
ital marketing
Disease prediction
Medication effectiveness
03
HEALTHCARE
Discount offering
Demand forecasting
04
SOCIAL MEDIA
05
SALES
Self driving cars
06
AUTOMATION
Pilotless aircrafts, drones
Claims prediction
07
CREDIT & INSURANCE
Fraud & risk detection

Machine Learning



•**Traditional Programming**: Data and program is run on the computer to produce the output.

•**Machine Learning**: Data and output is run on the computer to create a program. This program can be used in traditional programming.

- *Machine learning is an application of AI that enables systems to learn and improve from experience without being explicitly programmed.*

- *Machine learning focuses on developing computer programs that can access data and use it to learn for themselves.*

Machine Learning

- Allows computers to learn and
- infer from data

Types of Machine Learning

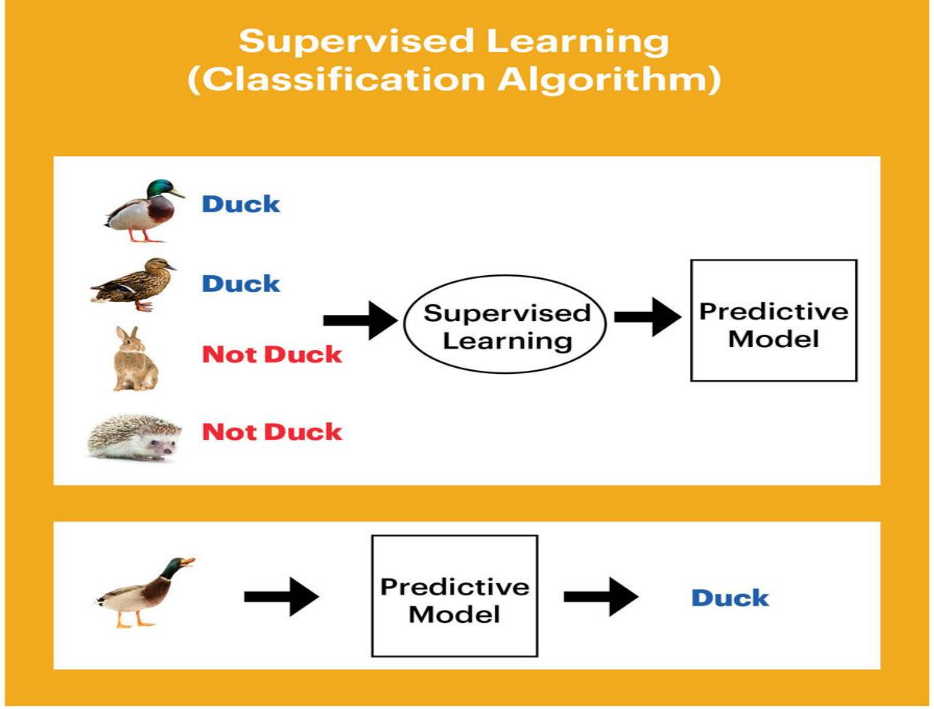
- Supervised
- Unsupervised
- Reinforcement Learning

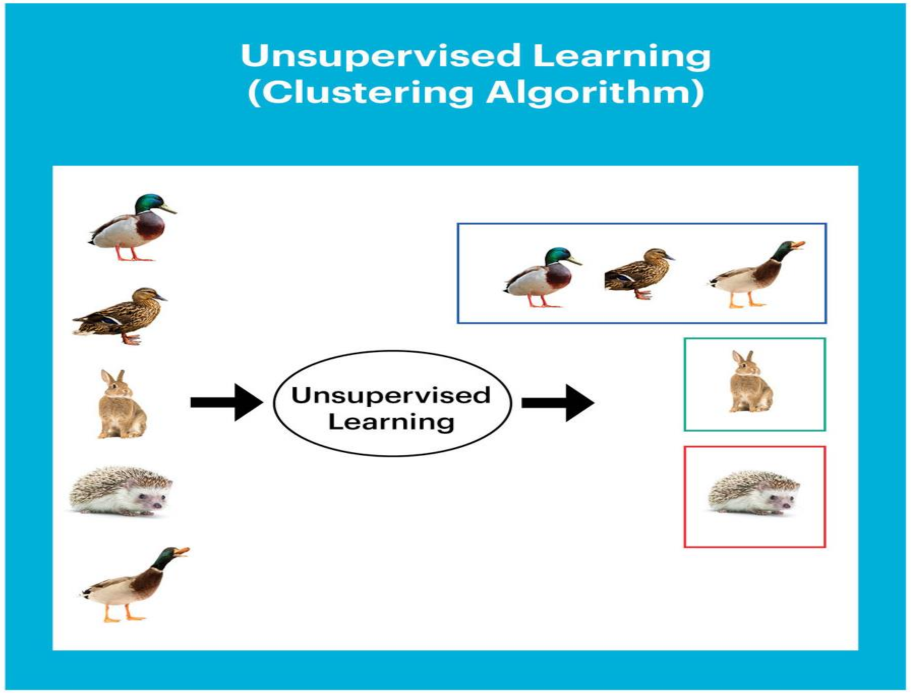
Supervised Learning

- Data points have a known outcome

Unsupervised Learning

- Data points have unknown outcome





Types of Supervised Learning

Regression

Outcome is continuous (numerical)

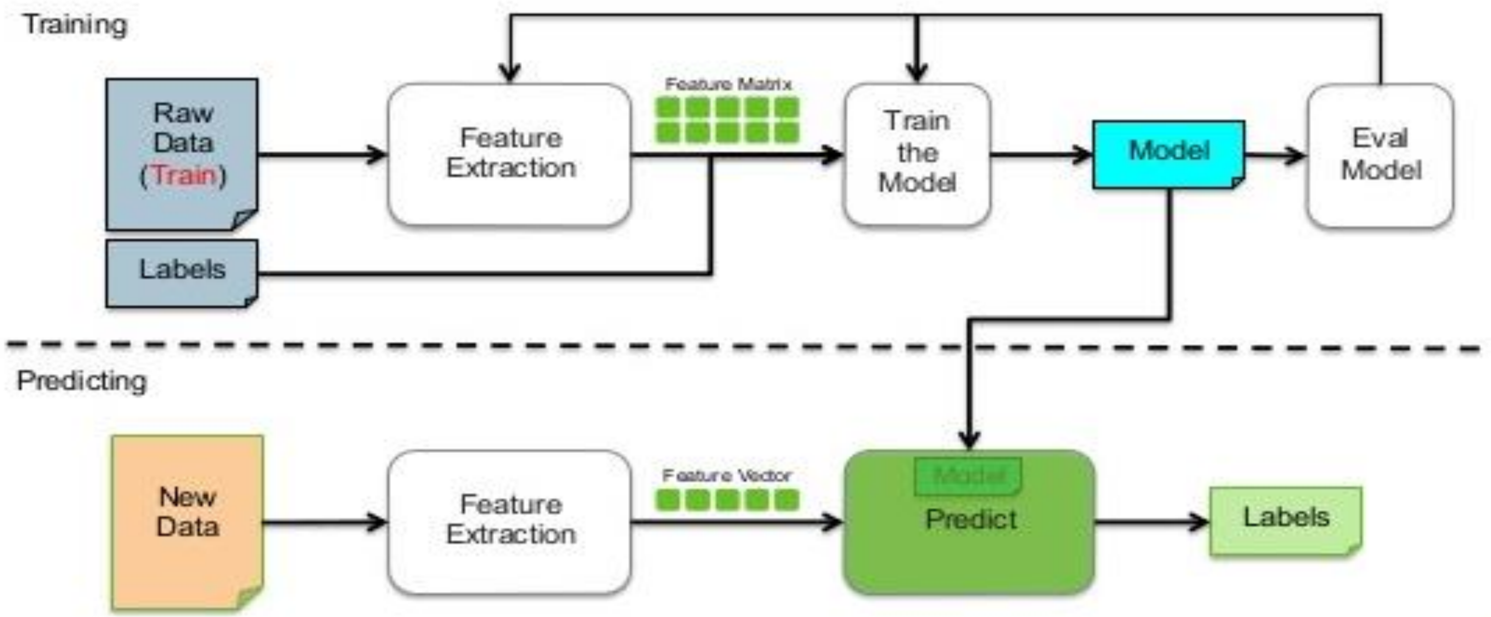
Ex:- home prices, happiness index

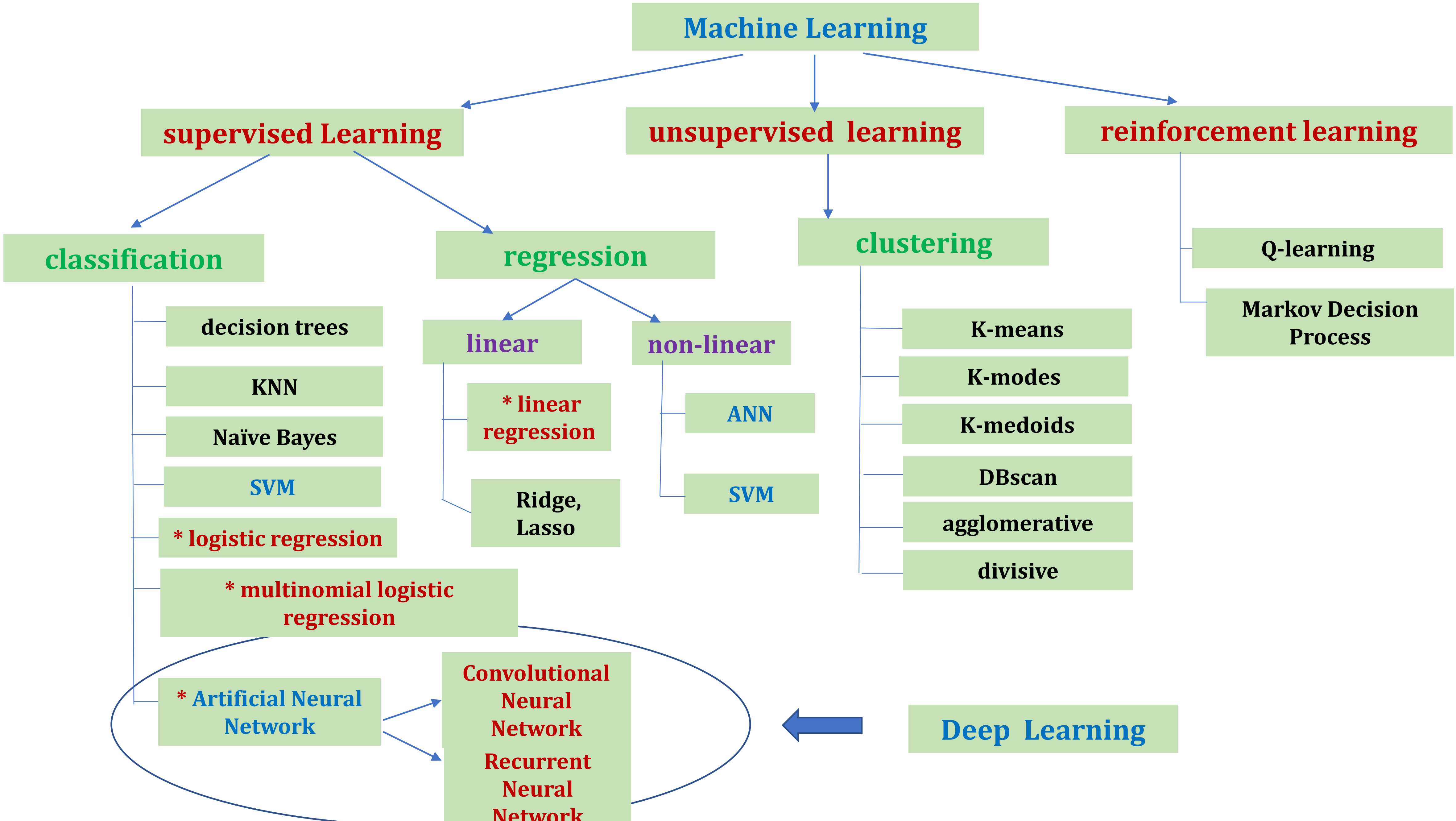
Classification

Outcome is a Category

Ex:- Object classes in Images

Supervised Learning Workflow





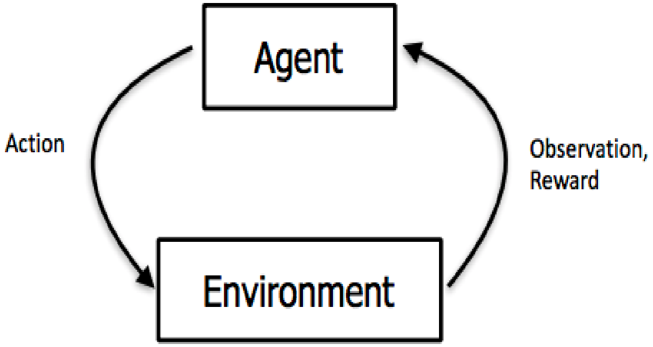
Machine Learning

- supervised Learning
  - classification
    - decision trees
    - KNN
    - Naïve Bayes
    - SVM
    - * logistic regression
    - * multinomial logistic regression
    - * Artificial Neural Network
      - Convolutional Neural Network
      - Recurrent Neural Network
  - regression
    - linear
      - * linear regression
      - Ridge, Lasso
    - non-linear
      - ANN
      - SVM
- unsupervised learning
  - clustering
    - K-means
    - K-modes
    - K-medoids
    - DBscan
    - agglomerative
    - divisive
- reinforcement learning
  - Q-learning
  - Markov Decision Process

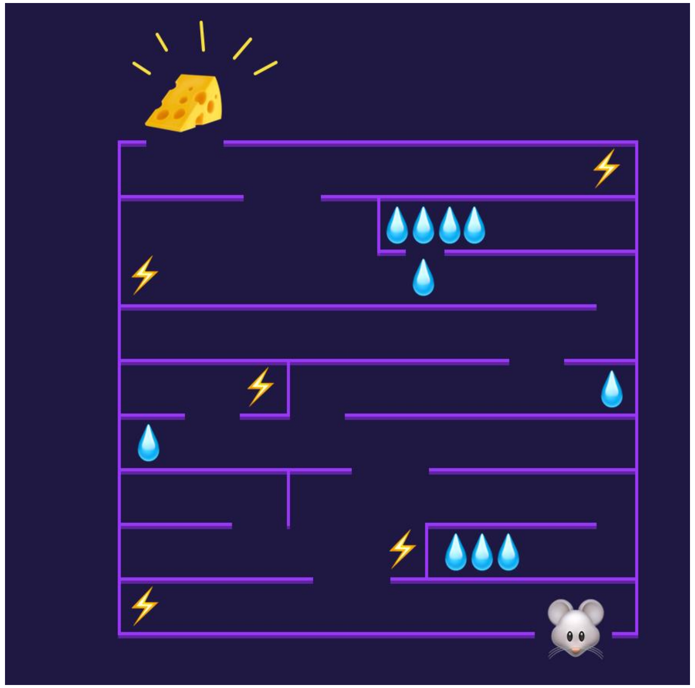
Deep Learning

Reinforcement Learning

- In supervised learning, training data comes with an answer key from some godlike "supervisor
- In **reinforcement learning (RL)** there's no answer key, but your reinforcement learning **agent** still must decide how to act to perform its task.
- In the absence of existing training data, the agent learns from experience.
- It collects the training examples ("this action was good, that action was bad") through **trial-and-error** as it attempts its task, with the <u>goal of maximizing long-term **reward**.</u>



The agent **observes** the environment, takes an **action** to interact with the environment, and receives positive or negative **reward.**

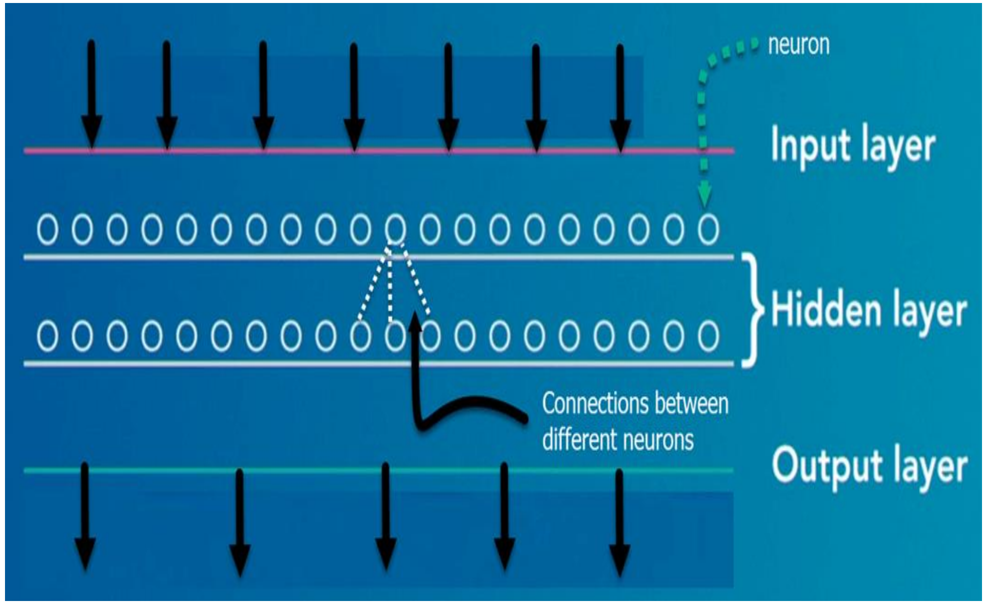


Deep Learning

- Deep Learning is about learning multiple levels of representation and abstraction that help to make sense of data such as images, sound, and text. it makes use of deep neural networks.

- Deep learning mimics the network of neurons in a brain.

- It is a subset of machine learning and is called deep learning because Deep learning algorithms are constructed with connected layers.



Algorithms

- ANN (Artificial neural networks)
- CNN (Convolutional neural networks)
- RNN (Recurrent neural networks)

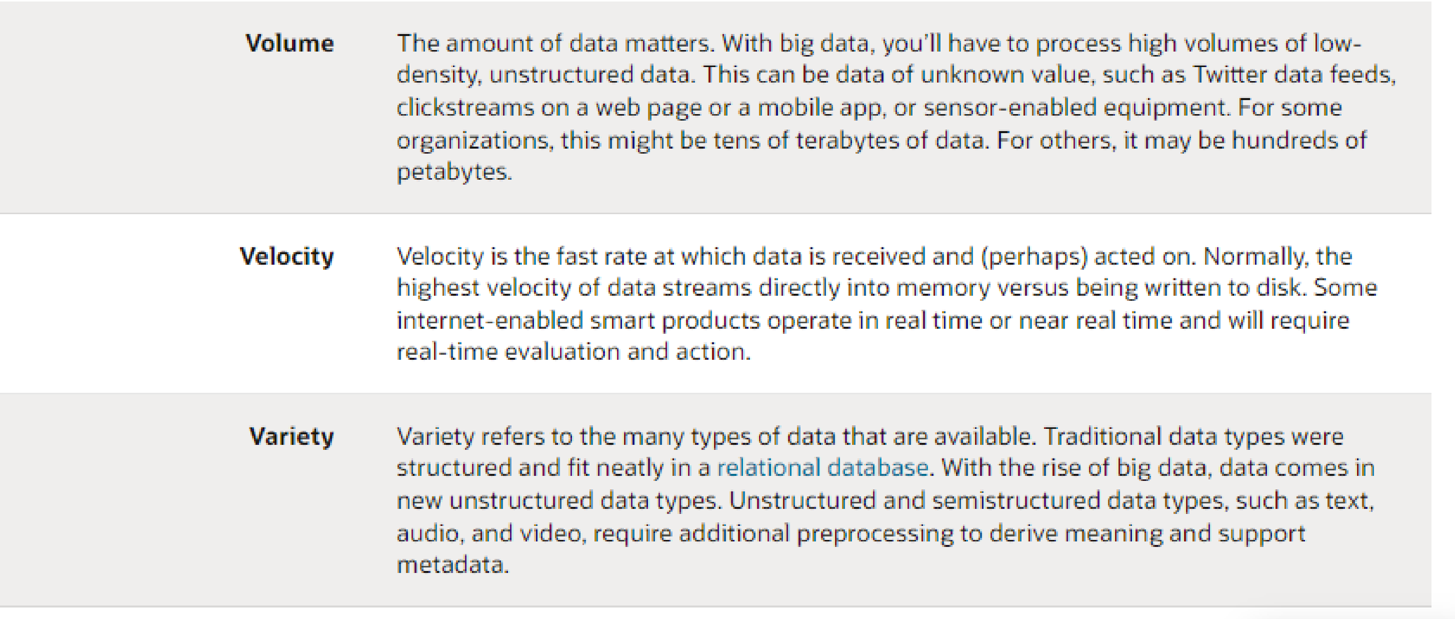
Applications

- **Object detection and Recognition**
- **Image Captioning**
- **Computer Vision**

Big Data

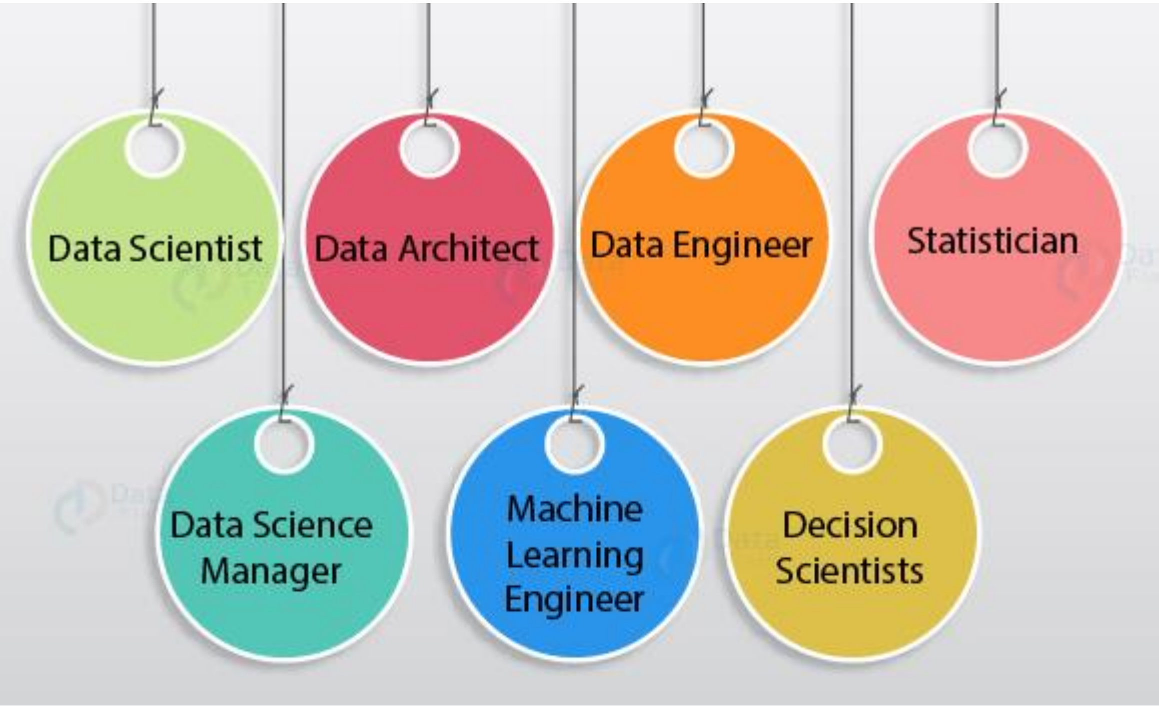
- The definition of big data is data that contains greater variety, arriving in increasing volumes and with more velocity. This is also known as the three Vs.

- Put simply, big data is larger, more complex data sets, especially from new data sources.



Volume	The amount of data matters. With big data, you'll have to process high volumes of low-density, unstructured data. This can be data of unknown value, such as Twitter data feeds, clickstreams on a web page or a mobile app, or sensor-enabled equipment. For some organizations, this might be tens of terabytes of data. For others, it may be hundreds of petabytes.
Velocity	Velocity is the fast rate at which data is received and (perhaps) acted on. Normally, the highest velocity of data streams directly into memory versus being written to disk. Some internet-enabled smart products operate in real time or near real time and will require real-time evaluation and action.
Variety	Variety refers to the many types of data that are available. Traditional data types were structured and fit neatly in a relational database. With the rise of big data, data comes in new unstructured data types. Unstructured and semistructured data types, such as text, audio, and video, require additional preprocessing to derive meaning and support metadata.

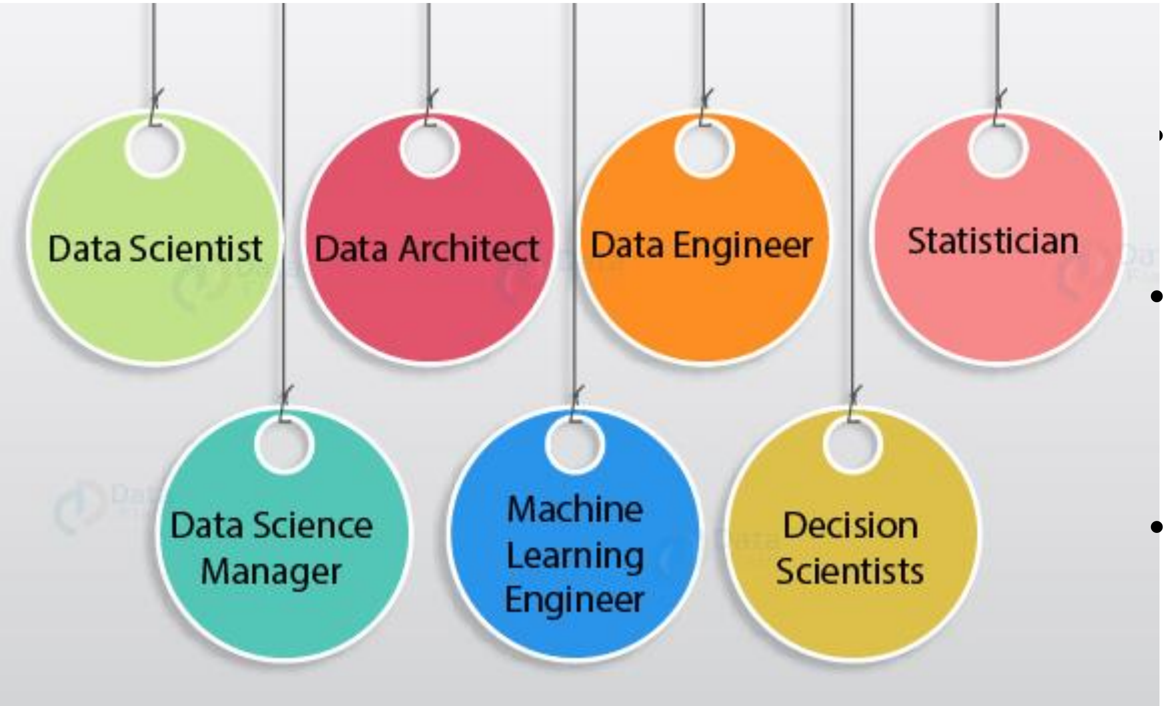
Job Roles Data Science



- **Data Scientists** are analytical experts who are responsible for **finding insights and patterns in the data**.
- Responsible for handling **raw data**, **analyzing the data,** implementing various **statistical procedures**, **visualizing** the data and **generating insights** from it.
- Must have knowledge of various tools **like Hadoop, R, Python,.**
- A **Data Architect** is responsible for implementing the blueprints of a company's **data platform in terms of delineates various models, policies, rules that govern the storage** of data as well as its use in the organizations.
- Tools used by a Data Architect are **XML, Hive, SQL, Spark and Pig**.

- A **Data Engineer** is responsible for **building big data pipelines and models** for the **data scientists** to work on.
- Must be well versed with both **structured as well as unstructured data.**
- Responsible for building **data models, maintaining, managing and testing** it.
- Responsible for modeling **large scale processing systems** using tools like **SQL, Hive, Pig, Python, Java etc.**

Job Roles Data Science



- A Statistician is responsible for **implementing A/B testing, harvesting data, describing data,** developing inferential statistical tools and performing hypothesis testing.

- Tools used by statisticians are R, SAS, SPSS, Matlab, Python, Stata, SQL etc.

- A **Machine Learning** Engineer is responsible for tailoring **machine learning models for performing classification and regression tasks**.

- It is an advanced field and people are required to possess analytical aptitude **skills to develop machine learning algorithms**.

- Some of the popular tools used by the machine learning engineers are **TensorFlow, Keras, PyTorch, scikit-learn**,

- **Decision Scientists** help the company to **make business decisions** with the help of tools like **Artificial Intelligence** and **Machine Learning.**

- It is a part of data science that extends to **design thinking and behavioral sciences to better understand the clients.**

Thank you