AI PROJECT CYCLE

Imagine:

- The world’s largest diamond, is in danger as Mr. X has threatened to steal it.
- No one is able to track Mr. X and so the situation is critical.
- You have been appointed as the Chief Security Officer and your job is to enhance the security of the diamond to make the area impossible for Mr. X to break into and steal the diamond.

The Aim of this System is to:

- Secure the Diamond
  - As you interacted with the authorities, you get to know that some people are allowed to enter the area where the diamond is kept. Some of them being - the maintenance people; officials; VIPs, etc.
  - Now, the challenge is to make sure that no unauthorized person enters the premises.

Problem Scoping

- While finalizing the aim of this system, you scope the problem which you wish to solve with the help of your project. This is ***Problem Scoping.***

- For the Purpose you need to decide on one:
  - a. Get photographs of all the authorised people.
  - b. Get photographs of all the unauthorised people.
  - c. Get photographs of the premises in which the diamond has been kept.
  - d. Get photographs of all the visitors.

Data Acquisition:

- As you start collecting the photographs, you actually acquire data in a visual form. This data now becomes the base of your security system. Note that the data needs to be accurate and reliable as it ensures the efficiency of your system. This is known as ***Data Acquisition.***

- **You Realise:**
  - *After acquiring the required data -*
    - That it is not uniform.
    - Some images are small in size while the others are big.
    - Some images are missing while you have multiple copies of others.
    - Thus, you think of putting all the information collected in a simplified format.

- **For Which:**
  - a. Create a table and put the names of people whose photographs you have.
  - b. Put all the photographs in a graph and try to interpret a pattern out of it.
  - c. Make a database to store the image data.
  - d. Remember all the faces you see in the images.

Data Exploration

- At this stage, you try to interpret some useful information out of the data you have acquired.
- For this, you explore the data and try to put it uniformly for a better understanding. This is known as ***Data Exploration.***

- Now you need to develop a System:
  - Which detects the face of a person entering the vault and match it with the existing image data you have in your system.
  - For this, you put all your data into the AI-enabled model and train it in such a way that it alerts the officials if an unknown person tries to enter the vault.

Modelling

- To implement your idea, you now look at different AI-enabled algorithms which work on Computer Vision (since you are working on visual data).
- You go through several models and select the ones which match your requirements.
- After choosing the model, you implement it. This is known as the Modelling stage.

Test Time

- Your surveillance system is now complete!
- You test it by sending a mix of known and unknown faces to the vault. You notice that the results were 70% correct.
- After evaluating this model, you work on other shortlisted AI algorithms and work on them.

Evaluation

- As you move towards deploying your model in the real-world, you test it in as many ways as possible. The stage of testing the models is known as **Evaluation.**
- In this stage, we evaluate each and every model tried and choose the model which gives the most efficient and reliable results.
- After proper testing, we deploy our surveillance system in the premises. Mr. X, who is unaware of the surveillance system, tries to break through the vault and gets caught in your system. We have saved the diamond!

AI Project Cycle - Defined!

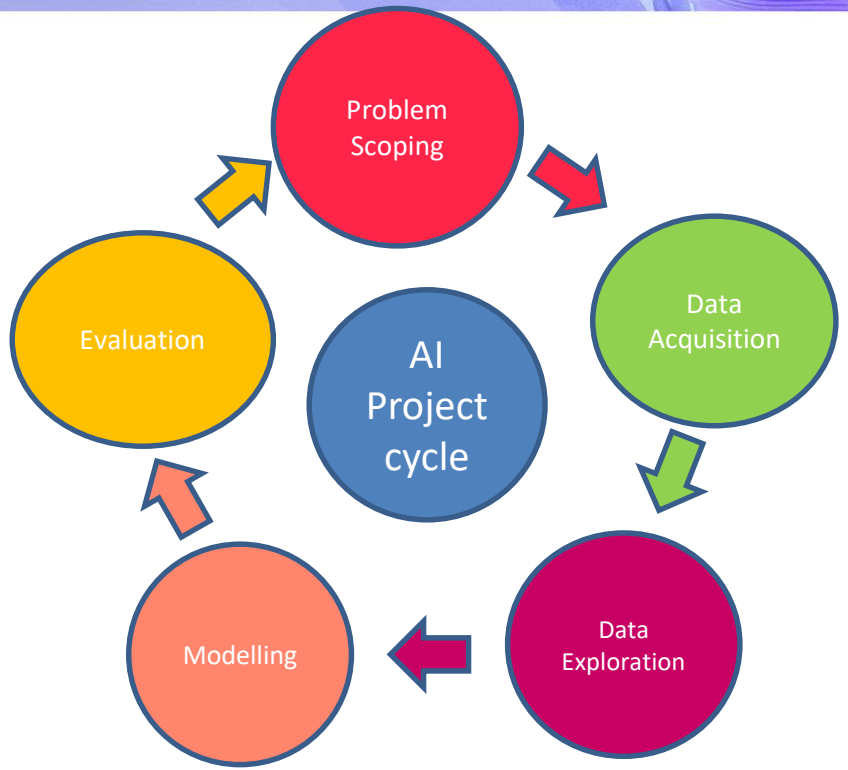
- Start with **Problem Scoping**, set the goal for the AI project by stating the problem which you wish to solve with it.
- Acquire data which will become the base of the project as it will help us in understanding what are the parameters that are related to the problem we are scoping.
- Go for **data acquisition** by collecting data from various reliable and authentic sources.
- Since the data we collect would be in large quantities, you can try to give it a visual form of different types of representations like graphs, databases, flow charts, maps, etc. This makes it easier for us to **interpret the patterns** in which our acquired data follows.

AI Project Cycle - Defined!

- After exploring the patterns, we can decide upon the type of model we would build to achieve the goal. For this, we can research online and **select various models** which give a suitable output.
- We can test the selected models and figure out which is the most efficient one.
- The most efficient model is now the base of our AI project and we can develop our algorithm around it.
- Once the modelling is complete, we now need to **test our model** on some newly fetched data. The results will help us in evaluating our model and hence improving it.
- **Finally, after evaluation**, the project cycle is now complete and what we get is our AI project.

AI PROJECT CYCLE

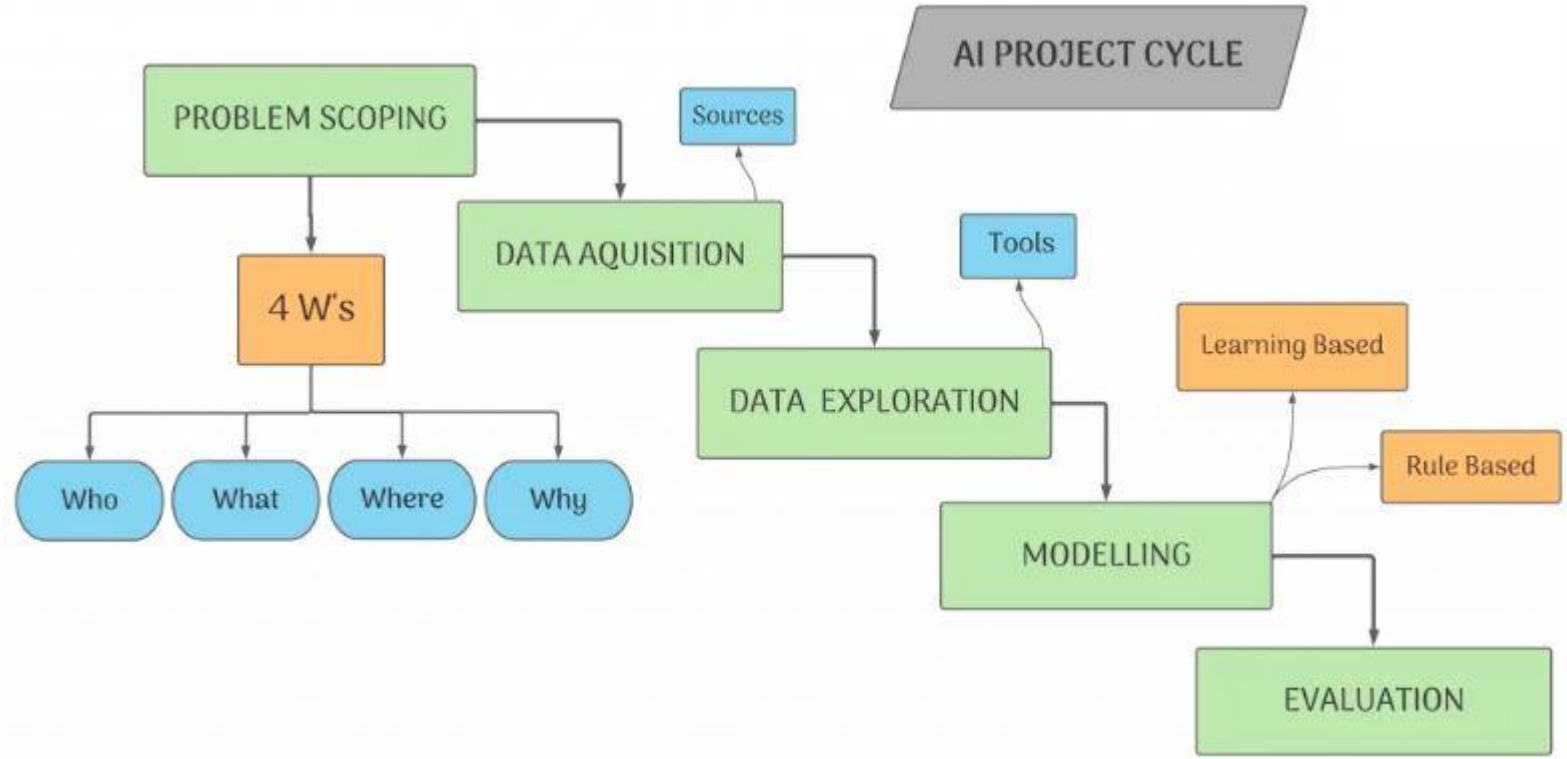
- Life cycle of AI project
- **Project Cycle** is a step-by-step **process to solve** problems using **proven scientific methods** and drawing inferences about them.



AI PROJECT CYCLE

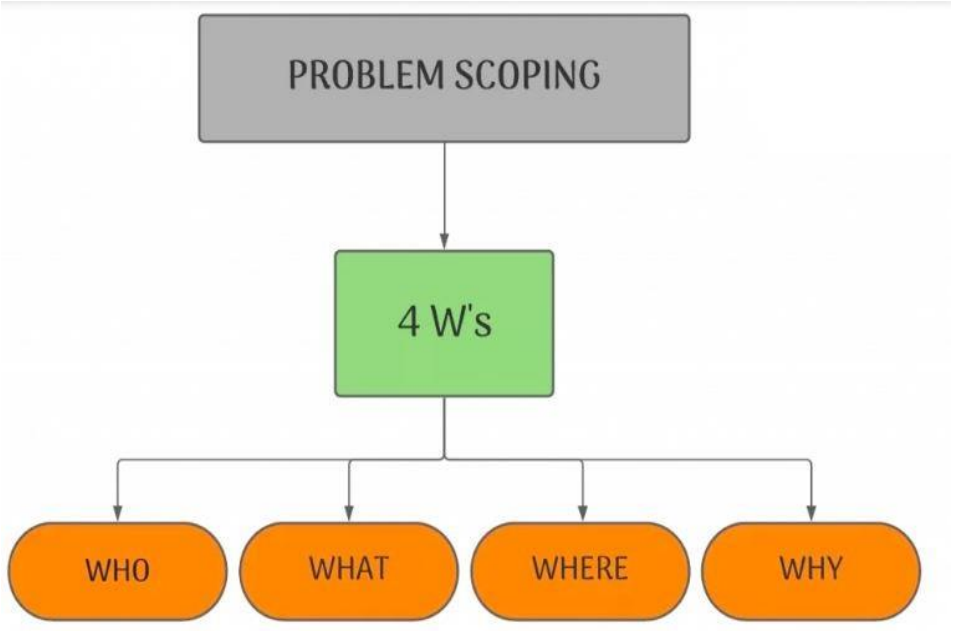
Problem Scoping	Understanding the problem
Data Acquisition	Collecting accurate and reliable data
Data Exploration	Arranging the data uniformly
Modelling	Creating Models from the data
Evaluation	Evaluating the project

AI PROJECT CYCLE



Problem Scoping:

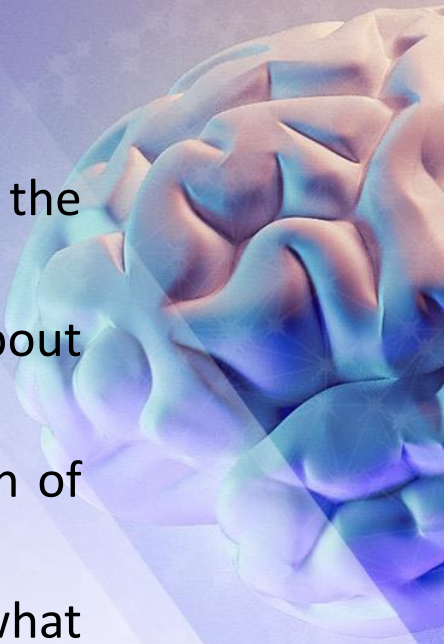
- It is a fact that we are surrounded by problems.
- They could be small or big, sometimes ignored or sometimes even critical.
- Many times we become so used to a problem that it becomes a part of our life.
- Identifying such a problem and having a vision to solve it, is what Problem Scoping is about.



Problem Scoping

- Who? - Refers that who is facing a problem and who are the stakeholders of the problem.
- What? - Refers to what is the problem and how you know about the problem.
- Where? - It is related to the context or situation or location of the problem.
- Why? - Refers to why we need to solve the problem and what are the benefits to the stakeholders after solving the problem.

The final outcome of problem scoping is the problem statement template.

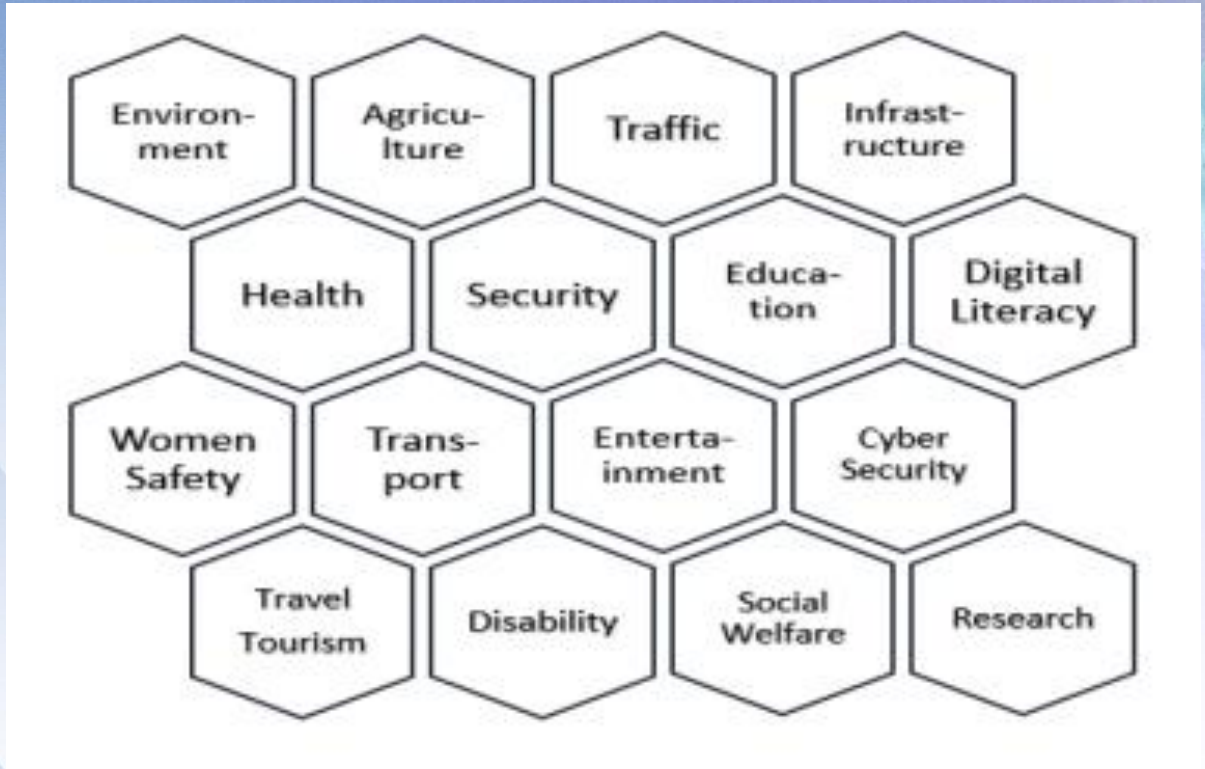


The problem statement template

- When the above 4Ws are completely filled you need to prepare a summary of these 4Ws.
- This summary is known as the problem statement template.
- This template explains all the key points in a single template.
- So if the same problem arises in the future this statement helps to resolve it easily.

Problem Scoping

Activity - Brainstorm around the theme and set a goal for the AI project



Problem Scoping:

- **Select a theme**

Agriculture

1. Yield rates
2. Sowing and harvesting patterns

Digital literacy

1. Online learning platforms
2. Digital awareness
3. Ebooks

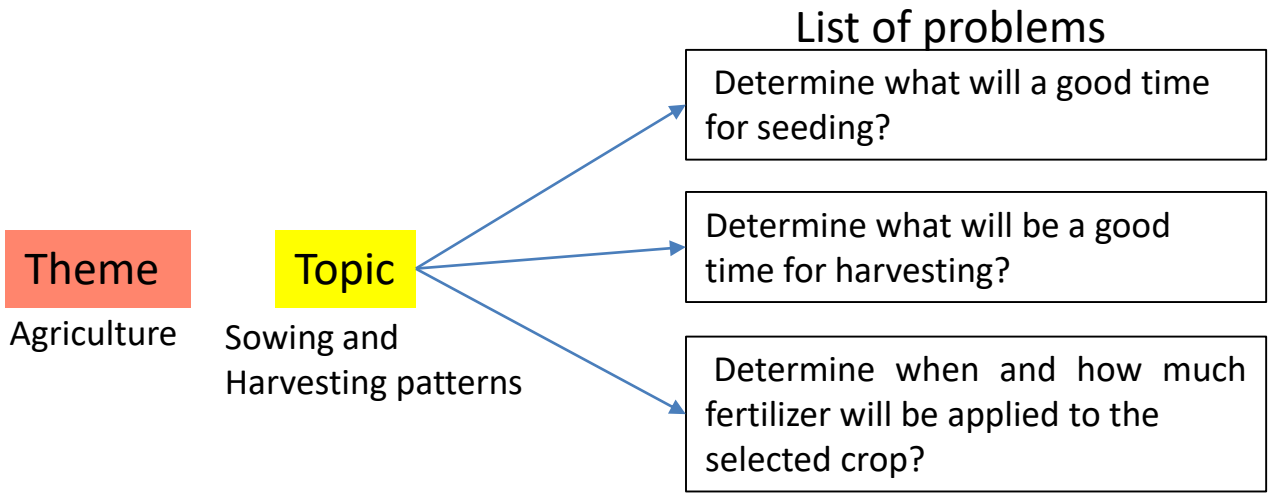
Health

1. Medicinal Aid
2. Mobile medications
3. Spreading of diseases

Problem Scoping

1. Select a theme

Eg: Agriculture: this theme includes different topics like pest issues, sowing and harvesting patterns, yield rates etc.



Problem Scoping:4Ws Problem Canvas:

Who?

- The “Who” block helps you in analyzing the people getting affected directly or indirectly due to it.
- Under this, you find out who the ‘Stakeholders’ to this problem are and what you know about them.
- Stakeholders are the people who face this problem and would be benefited with the solution.

Problem Scoping:4Ws Problem Canvas:

Who

- *Que.* Who are the Stakeholders?
- *Ans.* Farmers, Fertilizer producers, Labours and Tractor companies.

- *Que.* What do you know about them?
- *Ans.* These are some of the peoples worst affected by the problem and loses their money and time.

Problem Scoping:4Ws Problem Canvas:

What?

- Under the “What” block, you need to look into what you have on hand.
- At this stage, you need to determine the nature of the problem.
- What is the problem and how do you know that it is a problem?
- Under this block, you also gather evidence to prove that the problem you have selected actually exists.
- Newspaper articles, Media, announcements, etc are some examples.

Problem Scoping:4Ws Problem Canvas:

- **What**
- *Que.* What is the problem?
- *Ans.* Determine what will be the best time for seeding or crop harvesting.

- *Que.* How do you know that it is a problem? (Is there any evidence?)
- *Ans.* Seeding at improper position and imperfect time leads to the wastage of money and time.

Problem Scoping:4Ws Problem Canvas:

- ***Where?***
- Now that you know who is associated with the problem and what the problem actually is; you need to focus on the context/situation/location of the problem.
- This block will help you look into the situation in which the problem arises, the context of it, and the locations where it is prominent.

Problem Scoping:4Ws Problem Canvas:

- **Where**
- *Que.* What is the context/situation in which the stakeholders experience the problem?
- *Ans.* Decide the mature age for the crop and determine its time.

- *Que.* Where is the problem located?
- *Ans.* In the field.

Problem Scoping:4Ws Problem Canvas:

- ***Why?***
- You have finally listed down all the major elements that affect the problem directly.
- Now it is convenient to understand who the people that would be benefitted by the solution are; what is to be solved; and where will the solution be deployed.
- These three canvases now become the base of why you want to solve this problem.
- Thus in the “Why” canvas, think about the benefits which the stakeholders would get from the solution and how would it benefit them as well as the society.

Problem Scoping: 4Ws Problem Canvas:

- **Why**
- *Que.* Why will this solution be of value to the stakeholders?
- *Ans.* This solution will help us determine the exact time for sowing and harvesting of crops, thus leading to the maximum yield.

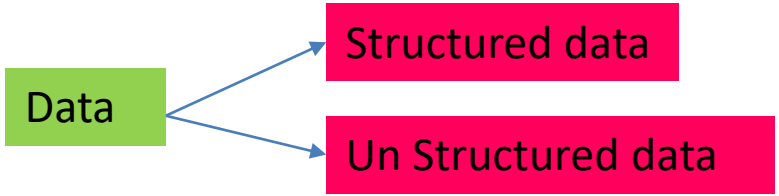
- *Que.* How will the solution improve their situation?
- *Ans.* They could maximize their profit.

Final Problem statement

	Stakeholders	Who
Our	Farmers, Fertilizer Producers, Labours, Tractor Companies	
has /have a problem that	The problem, Issue, Need	What
	Determine what will a good time for seeding or crop harvesting	
When/while	Context/Situation	When
	Decide the mature age for the crop and determine its time	
An ideal solution would	Solution Benefits	Why
	Take the crop on time and supply against market demand on time	

Data Acquisition

- **Data:**
- Data can be defined as a representation of facts or instructions about some entity (students, school, sports, business, animals etc.) that can be processed or communicated by human or machines.
- Data is a collection of facts, such as numbers, words, pictures, audio clips, videos, maps, measurements, observations or even just descriptions of things.
- Data may be represented with the help of characters such as alphabets (A-Z, a-z), digits (0-9) or special characters (+, -, /, *, <, >, = etc.)



Data Acquisition

Structured Data:

- Structured data is categorized as quantitative data.
- It's the type of data most of us work with every day.
- Structured data has predefined data types and format so that it fits well in the column/fields of database or spreadsheet.
- They are highly organised and easily analysed.
- The data is structured in accurately defined fields.
- The data is stored in relational databases or spreadsheets (like Excel).
- Examples of Structured data are: Name, age, address, cricket score board, school time table etc.

Data Acquisition

Unstructured Data:

- Unstructured data is categorized as qualitative data.
- It cannot be processed and analysed using conventional relational database (RDBMS) methods.
- Unstructured data is difficult to deconstruct because it has no predefined model, meaning it cannot be organized in relational databases.
- Instead, non relational, or NOSQL databases, are best fit for managing unstructured data.
- Examples of unstructured data include text, video, audio, mobile activity, social media activity, satellite imagery, surveillance imagery and the list goes on.

Data Acquisition

- **Datasets:**
- A Data set is a set or collection of data.
- This set is normally presented in a tabular pattern.
- Every column describes a particular variable and each row corresponds to a given member of the data set.
- Data sets describe values for each variable for unknown quantities such as height, weight, temperature, volume, etc of an object or values of random numbers. The values in this set are known as a datum.
- The data set consists of data of one or more members corresponding to each row.

Data Acquisition

- Data set eg:

Name of Students	Attendance (in %)	Gender	Participation in Sports	Total Marks obtained (in %)
A	76	FEMALE	Y	92
B	82	MALE	Y	88
C	84	MALE	N	87
D	92	FEMALE	N	90
E	78	MALE	Y	86
F	67	FEMALE	Y	80
G	90	FEMALE	N	88

Data Acquisition

Training data	Test Data
A training dataset is a database of examples used during the learning process and is used to fit the parameters.	A test set is set of example used only to access the performance the fully specified classifier.
Maximum part of the dataset comes under training data (Usually 80%).	A very little part of dataset is used for test data (Usually 20%).

Note: **The training data and the test data are not different, they are usually divided from the main dataset in 80% - 20%.**

Data Acquisition

Data Features:

- Data features refer to the type of data we want to collect.
- A measurable piece of data that can be used for analysis.
- Features are also sometimes referred to as “variables” or “attributes.”
- Depending on what we're trying to analyze, the features we include in our dataset can vary widely.
- In CSV, Excel and databases, they could be seen as columns.

Data Acquisition

- Data sources

Data Acquisition

Acquiring Data:

- **Surveys:**
  - A research method used for collecting data from a predefined group of respondents to gain information and insights into various topics of interest.
- **Camera:**
  - A camera captures a visual image.

    A device for recording visual images in the form of photographs, film, or video signals.
  - Could be used to collect data for CV projects.
- **Web Scraping:**
  - Web scraping is the process of collecting structured web data in an automated fashion. It's also called web data extraction.
  - Some of the main use cases of web scraping include price monitoring, price intelligence, news monitoring, lead generation, and market research among many others.

Data Acquisition

- Observations:
  - Some data we can acquire through monitoring and close inspection**.**
- **Sensors:**
  - A device which detects or measures a physical property and records, indicates, or otherwise responds to it.
  - *E.g.* - Temperature Sensors, Humidity Sensors, Pressure Sensors, Proximity Sensors, Level Sensors, Accelerometers, Gyroscope, Infrared Sensors, etc.
- **API (Application Program Interface):**
  - An API is a software intermediary that allows two applications to talk to each other.

Data Acquisition

Acquiring Data from Reliable Sources:

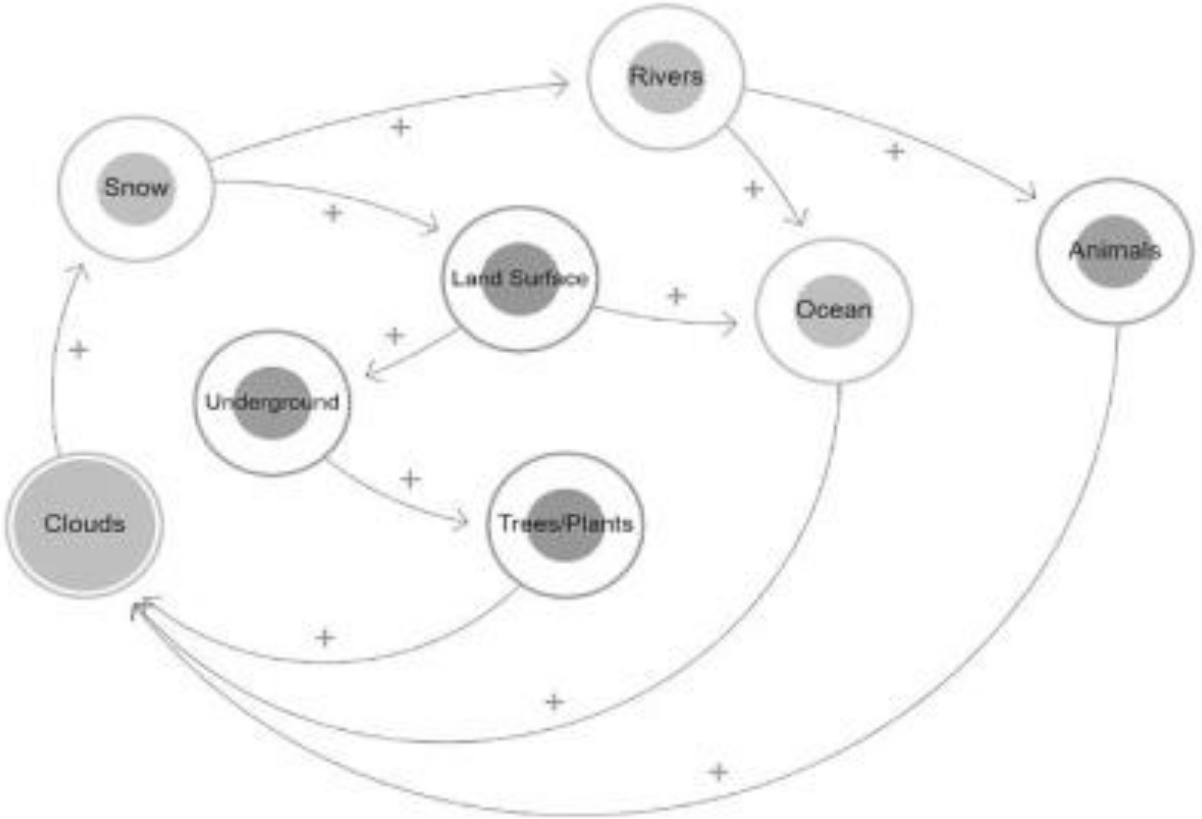
- Sometimes, we use the internet and try to acquire data for your project from some random websites.
- Such data might not be authentic as its accuracy cannot be proved.
- Due to this, it becomes necessary to find a reliable source of data from where some authentic information can be taken.
- At the same time, we should keep in mind that the data which we collect is open-sourced and not someone's property.
- Extracting private data can be an offence. One of the most reliable and authentic sources of information, are the open-sourced websites hosted by the government.
- These government portals have general information collected in suitable format which can be downloaded and used wisely.
- Some of the open-sourced Govt. portals are: data.gov.in, india.gov.
- Some other sources: Kaggle Datasets, Amazon Datasets (Registry of Open Data on AWS), Yahoo WebScope.

Data Acquisition

System maps

- System maps help us to find the relationship between the elements of the problem which we have scoped
- A system map shows the components and boundary of a system and the components of the environment at a point in time.
- The main use of a system map is to help structure a system and communicate the result to others.
- It helps us in strategizing the solution for achieving the goal of our project.
- help to understand complex issues with multiple factors that affect each other
- **Circles** represents the elements,
- **Arrows** represents the relationship between the elements. Length of arrow represents time for a change to happen. This is **time delay. The arrow- head** depicts the direction of the effect and the sign (+ or -) shows their relationship. **If the arrow goes from X to Y with a + sign, it means that both are directly related to each other. If the arrow goes from X to Y with a – sign, it means that both the elements are inversely related to each other .**
- **Loops** represent a specific chain of causes and effects.
- To change the outcome of a system, as a change maker, either change the elements in a system or change the relationships between elements.

System maps


Rivers
Snow
Land Surface
Ocean
Animals
Underground
Clouds
Trees/Plants
+
+
+
+
+
+
+
+
+
+

Data Exploration:

- Arrange the gathered data uniformly for a better understanding.
- A process of interpreting the acquired data to find out useful information from the acquired data.
- The goal of data exploration is to learn about characteristics and potential problems of a data set without the need to formulate assumptions about the data beforehand.
- In statistics, data exploration is often referred to as “exploratory data analysis” and contrasts traditional hypothesis testing.
- It was most prominently promoted by the statistician “John W. Tukey” to suggest hypotheses about the causes of observed phenomena and to assess assumptions on which statistical methods are based.
- Since its beginnings, EDA has been a very graphical approach.
- Typical plots include histograms, box plots, scatter plots and many more in order to learn about distributions, correlations, outliers, trends, and other data characteristics.

Data Exploration:

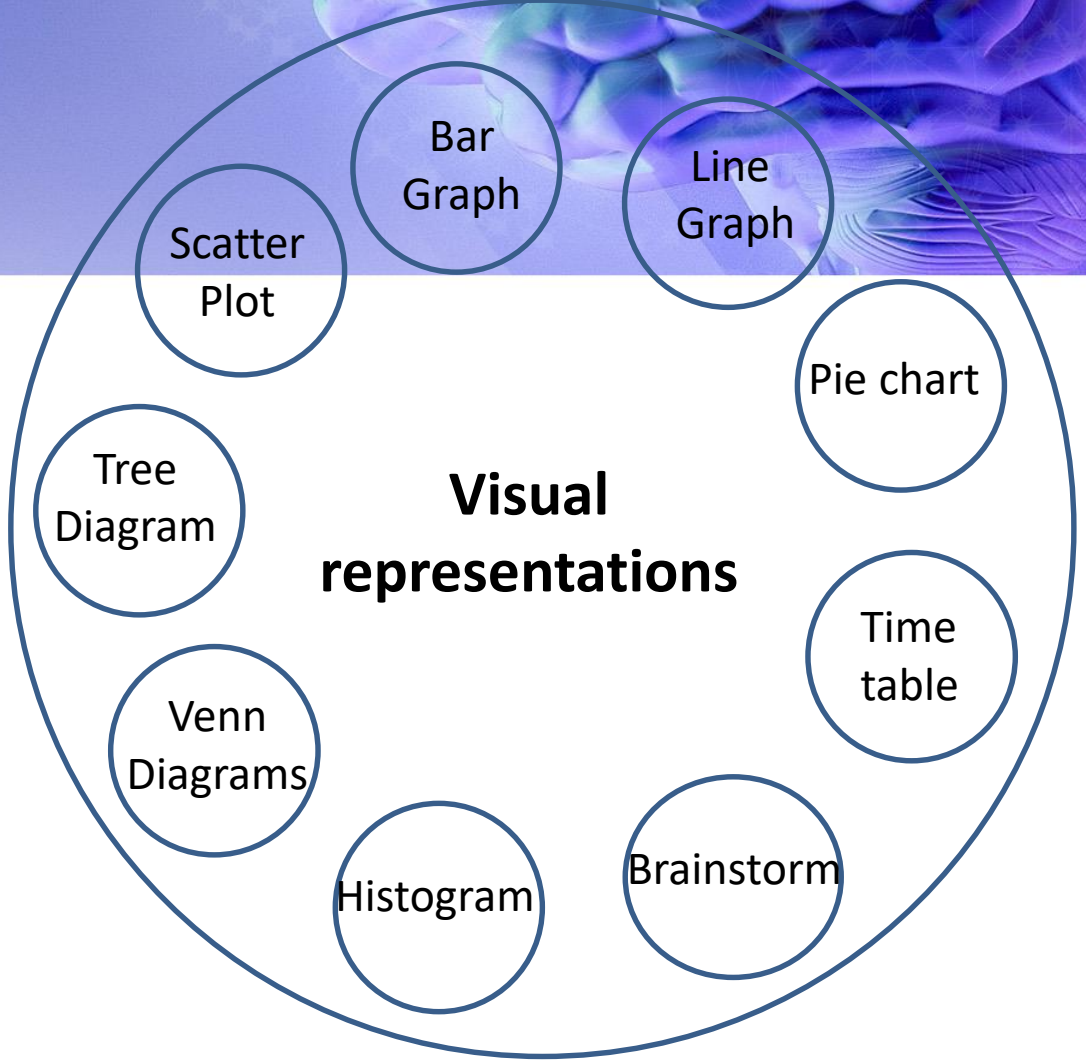
Why to Explore?

Data exploration is done by visualizing the data or arranging the data uniformly for a better understanding.

- Thus, to analyze the data, we need to visualize it in some user-friendly format so that we can:
  - Quickly get a sense of the trends, relationships and patterns contained within the data.
  - Define strategy for which model to use at a later stage.
  - Communicate the same to others effectively.

Data Exploration:

Data Visualization Techniques:



Data Exploration:

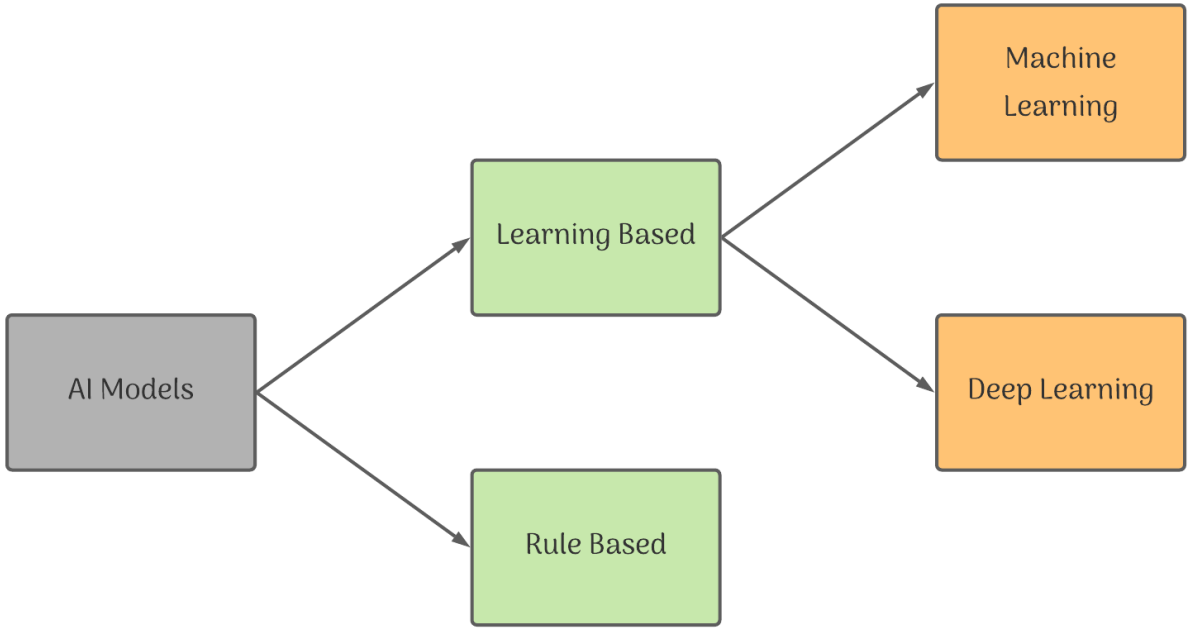
Activity: List down 5 new data visualization techniques which you learnt from

Data Visualisation Technique 1	
Name of the Representation	
One-line Description	
How to draw it	
Suitable for which data type?	

Modelling

- AI Modelling refers to developing algorithms, also called models which can be trained to get intelligent outputs. That is, writing codes to make a machine artificially intelligent.
- The graphical representation makes the data understandable for humans as we can discover trends and patterns out of it.
- But when it comes to machine accessing and analysing data, it needs the data in the most basic form of numbers (which is binary – 0s and 1s) and when it comes to discovering patterns and trends in data, the machine goes for mathematical representations of the same.
- The ability to mathematically describe the relationship between parameters is the heart of every AI model.
- Thus, whenever we talk about developing AI models, it is the mathematical approach towards analysing data which we refer to.

Modelling


AI Models
Learning Based
Rule Based
Machine Learning
Deep Learning

Modelling

Rule Based Approach :

- Rule Based Approach Refers to the AI modelling where the relationship or patterns in data are defined by the developer.
- The machine follows the rules or instructions mentioned by the developer, and performs its task accordingly.

Modelling

Rule Based Approach (Decision Tree):

Outlook	Temperature	Humidity	Wind	Elephant spotted?
Sunny	Hot	High	Weak	No
Sunny	Hot	High	Strong	No
Overcast	Hot	High	Weak	Yes
Rain	Mild	High	Weak	Yes
Rain	Cool	Normal	Weak	Yes
Rain	Cool	Normal	Strong	No
Overcast	Cool	Normal	Strong	Yes

Modelling

Outlook	Temperature	Humidity	Wind	Elephant spotted?
Sunny	Mild	High	Weak	No
Sunny	Cool	Normal	Weak	Yes
Rain	Mild	Normal	Weak	Yes
Sunny	Mild	Normal	Strong	Yes
Overcast	Mild	High	Strong	Yes
Overcast	Hot	Normal	Weak	Yes
Rain	Mild	High	Strong	No

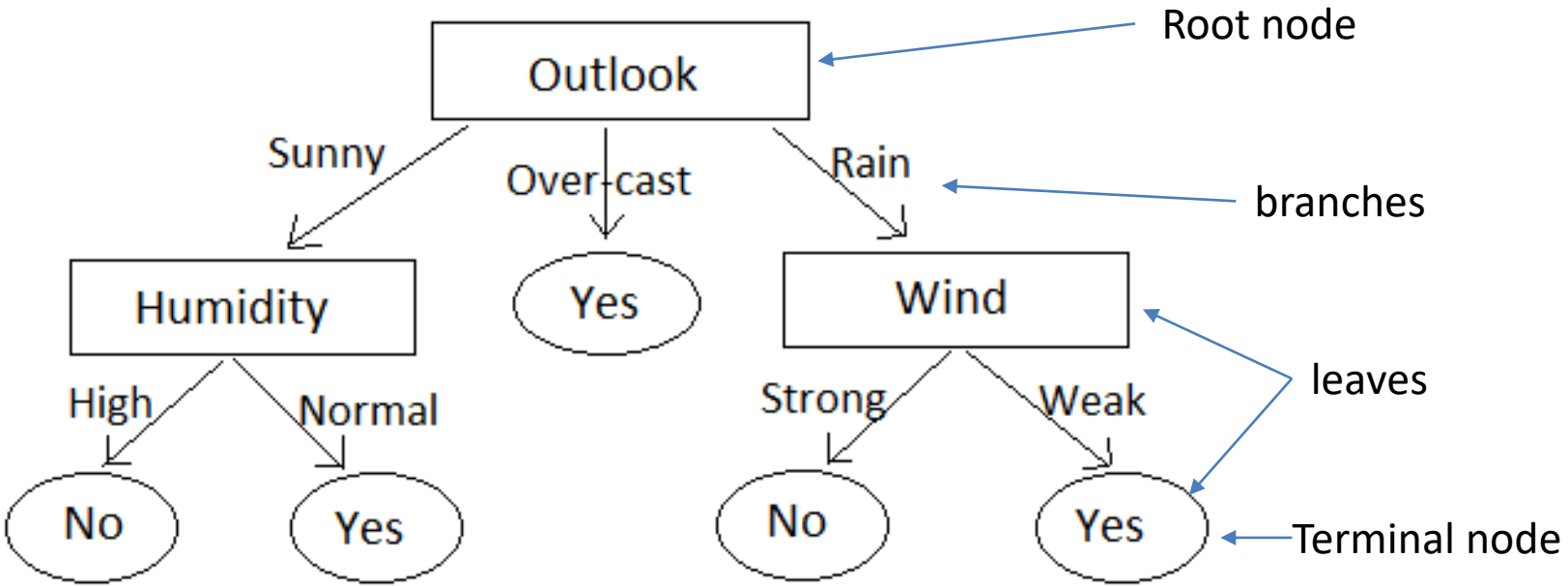
Modelling

Rule Based Approach (Decision Tree):

- Decision tree is the most powerful and popular tool for classification and prediction.
- It made up of several nodes with top-down approach
- A Decision tree is a flowchart like tree structure.
- *The basic structure of a Decision Tree starts from the root which the point where the decision tree starts. From there, the tree diverges into multiple directions with the help of arrows called branches.*
- Each internal node denotes a test on an attribute, each branch represents an outcome of the test, and each leaf node (terminal node) holds a class label.

Modelling

- **Rule Based Approach (Decision Tree):**



Drawback of Rule based approach

- A drawback/feature for this approach is that the learning is static.
- The machine once trained, does not take into consideration any changes made in the original training dataset.
- That is, if you try testing the machine on a dataset which is different from the rules and data you fed it at the training stage, the machine will fail and will not learn from its mistake.
- Once trained, the model cannot improvise itself on the basis of feedbacks. Thus, machine learning gets introduced as an extension to this as in that case, the machine adapts to change in data and rules and follows the updated path only, while a rule-based model does what it has been taught once.

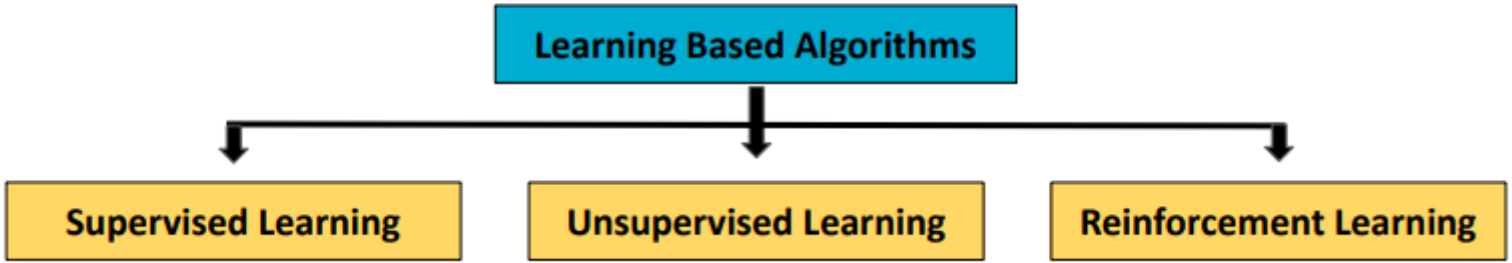
Modelling

Learning Based Approach :

- Refers to the AI modelling where the machine learns by itself.
- Under the Learning Based approach, the AI model gets trained on the data fed to it and then is able to design a model which is adaptive to the change in data. That is, if the model is trained with X type of data and the machine designs the algorithm around it, the model would modify itself according to the changes which occur in the data so that all the exceptions are handled in this case.
- Thus, the machine looks at the data, tries to extract similar features out of it and clusters same datasets together.
- In the end as output, the machine tells us about the trends which it observed in the training data.

Modelling

Some of the Common AI Models:

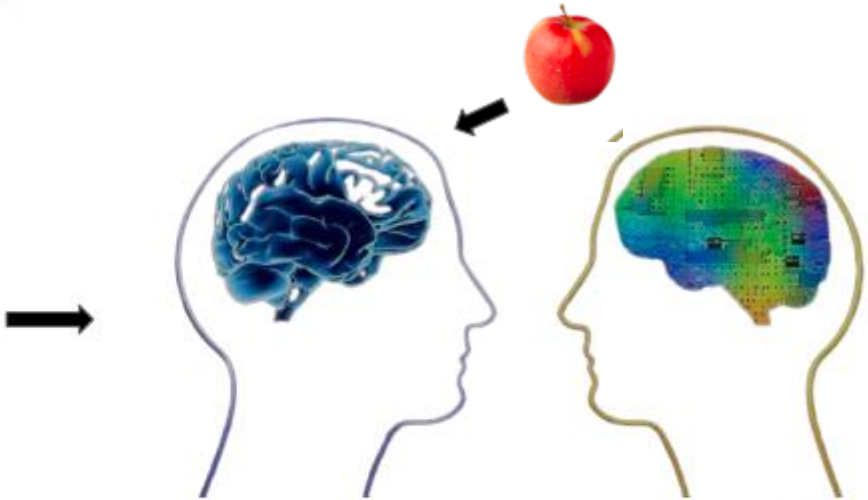


Modelling

Supervised Learning Algorithm:

Input

Figure	Fruit
	Apple
	Mango
	Orange
	Watermelon



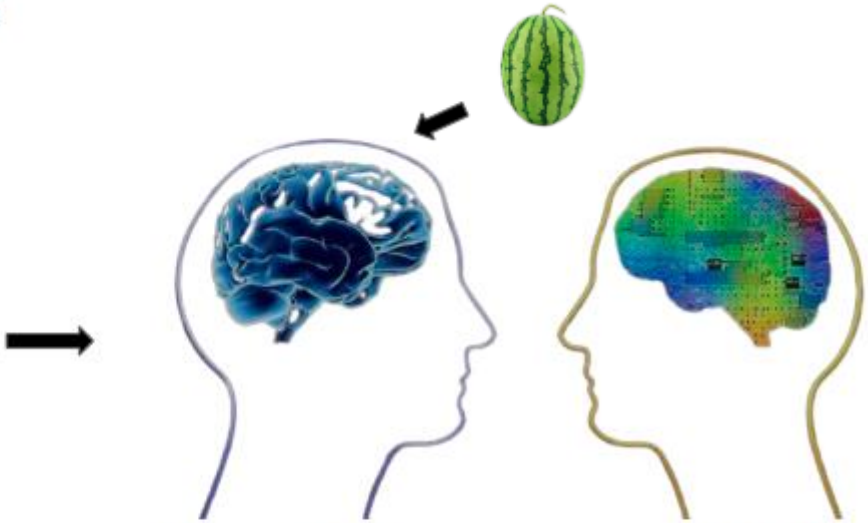
Output = Apple

Modelling

Supervised Learning Algorithm:

Input

Figure	Fruit
	Apple
	Mango
	Orange
	Watermelon



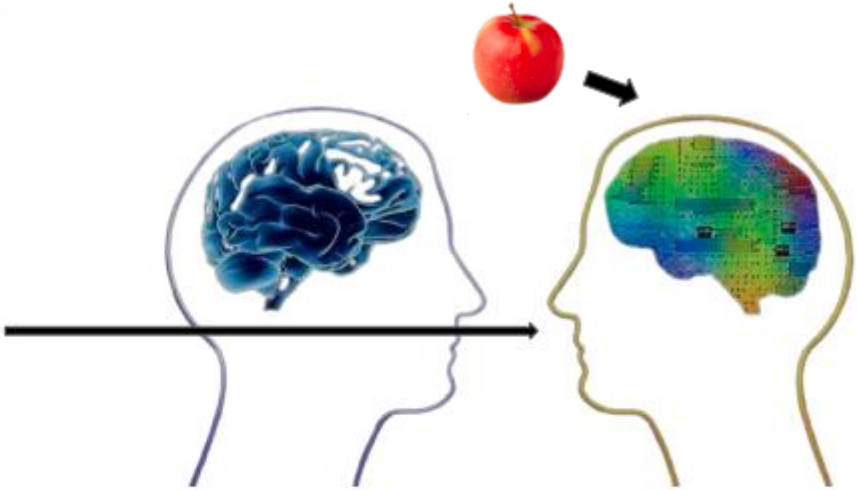
Output = Watermelon

Modelling

Supervised Learning Algorithm:

Input

Figure	Fruit
	Apple
	Mango
	Orange
	Watermelon



Modelling

Supervised Learning Algorithm:

Input

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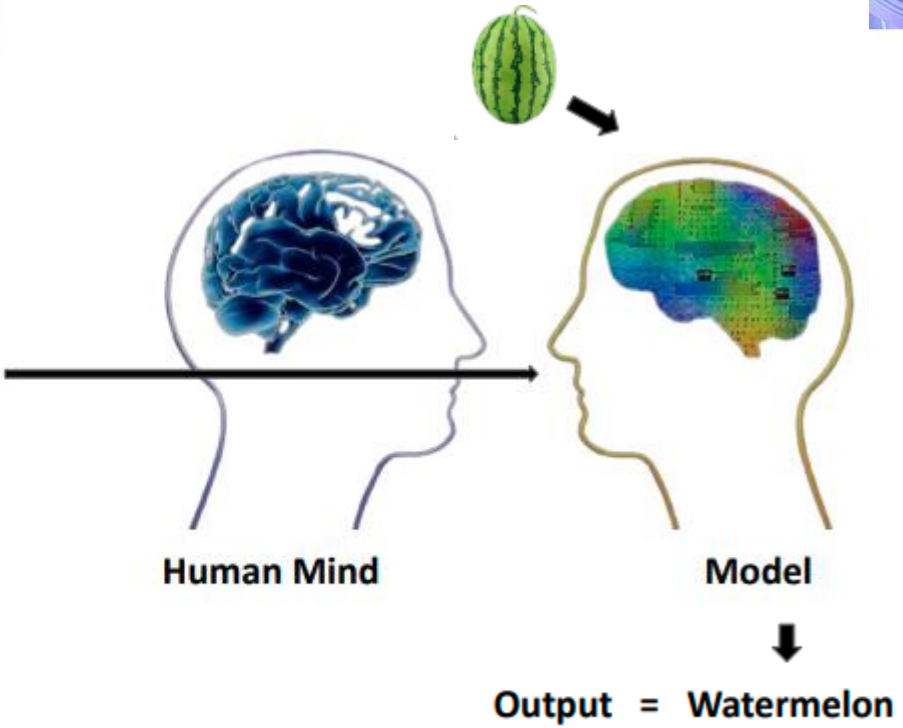


Modelling

Supervised Learning:

- In a supervised learning model, the dataset which is fed to the machine is labelled.
- In other words, we can say that the dataset is known to the person who is training the machine only then he/she is able to label the data.
- A label is some information which can be used as a tag for data. For example, students get grades according to the marks they secure in examinations. These grades are labels which categorize the students according to their marks.

Modelling

Two types of Supervised Learning Models:

- Regression
- Classification

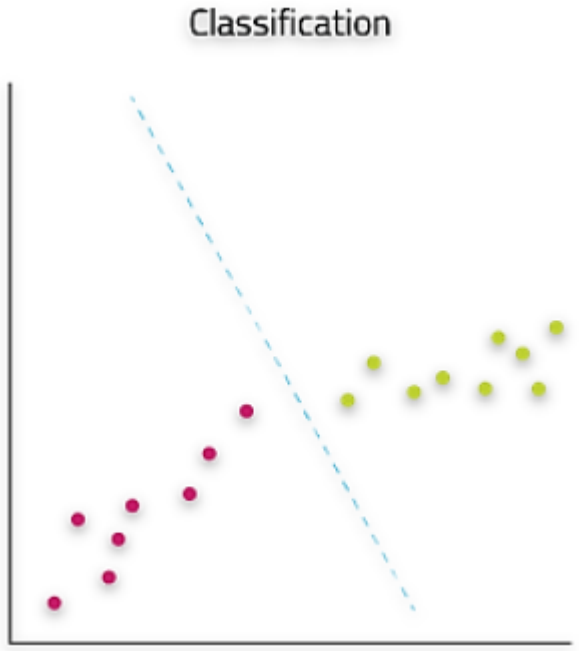
Modelling

Classification -

- This model works where the data is classified according to the labels.
- For example, in the grading system, students are classified on the basis of the grades they obtain with respect to their marks in the examination. This model works on discrete dataset which means the data need not be continuous.

  -*Types of classification* -

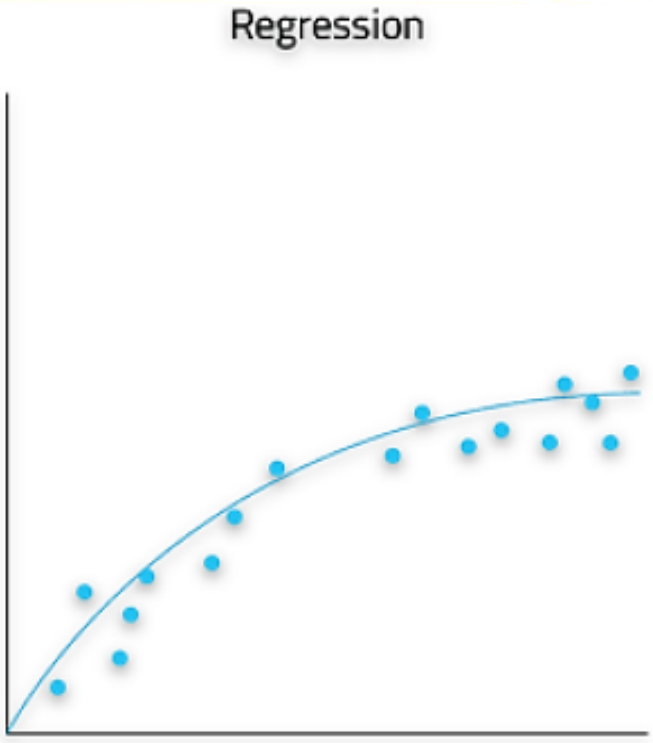
  1. Logistic Regression
  2. Naïve Bayes
  3. Stochastic Gradient Descent
  4. Support Vector Machine



Modelling

Regression -

- These models work on continuous data.
- For example, if you wish to predict your next salary, then you would put in the data of your previous salary, any increments, etc., and would train the model. Here, the data which has been fed to the machine is continuous.
  - *Types of regression* -
    1. Linear Regression
    2. Stepwise Regression
    3. Ridge Regression
    4. Lasso Regression
    5. Polynomial Regression



Supervised Learning

- **Advantages:-**
- Supervised learning allows collecting data and produces data output from previous experiences.
- Helps to optimize performance criteria with the help of experience.
- Supervised machine learning helps to solve various types of real-world computation problems.
- It performs classification and regression tasks.
- We have complete control over choosing the number of classes we want in the training data.
- **Disadvantages:-**
- Classifying big data can be challenging.
- Training for supervised learning needs a lot of computation time. So, it requires a lot of time.
- Supervised learning cannot handle all complex tasks in Machine Learning.
- Computation time is vast for supervised learning.
- It requires a labelled data set.
- It requires a training process.

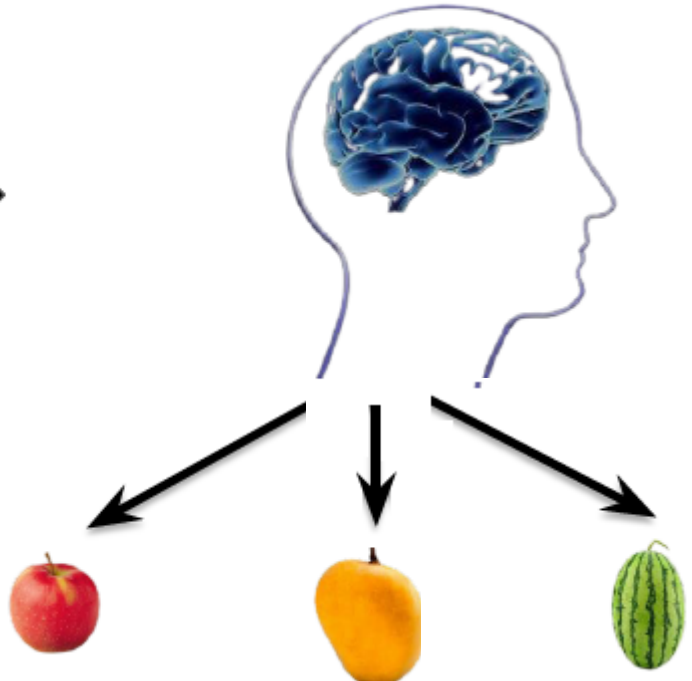
Modelling

Unsupervised Learning Algorithm:

Input

Figure	
	
	
	
	

Human Mind



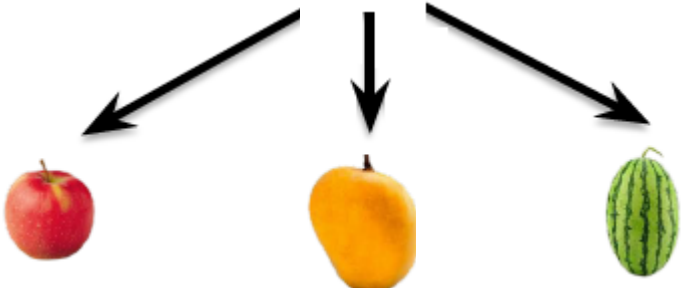
Modelling

Unsupervised Learning Algorithm:

Input

Figure	
	
	
	
	

Model



Modelling

Unsupervised Learning:

- An unsupervised learning model works on unlabelled dataset.
- This means that the data which is fed to the machine is random and there is a possibility that the person who is training the model does not have any information regarding it.
- The unsupervised learning models are used to identify relationships, patterns and trends out of the data which is fed into it.
- It helps the user in understanding what the data is about and what are the major features identified by the machine in it.

Modelling

- **Unsupervised Learning:**
  - Clustering
  - Dimensionality reduction

Modelling

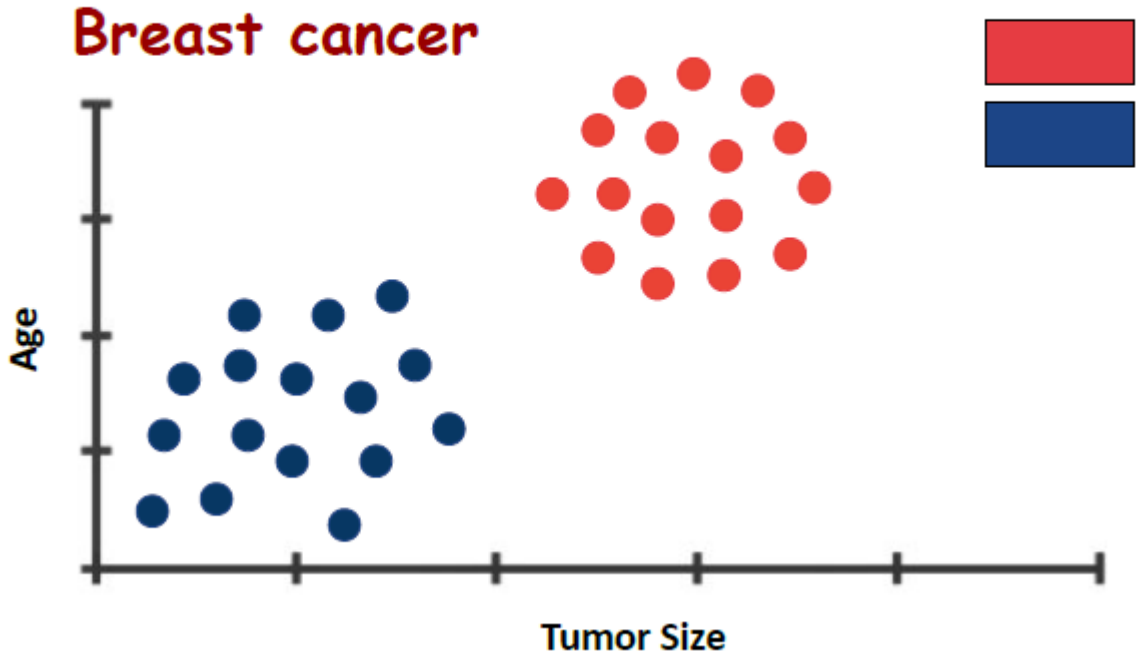
Unsupervised Learning:

- ***Clustering*** **-**
  - Refers to the unsupervised learning algorithm which can cluster the unknown data according to the patterns or trends identified out of it.
  - The patterns observed might be the ones which are known to the developer or it might even come up with some unique patterns out of it.

Modelling

Unsupervised Learning:

Clustering -



Modelling

Unsupervised Learning:

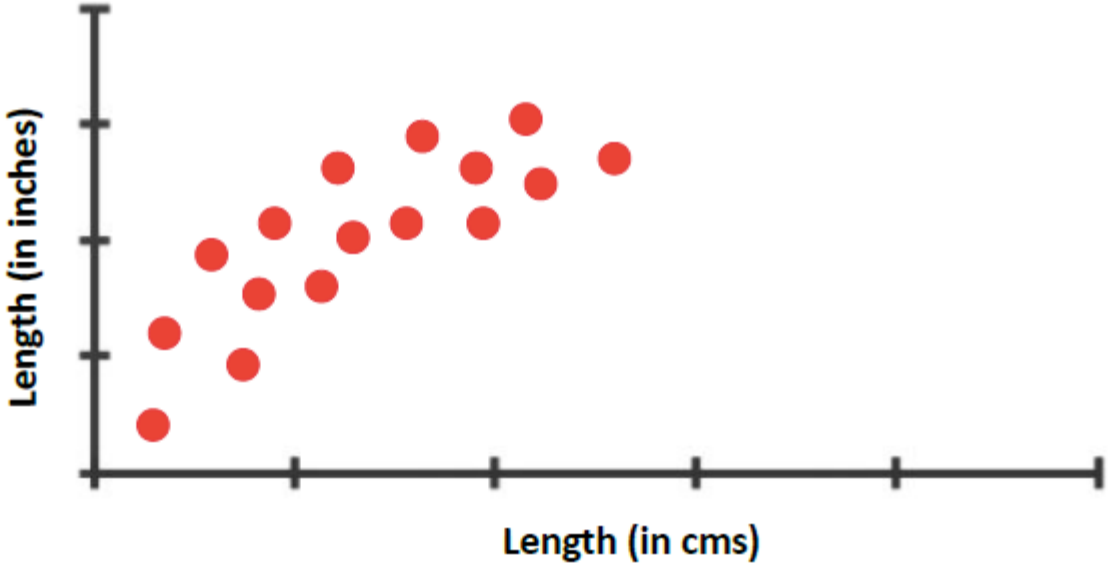
- *Dimensionality Reduction* -
  - An unsupervised learning problem.
  - Dimensionality reduction refers to techniques for reducing the number of input variables in training data.

    Example: 2D ----> 1D, 3D ---> 2D
  - Used basically for two purposes:
    - Data Compression
    - Visualization

Modelling

Unsupervised Learning:

Dimensionality Reduction -



Modelling

Unsupervised Learning:

- *Dimensionality Reduction* -
- Two main classes of algorithms.
- 1. *Linear Algebra Methods*
  - Principal Components Analysis
  - Singular Value Decomposition
  - Non-Negative Matrix Factorization
- 2. *Manifold learning methods*
  - Isomap Embedding
  - Locally Linear Embedding
  - Multidimensional Scaling
  - Spectral Embedding
  - t-distributed Stochastic Neighbor Embedding

Unsupervised Learning

- **Advantages of unsupervised learning:**
- It does not require training data to be labeled.
- Dimensionality reduction can be easily accomplished using unsupervised learning.
- Capable of finding previously unknown patterns in data.
- **Flexibility**: Unsupervised learning is flexible in that it can be applied to a wide variety of problems, including clustering, anomaly detection, and association rule mining.
- **Exploration**: Unsupervised learning allows for the exploration of data and the discovery of novel and potentially useful patterns that may not be apparent from the outset.
- **Low cost**: Unsupervised learning is often less expensive than supervised learning because it doesn't require labeled data, which can be time-consuming and costly to obtain.
- **Disadvantages of unsupervised learning :**
- Difficult to measure accuracy or effectiveness due to lack of predefined answers during training.
- The results often have lesser accuracy.
- The user needs to spend time interpreting and label the classes which follow that classification.
- **Lack of guidance**: Unsupervised learning lacks the guidance and feedback provided by labeled data, which can make it difficult to know whether the discovered patterns are relevant or useful.
- **Sensitivity to data quality**: Unsupervised learning can be sensitive to data quality, including missing values, outliers, and noisy data.
- **Scalability**: Unsupervised learning can be computationally expensive, particularly for large datasets or complex algorithms, which can limit its scalability.

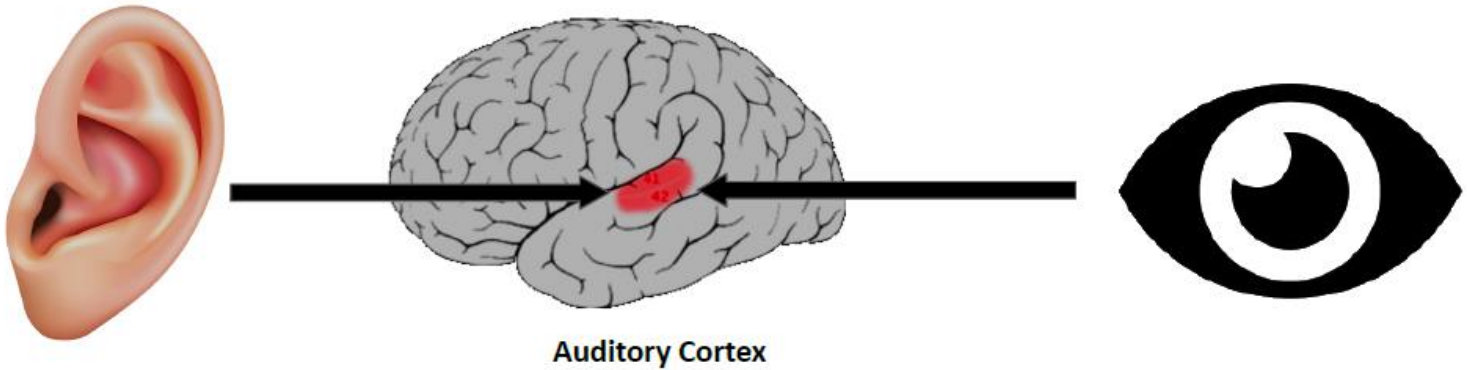
Evaluation

- Once a model has been made and trained, it needs to go through proper testing so that one can calculate the efficiency and performance of the model.
- Hence, the model is tested with the help of Testing Data (which was separated out of the acquired dataset at Data Acquisition stage) and the efficiency of the model is calculated on the basis of the parameters mentioned below:

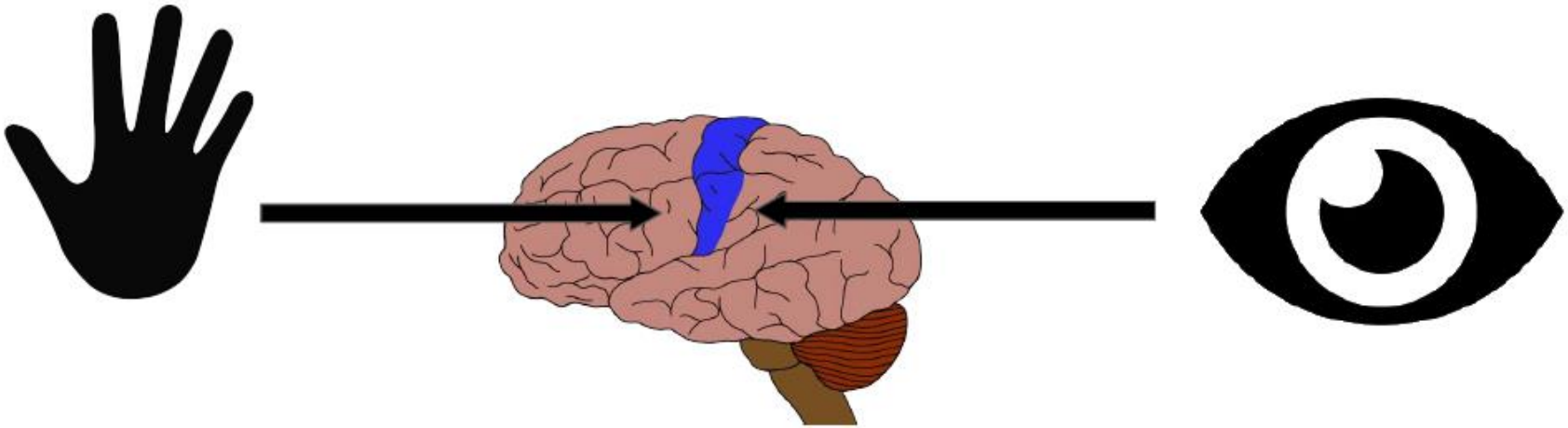
Neural Network

- Neural networks were first proposed in 1944 by *Warren McCulloch and Walter Pitts*.
    - ❖ Origins - Algorithm that’s try to mimic the human mind.
    - ❖ Was very widely used in early 80s and early 90s.
    - ❖ Popularity diminished in late 90s due to hardware limitations.

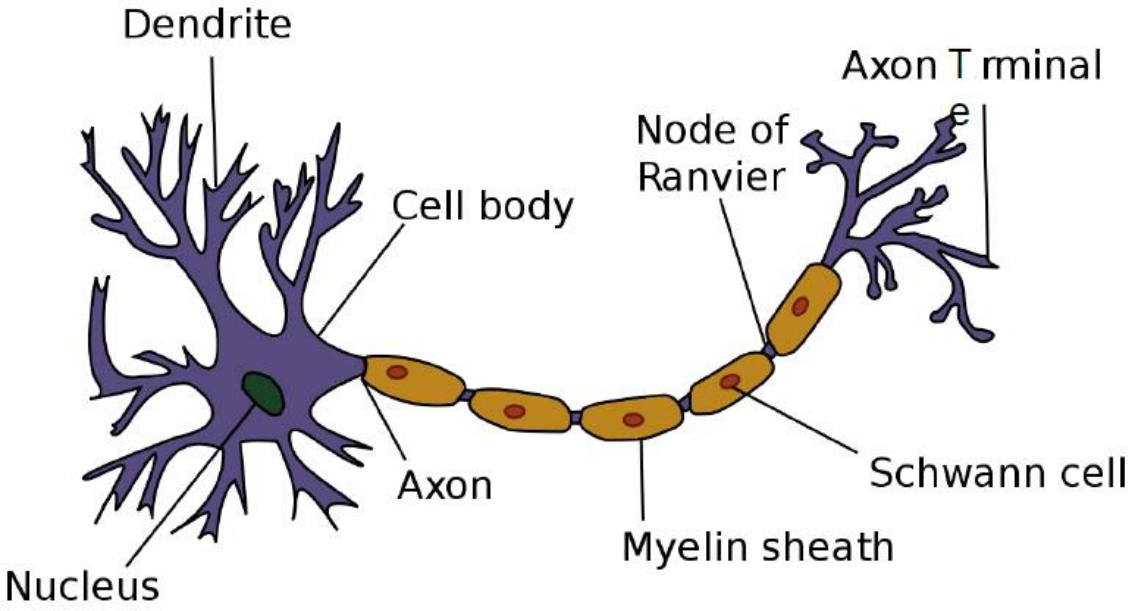
- **Human Nervous System:**



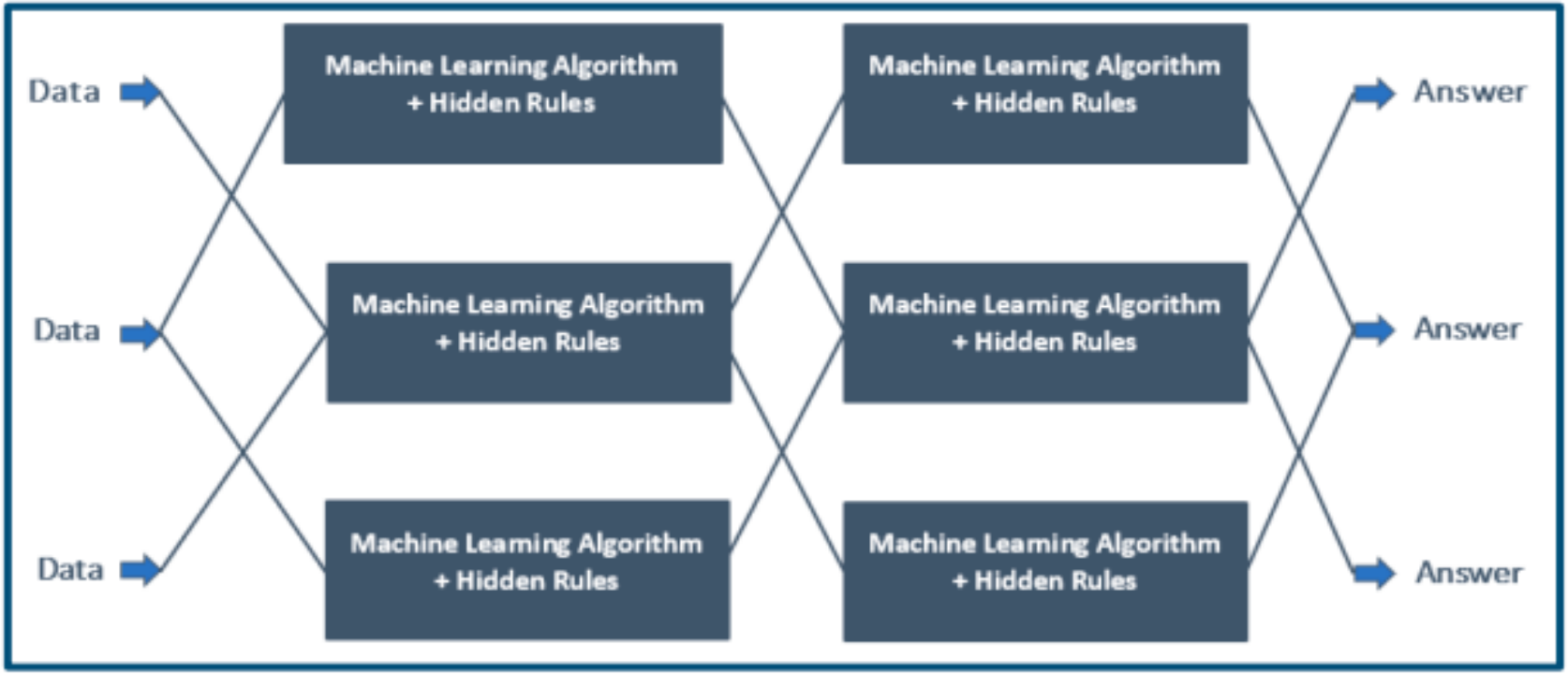
Human Nervous System:



- Neuron


Dendrite
Axon Terminal
Node of Ranvier
Cell body
Schwann cell
Axon
Myelin sheath
Nucleus

Neural network layers

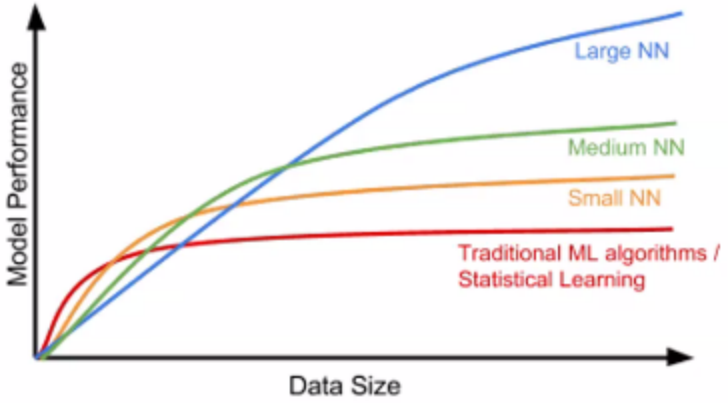


Neural network layers

- A Neural Network is divided into multiple layers and each layer is further divided into several blocks called nodes.
- Each node has its own task to accomplish which is then passed to the next layer.
- The first layer of a Neural Network is known as the input layer. The job of an input layer is to acquire data and feed it to the Neural Network. No processing occurs at the input layer.
- Next to it, are the hidden layers. Hidden layers are the layers in which the whole processing occurs. Their name essentially means that these layers are hidden and are not visible to the user. Each node of these hidden layers has its own machine learning algorithm which it executes on the data received from the input layer.
- The processed output is then fed to the subsequent hidden layer of the network. There can be multiple hidden layers in a neural network system and their number depends upon the complexity of the function for which the network has been configured.
- Also, the number of nodes in each layer can vary accordingly.
- The last hidden layer passes the final processed data to the output layer which then gives it to the user as the final output.
- Similar to the input layer, output layer too does not process the data which it acquires. It is meant for user-interface.

Neural Networks

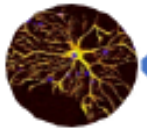
1. Neural networks are loosely modelled after how neurons in the brain behave.
2. They are able to automatically extract features without input from the programmer.
3. Every neural network node is essentially a machine learning algorithm.
4. It is useful when solving problems for which the data set is very large.



Source: https://towardsdatascience.com/machine-learning-a-gentle-introduction-17e96d8143fc

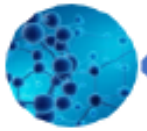
- The larger Neural Networks tend to perform better with larger amounts of data whereas the traditional machine learning algorithms stop improving after a certain saturation point

Neural Network features



Neural Network systems are modelled on the human brain and nervous system.

They are able to automatically extract features without input from the programmer.



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