Jawaharlal Nehru Technological University Hyderabad

School of Continuing and Distance Education

Certificate course on AI ML
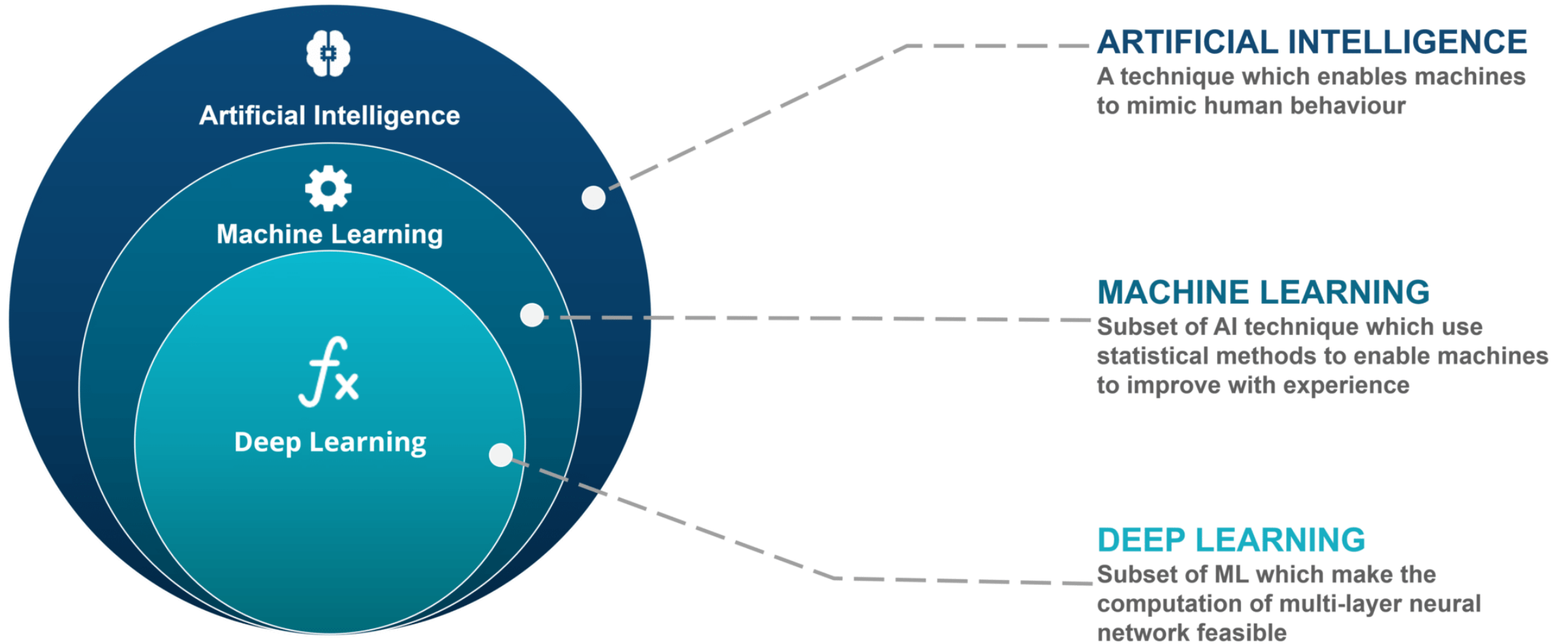
Introduction to Artificial Intelligence and Machine Learning

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Dr N V Ganapathi Raju

Professor, HOD IT, GRIET

Consultant

AI / ML / DL

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

What is A.I. ?

|	
"[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . ." (Bellman, 1978)	"The study of mental faculties through the use of computational models.“ (Chamiak and McDermott, 1985)
"The study of how to make computers do things at which, at the moment, people are better." (Rich and Knight, 1991)	"The branch of computer science that is concerned with the automation of intelligent behavior" (Lugar + Stubblefield 1993)
definitions of artificial intelligence, organized into four categories	

| Views of AI fall in four categories	
Think Humanly	Think rationally
Acting humanly	Acting rationally

Intelligent Agents

- An **agent** is anything that can be viewed as **perceiving** its environment through **sensors** and **acting** upon that environment through **actuators.**

actions change environment
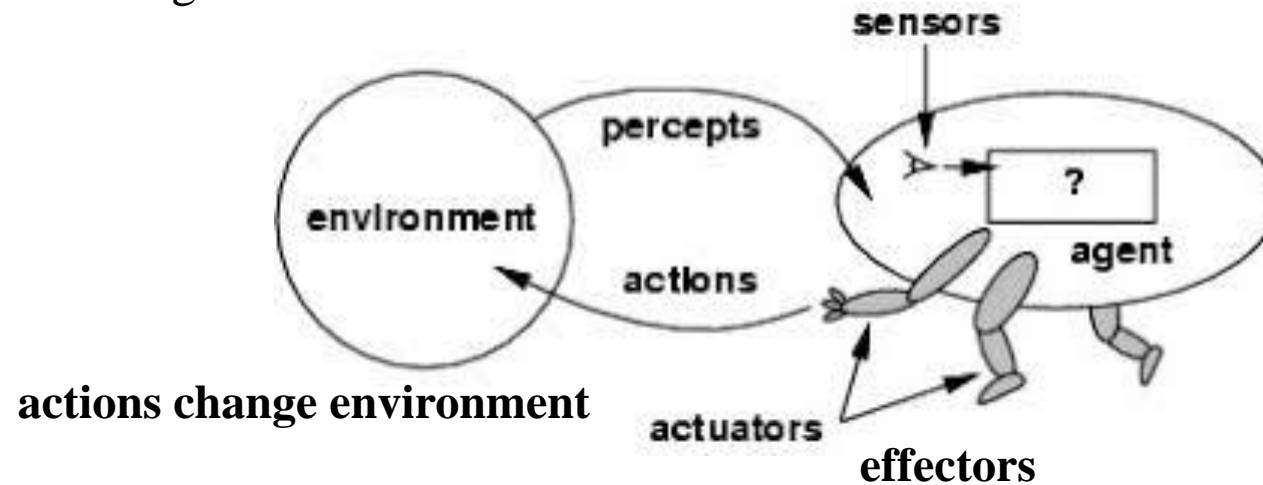
effectors

Agents:

- Operate in an environment

- Perceives its environment through sensors

- Acts upon its environment through actuators / effectors

- Have goals (Agents has to satisfy)

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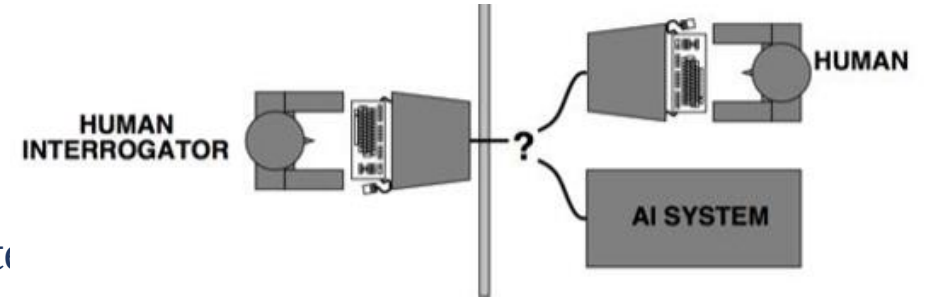
- A computer passes the test of intelligence, if it can fool a human int

- 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…)
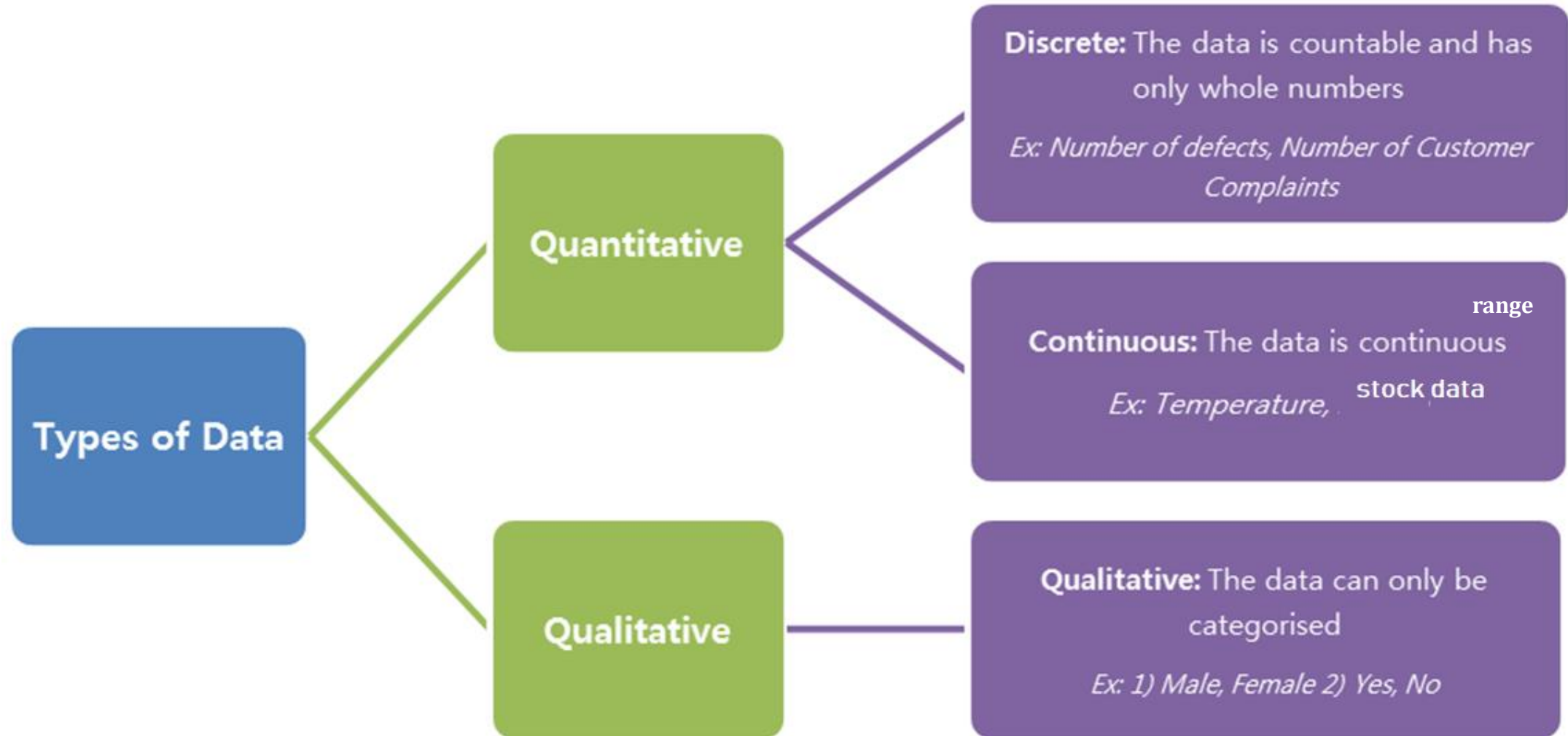
- **Image / Audio / Video / Signal….**

Data

- **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

Discrete: The data is countable and has only whole numbers

Ex: Number of defects, Number of Customer Complaints

Continuous: The data is continuous range

Ex: Temperature, stock data

Qualitative

Qualitative: The data can only be categorised

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

DATA SCIENCE and MACHINE LEARNING using Python

Types of Data

- **Structured data**

- **Unstructured data**

- **Semi Structured 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.

Types of Data

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?

DATA SCIENCE and MACHINE LEARNING using Python
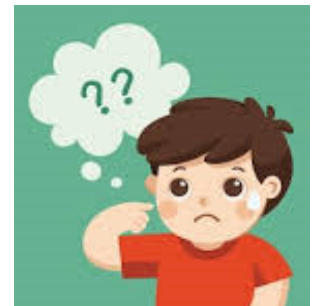
Students for AI ML course

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%
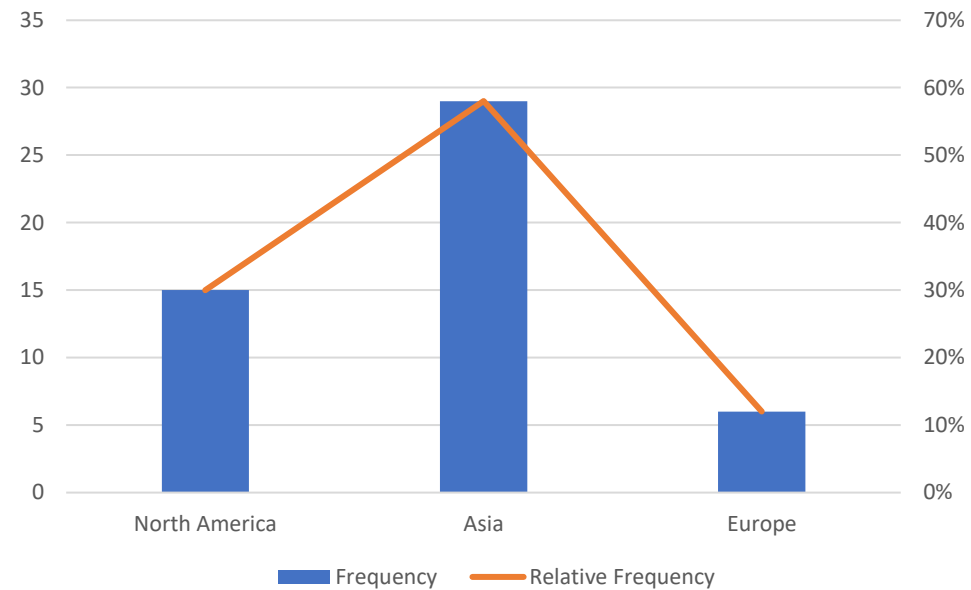
Interpret ?

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

Interpret ?

DATA SCIENCE and MACHINE LEARNING using Python
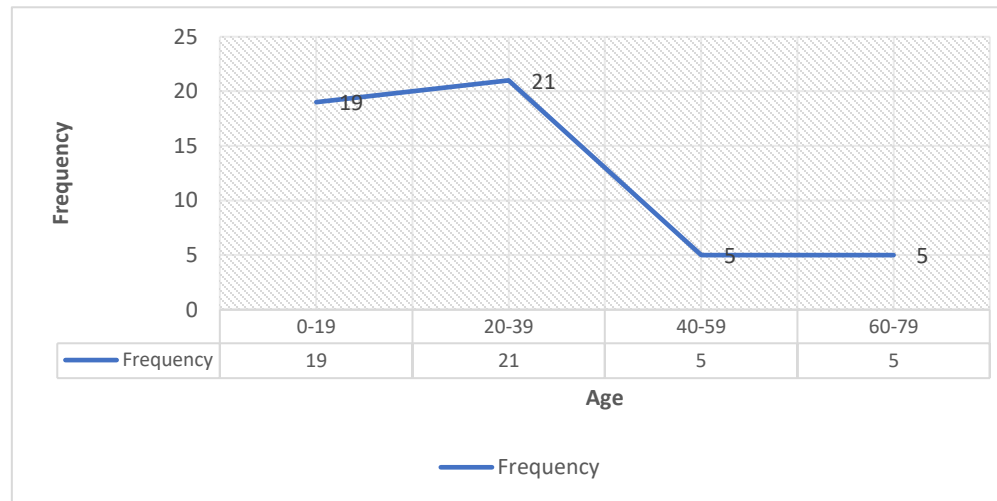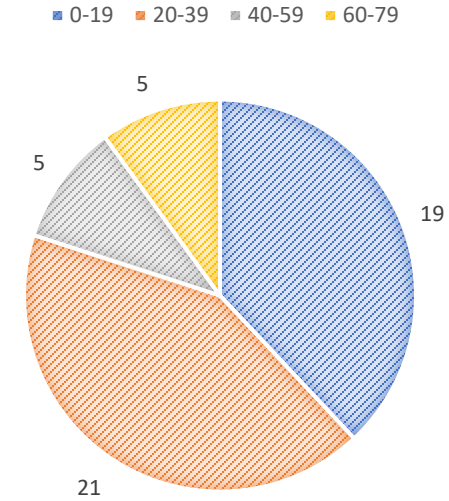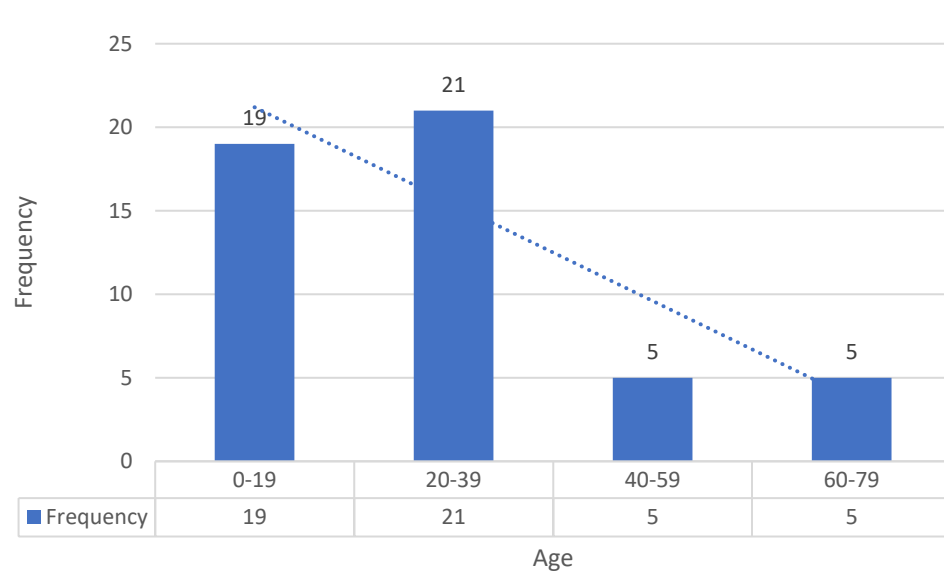
Data Analytics

- 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 <u>statistics</u>, <u>mathematics</u>, <u>programming</u>, <u>problem-solving</u>, <u>capturing data in ingenious ways</u>, the <u>ability to look at things differently</u> 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.

Higher the demand for cabs, higher is the fare charged
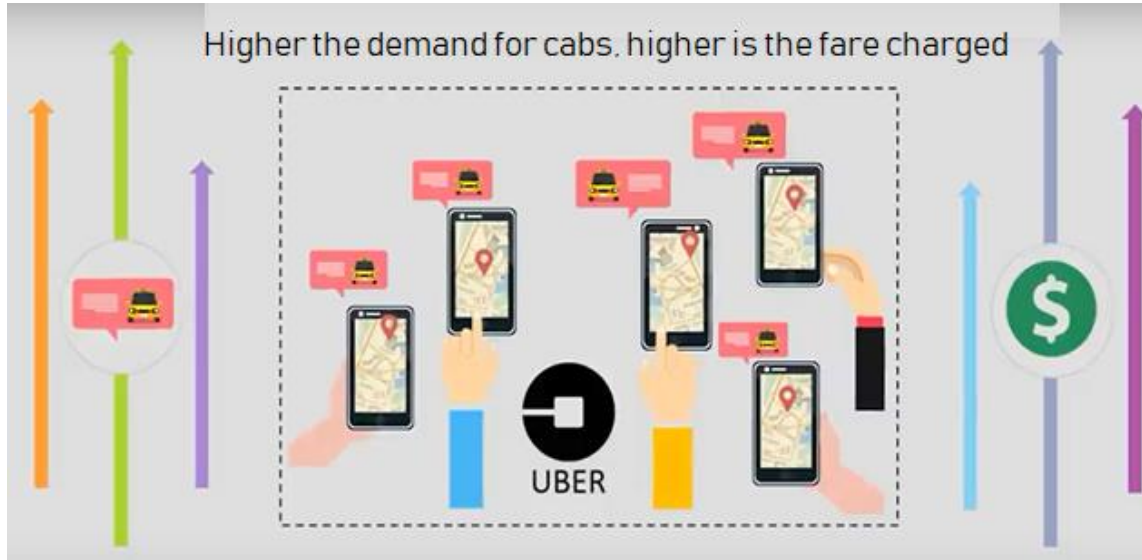
To build a dynamic pricing model that takes effect when a lot of people in the same area are requesting rides at the same time.

Data Science At Apple

WATCH

- 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

Move   10:09

312
OF 600 CALS
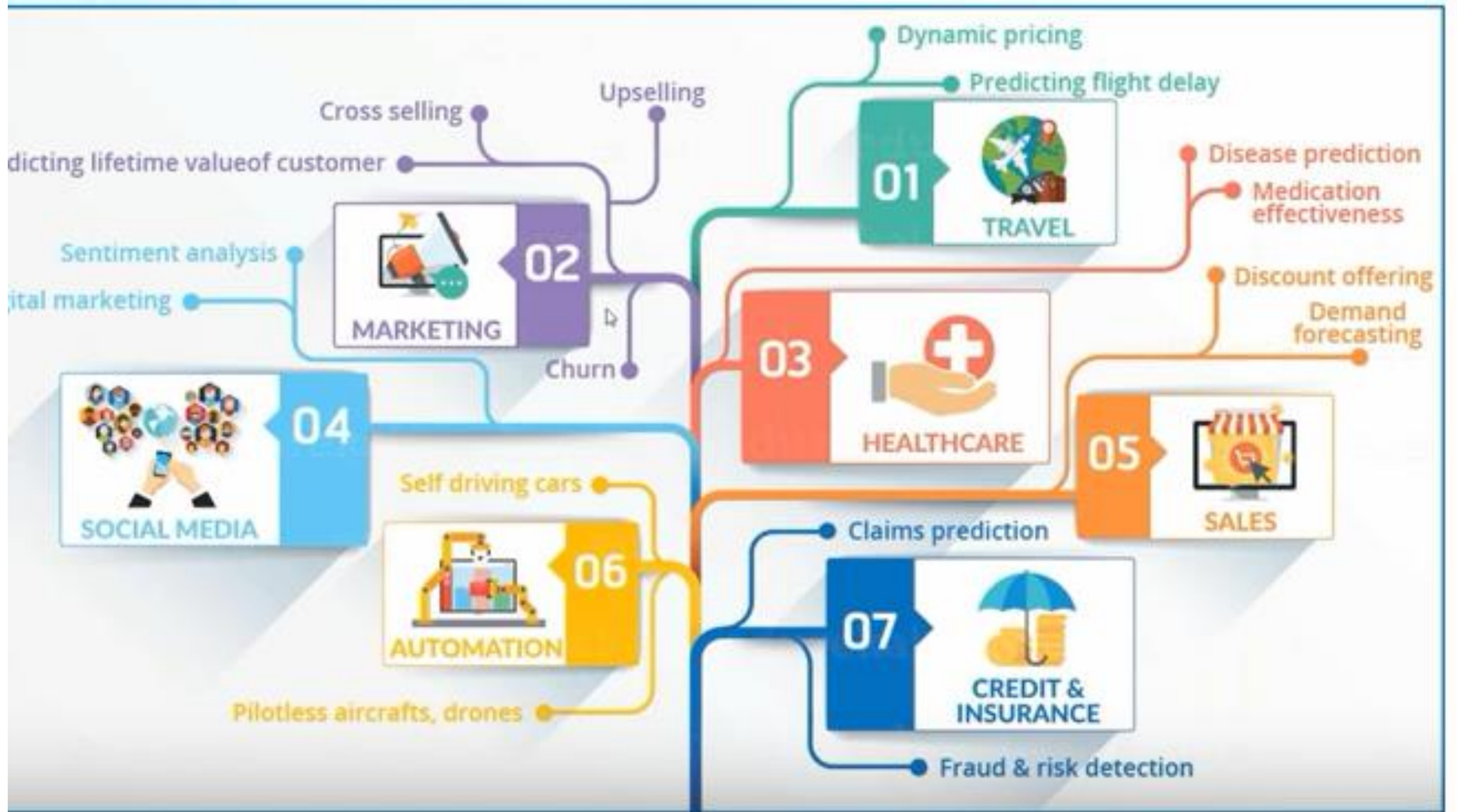
Machine Learning

- *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
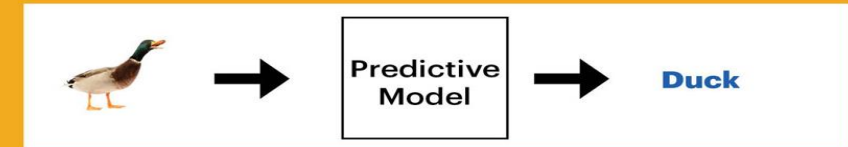
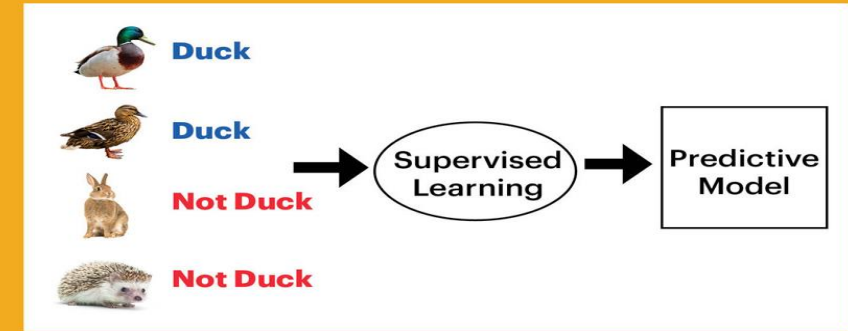- **Supervised**
- **Unsupervised**
- **Reinforcement Learning**

Supervised Learning

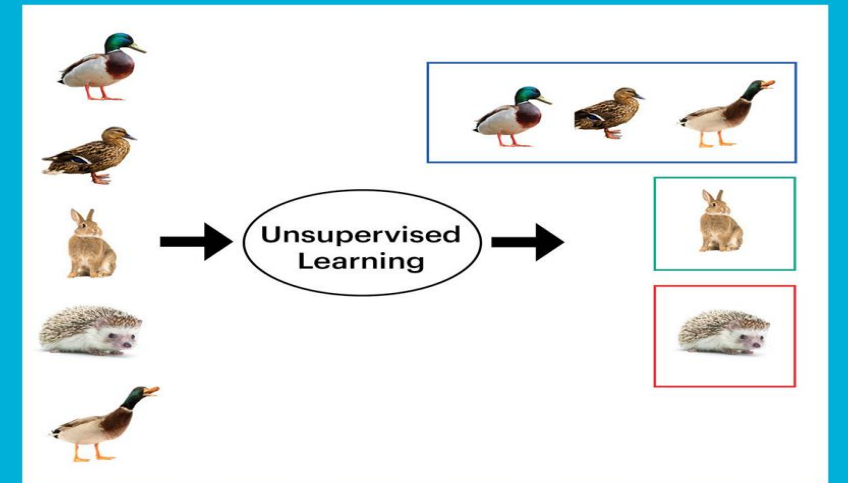- **Data points have a known outcome**

Unsupervised Learning

- **Data points have unknown outcome**

AI ML JNTUH SCDE

Supervised Learning
(Classification Algorithm)

Duck
Duck
Not Duck
Not Duck
→ Supervised Learning → Predictive Model

→ Predictive Model → Duck

Unsupervised Learning
(Clustering Algorithm)

→ Unsupervised Learning →

Types of Supervised Learning

Regression   **Classification**

Outcome is continuous (numerical)   **Outcome is a Category**

Ex:- home prices, happiness index   **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 goal of maximizing long-term **reward**.
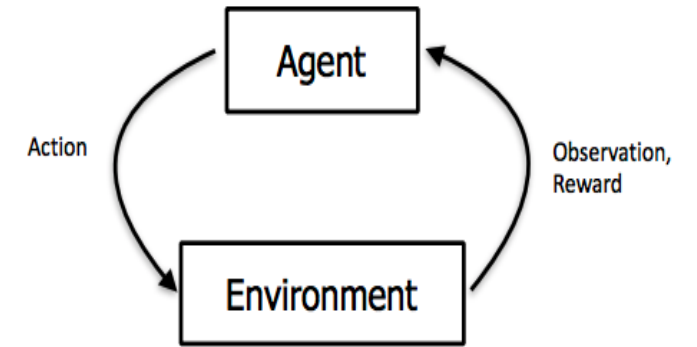
The agent **observes** the environment, takes an **action** to interact with the environment, and receives positive or negative **reward.**

AI ML JNTUH SCDE

Deep Learning

TensorFlow   K Keras

- 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.
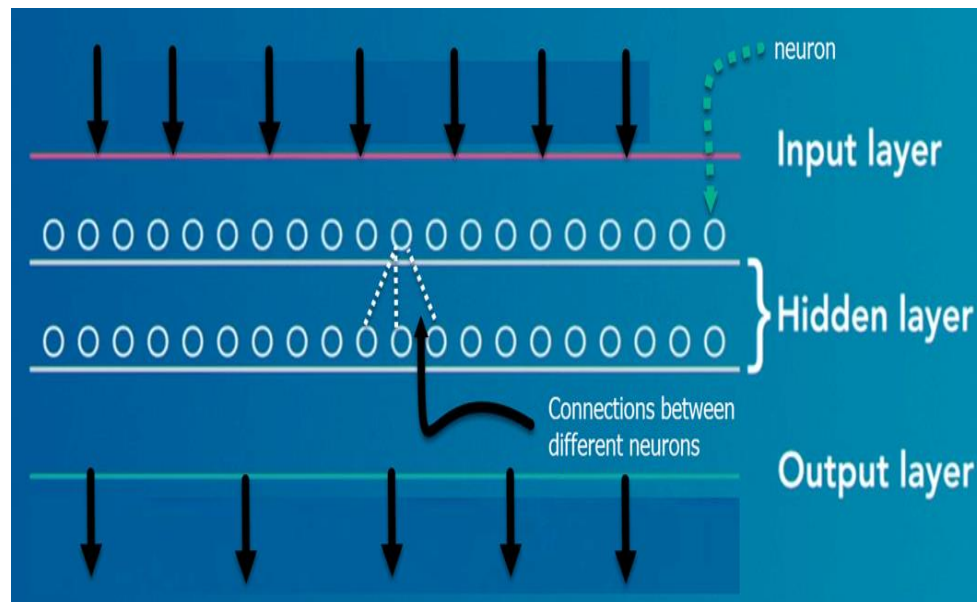
Algorithms

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

Applications

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

Thank you