Unit 1 AI Reflection

Unit 1.1 – Understanding AI

Purpose: Introduction to the program.

The Artificial Intelligence Curriculum hopes to inspire AI-Readiness in you. At the end of this program, we hope you will get a deep understanding of AI, access to AI-powered tools and the ability to create solutions with AI.

Welcome to an introduction to Artificial Intelligence! What do you think Artificial Intelligence is?

What do you want to learn about AI?

How do you think we should go about it?

What will you learn?

- When a machine possesses the ability to mimic human traits, i.e., make decisions, predict the future, learn and improve on its own, it is said to have artificial intelligence. In other words, you can say that a machine is artificially intelligent when it can accomplish tasks by itself - collect data, understand it, analyse it, learn from it, and improve it.
- AI is a form of intelligence; a type of technology and a field of study.
- AI theory and development of computer systems (both machines and software) are able to perform tasks that normally require human intelligence.
- Artificial Intelligence covers a broad range of domains and applications and is expected to impact every field in the future.

Overall, its core idea is to build machines and algorithms which are capable of performing computational tasks that would otherwise require human-like brain functions.

What is Artificial Intelligence?

When a machine…

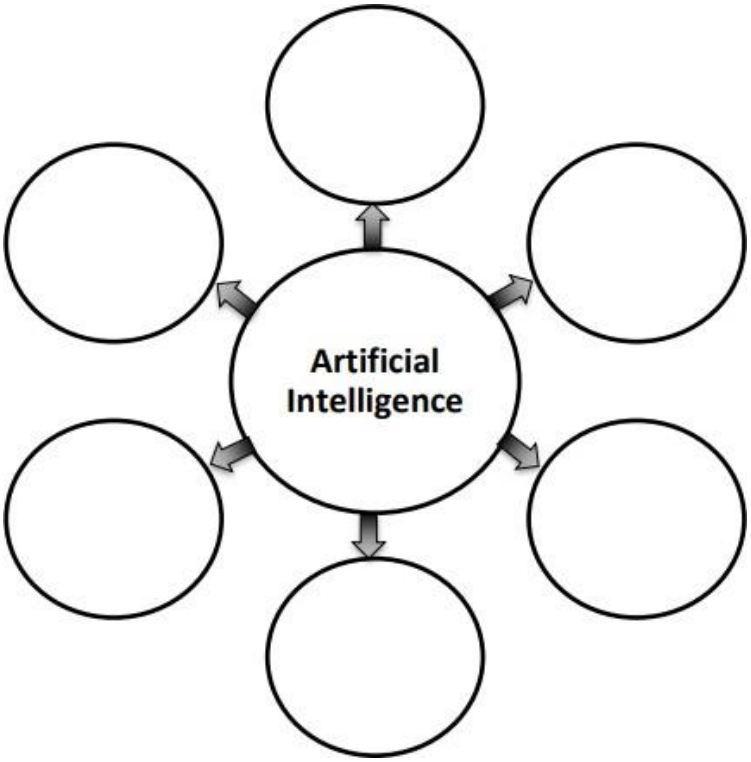
- Mimics human intelligence
- Can solve real-world problems
- Improves on its own from past experiences
- Can predict and make decisions on its own

…it can be termed as Artificially Intelligent!

How to make machine intelligent?



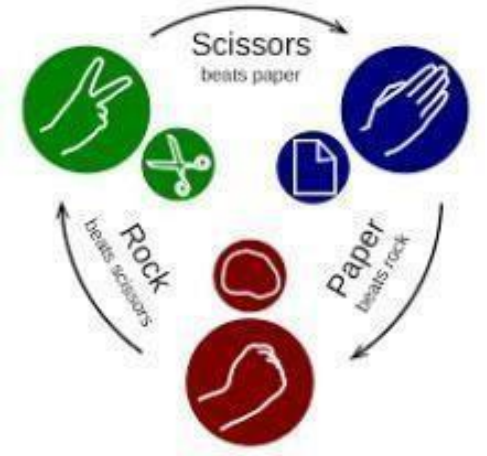
How do you think Artificial Intelligence can help you as you go about your daily life? Fill in your ideas below.



Activity: Game Time

In this activity, you will visit a few online resources to play games and experience the power of AI.

Resources:

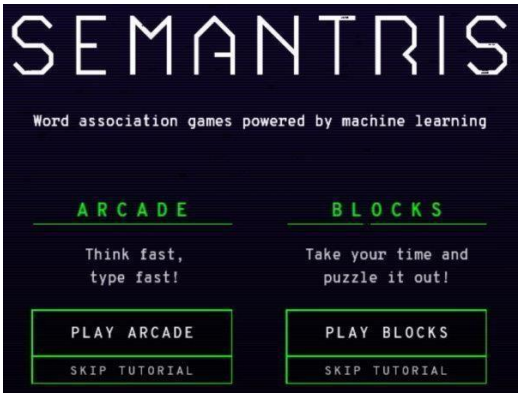


Game 1 (Rock, Paper and Scissors):
Rules for playing Game 1:

- ✓ Type the link below to launch the tool
- ✓ Scroll down and check the box "I Agree". Click on Let' Go
- ✓ You may turn off the camera to select the moves directly from the screen
- ✓ Start the game by selecting "rock", "scissors" or "paper"
- ✓ Choose continuously until you create a pattern and check how AI tries to win.

Visit https://next.rockpaperscissors.ai/ to play the game online.

Game 2 (Semantris):



Rules for playing Game 2:

- ✓ Type the link given and click on launch experiment option to start the game.
- ✓ Click on Play Arcade option to start playing the game.
- ✓ Each time AI gives you the highlighted clue, you are supposed to enter the most closely associated word to get more scores.
- ✓ Check how machine understands your words

Visit https://research.google.com/semantris/ to experience the magic online.

Game 3 (Quick, Draw):



Rules for playing Game 3:

- ✓ Type the link and click on Let's Draw option to start playing the game.
- ✓ An item will be named on the screen for you to draw in 20 seconds after you click on Got it!
- ✓ AI will guess whatever you draw on the white screen.
- ✓ Try drawing 6 objects correctly in a row to win the game!

Launch the game at https://quickdraw.withgoogle.com/

It's time for you to try them out!



Games are an integral part of our culture. People across the world participate in different kinds of games as a form of social interaction, competition, and enjoyment.

The basic principle of every game is rule-setting and following the rules.

Write down three rules in the given spaces you would set before playing any game.

Rule 1

Rule 2

Rule 3

Purpose: Expose you to the 3 domains of AI (Natural Language Processing, Computer Vision, and Data for AI).

Brief: You will go through three AI games in the form of a challenge. Game Descriptions:

Rock, Paper & Scissors: A game based on Data for AI where the machine tries to predict the next move of the participant. It is a replica of a basic rock, paper and scissors game where the machine tries to win ahead by learning from the participant's previous moves.

Semantris: A game based on Natural Language Processing is a set of word association games powered by machine-learned, natural language understanding technology. Each time you enter a clue, the AI looks at all the words in play and chooses the ones it thinks are most related.

Quick, Draw: A game based on Computer Vision developed by Google that challenges players to draw a picture of an object or idea and then uses a neural network artificial intelligence to guess what the drawings represent.

We are going to get serious now! You are challenged by an eccentric data scientist, to solve 3 challenges he designed. You have 60 mins before he inserts a virus into every electronic device in the world! We will work in groups of 4-5 students now. Whether you are ready or not, the countdown is going to start now! Grab a seat in front of the computer and start your challenge.

Game 1: The AI Game Challenge

Guess what……?

- Here are some visuals that will help you guess the games you are going to play. You have 10 seconds to guess and write the name of the games below:



Guess the game.

Have you tried it before?

_____

_____

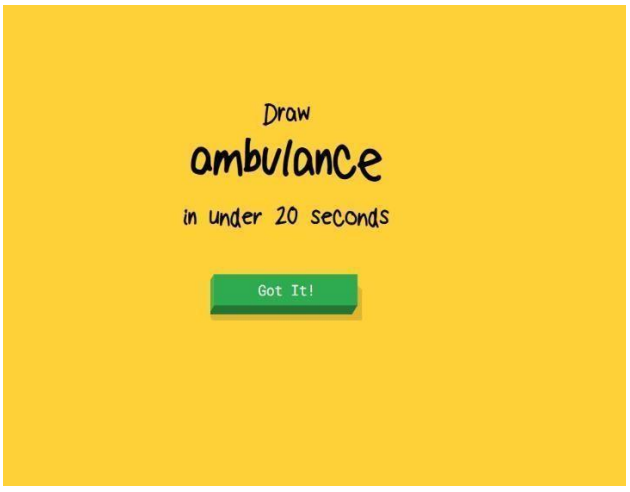


Guess the game.

Have you tried it before?

_____

_____



Guess the game.

Have you tried it before?

_____

_____

Pair Activity:

Team up with a partner and let the challenge begin!

List the different sources from where you can collect data.

Game 1: Rock, Paper and Scissors

(*based on Data for AI*)

Write three things you learnt from the game.

_____

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_____

Game 2: Semantris

(*based on Natural Language Processing - NLP*)

Mention three things you understood about the game.

What is Natural Language Processing?

_____

_____

_____

Game 3: Quick Draw

(*based on Computer Vision – CV*)

Did you face any difficulty while playing this game? How did you overcome this?

What is Computer Vision?

_____

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Depending on the type of data, we can divide AI into different domains:

CV

Computer Vision, is an AI domain works with videos and images enabling machines to interpret and understand visual information.

NLP

Natural Language Processing (NLP) is an AI domain focused on textual data enabling machines to comprehend, generate, and manipulate human language.

Statistical Data

Statistical Data refers to statistical techniques to analyse, interpret and draw insights from numerical/tabular data.

Some AI Applications



Face Lock in Smartphones

Smartphones nowadays come with the feature of face locks in which the smartphone's owner can set up his/her face as an unlocking mechanism for it. The front camera detects and captures the face and saves its features during initiation. Next time onwards, whenever the features match, the phone is unlocked.

Smart assistants

Smart assistants like Apple's Siri and Amazon's Alexa recognize patterns in speech, then infer meaning and provide a useful response.





Fraud and Risk Detection
Finance companies were fed with bad debts and losses every year. However, they had a lot of data which used to get collected during the initial paperwork while sanctioning loans. They decided to bring in data scientists to rescue them from losses. Over the years, banking companies learned to divide and conquer data via customer profiling, past expenditures, and other essential variables to analyse the probabilities of risk and default. Moreover, it also helped them to push their banking products based on customer's purchasing power.

Medical Imaging: For the last decades, computer supported medical imaging application that has been a trustworthy help for physicians. It doesn't only create and analyse images, but also becomes an assistant and helps doctors with their interpretation. The application is used to read and convert 2D scan images into interactive 3D models that enable medical professionals to gain a detailed understanding of a patient's health condition.



Let's Discuss

Why should these three games be relevant for AI awareness?

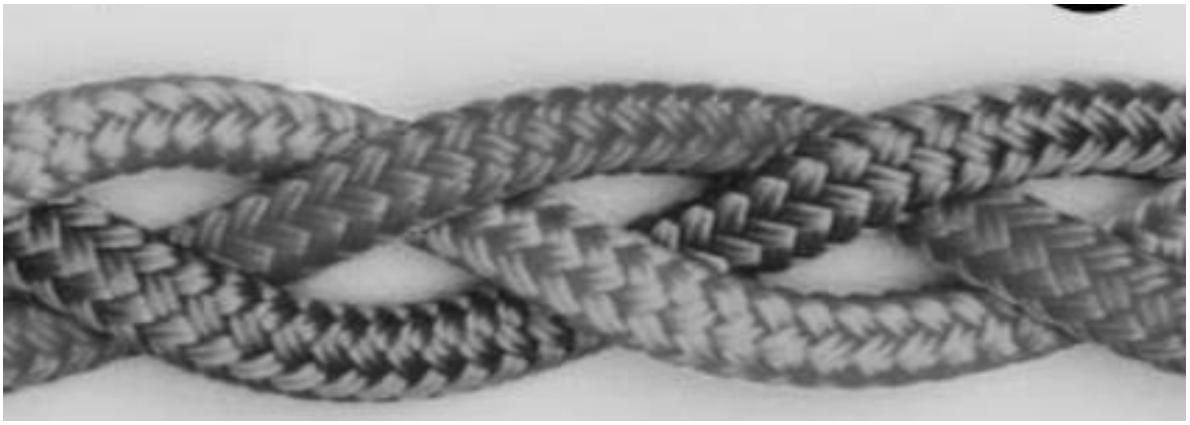
Group Activity: Reflect and Analyse

Purpose: To understand how three AI domains are inter-related to each other.

You will get to know that even if these three domains of AI – Natural Language Processing, Computer Vision and Data for AI are quite distinct from each other, they together constitute the concept of Artificial Intelligence.

Take three different colour strands and work them into a braid. See how long your braid can become within 30 seconds!! Ready? Go!!!

Let's understand: To understand AI, we draw an analogy from the three strands in a braid. One is the Statistical Data strand, the second is the Natural Language Processing strand and the third strand is the Computer Vision. They all together constitute the concept called Artificial Intelligence.



Revision Time

Part A

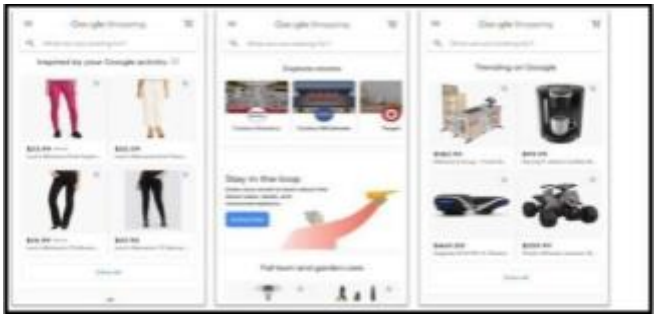
Quiz Time: AI Quiz

1. Which one of the following is an application of AI?
   a. Remote controlled Drone
   b. Self-Driving Car
   c. Self-Service Kiosk
   d. Self-Watering Plant System
2. This language is easy to learn and is one of the most popular languages for AI today:
   a. C++
   b. Python
   c. Ruby
   d. Java
3. This field is enabling computers to identify and process images as humans do:
   a. Face Recognition
   b. Model-view-controller
   c. Computer Vision
   d. Eye-in-Hand System
4. What does NLP stand for in AI?
   a. Neutral Learning Projection
   b. Neuro-Linguistic Programming
   c. Natural Language Processing
   d. Neural Logic Presentation
5. Which of the following is not a domain of artificial intelligence?
   a. Data Management System
   b. Computer Vision
   c. Natural Language Processing
   d. Data Science
6. How excited are you about this AI curriculum?
   a. Very Excited!
   b. A bit excited
   c. Same as always
   d. Not excited at all

Part B

1. How can AI be used as a tool to transform the world into a better place?
2. Can you list down a few applications in your smartphone that widely make use of computer vision?
3. Draw out the difference between the three domains of AI with respect to the types of data they use.
4. Identify the features and the domain of AI used in them:

(a)



(b)



(c)



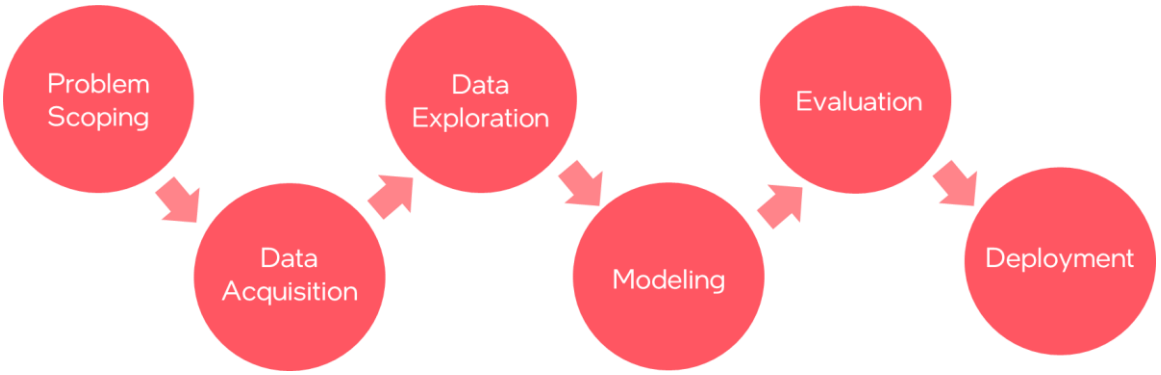
5. Separate the following areas based on the kinds of domains widely used in them:
    a. Crop productivity
    b. Traffic regulation
    c. Maps and navigation
    d. Text editors and autocorrect
    e. Identifying and predicting disease
6. After the pandemic, it's been essential for everyone to wear a mask. However, you see many people not wearing masks when in public places. Which domain of AI can be used to build a system to detect people not wearing masks?
7. Search for an online game that recognizes the image drawn by you. Write down the observations including the AI domain used by it.

Teamwork:

Pair yourself up with your classmates to come up with the dialogues. One out of the two will act like a chatbot answering stress-related queries during exams and the other can ask the questions. For example, you can ask ways to remain optimistic during exams and your friend acting as the chatbot may respond with answers like meditating, strolling through a park, etc.

1.2 AI Project Cycle

Lesson Title: AI Project Cycle	**Approach:** Interactive Session
Summary: Students will learn about the AI Project Cycle and get familiar with it.	
Learning Objectives: Students will know how they can get started on an AI project.	
Learning Outcomes: Describe the stages in the AI project cycle.	
Pre-requisites: Basic computer literacy	
Key-concepts: AI project cycle	



Let us think!

- Problem Scoping means

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- Data Acquisition means

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- Data Exploration means

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- Modelling means

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_____

- Evaluation means

_____

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- Deployment means

_____

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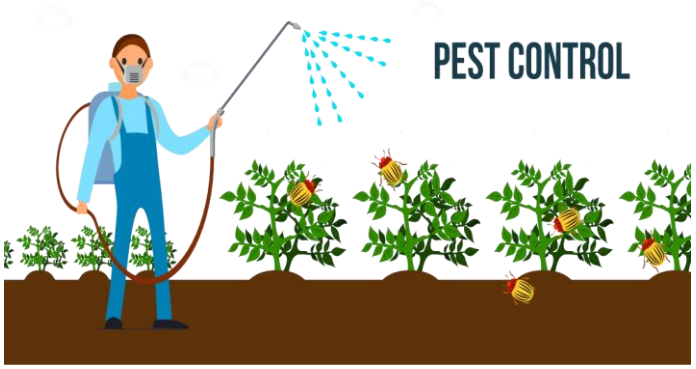
Let us understand!

Let us go through the AI project cycle with the help of an example.

Problem: Pest infestation damages crops

The cotton industry in India consists of 6 million local farmers. Cotton crops frequently get infected with the Pink Bollworm. It is difficult to see these insects with the naked eye. Small farmers find it very difficult to get rid of these insects. They do not have advanced tools and techniques to protect their plants from Pink Bollworm.







Can we solve this problem with AI? How?

Watch the video at this link - https://www.youtube.com/watch?v=LP_A4jydmz4

Ask students about possible solutions to this problem before moving ahead. Invite them to think of non-AI solutions as well.

Now that you are aware of AI concepts, plan to use them in accomplishing your task.

Start with listing down all the factors which you need to consider to save the cotton crop.

This system aims to:

_____

_____

_____

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

Now, as you interact with the farmers, you get to know different types of worms affecting the cotton crop. You will collect the following data

- Images of the pest
- Farmer names
- Village names
- Farm size
- Pesticide usage

As you start collecting the images, names of villages, farmers and other details you actually acquire data. This data now becomes the base of your pest management 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.**

After acquiring the required data, you realise that it is not uniform. Some images are small in size while others are big. Some images and other data are missing while you have multiple copies of others. So, we clean the data, try to make it uniform and fill in the missing data to make it more understandable.

By exploring the data, researchers can identify patterns and trends related to Pink Bollworm infestations, pesticide usage, crop yields, and other relevant factors.

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**.

After exploring the data, now you know that you need to develop an AI-enabled app using which the farmers will click the pictures of the collected pests using the phone camera. The AI app then decides whether the image is valid. Based on the number of pests recognized by the system and rules laid out by entomologists, recommendations are displayed

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.

Your pest management system is now complete! You test it by first emptying the trap of pests onto a blank sheet of paper and opening the app, then clicking pictures of pests. You notice that the results were 70% correct. After evaluating this model, you work on other shortlisted AI algorithms and work on them.

You test the algorithms to

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, you deploy your pest management app by getting it installed on farmer's mobile phones.

The last stage where you *deploy your solution based on the model* you've selected is known as **Deployment**.

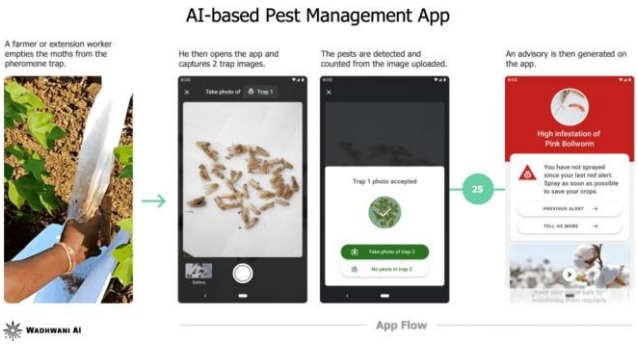
Let us look at the main features of CottonAce app-

CottonAce app

- CottonAce is a mobile application that can help farmers protect their crops from pests.
- CottonAce uses AI to warn the farmers about a possible pest infestation.
- It aids farmers in –
- Determining the correct amount of pesticides
- Knowing the right time to spray pesticides
- Seeking professional help as needed.



Integrated Pest Management



How does it work?

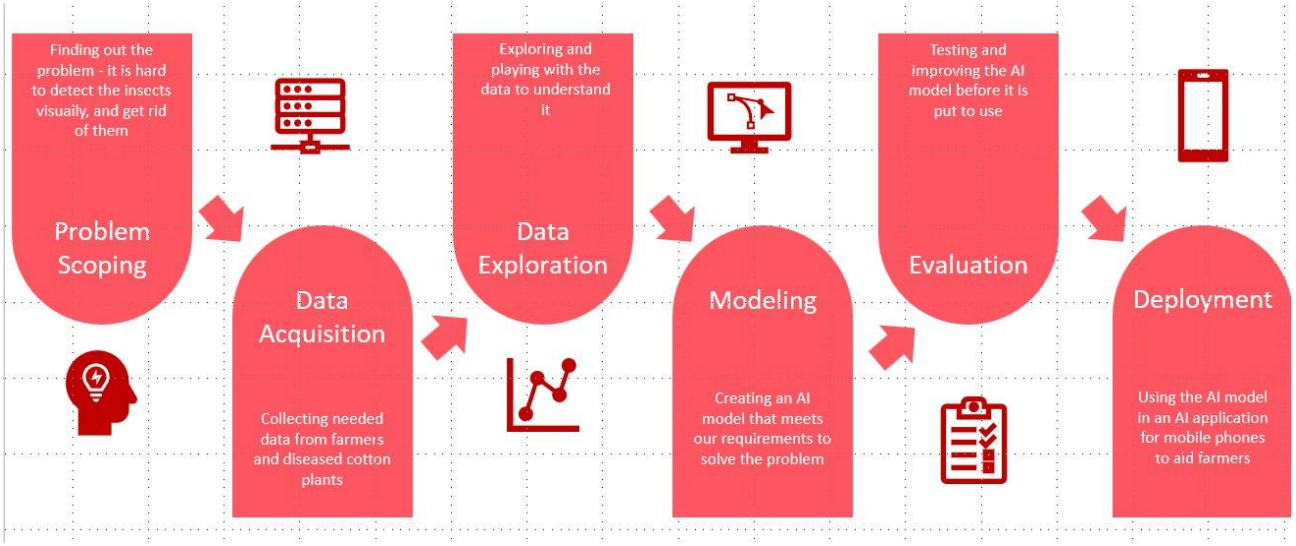
- A farmer sets up a trap to capture pests.
- Take a picture of the captured pests.
- Upload the picture on the app.
- The app detects the insect, level of infestation, and the required measures to cure it.

You can add 'Small farms that used the app saw jumps in profit margins of up to 26.5 percent. A drop-in pesticide costs of up to 38 percent was also observed'.

What is AI project cycle mapping?

Mapping the individual steps in an AI project to the steps in the AI project cycle.

Let us map the steps of Pest Management project to the steps in the AI project cycle.



Why do we need an AI Project Cycle?

Efficiency



To create better AI solutions easily

We can build an AI solution faster and with lesser effort

Modularity



To break the process into many smaller parts

If our AI solution does not work, we don't have to check and change everything

Conclusion:

"Greater efficiency implies that the solution can be developed faster and in a more convenient way. Due to modularity, the complex problem of cotton diseases and the process of making a solution for it can be broken down into simpler steps".

AI Project Cycle – Defined!

What you did just now was an example of AI Project Cycle. Starting with Problem Scoping, you set the goal for your AI project by stating the problem which you wish to solve with it.

- AI project cycle is the cyclical process followed to complete an AI project.
- AI project cycle takes us through different steps involved in a project.
- AI project cycle helps us:
  - to create better AI projects easily
  - to create AI projects faster
  - to understand the process

1.2.1 Problem Scoping

Let us start with the first step of AI Project cycle – Problem Scoping.

Let us Recap

What according you does Problem Scoping mean? Write in your words below:

_____

_____

_____

_____

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.

Title: Problem Scoping	**Approach:** Instructor-led Interactive Session + Activity
Summary: Students will be introduced to the 4Ws problem Canvas and Problem Statement template. They will be able to set goal for their AI projects to solve problems around them.	
Learning Objectives: • Students will know how they can get started on an AI project. • To problem scope with the help of template/worksheet.	
Learning Outcomes: • Apply the problem scoping framework. • Frame a Goal for the project.	
Pre-requisites: Basic computer literacy	
Key-concepts: Problem scoping	

Session Preparation

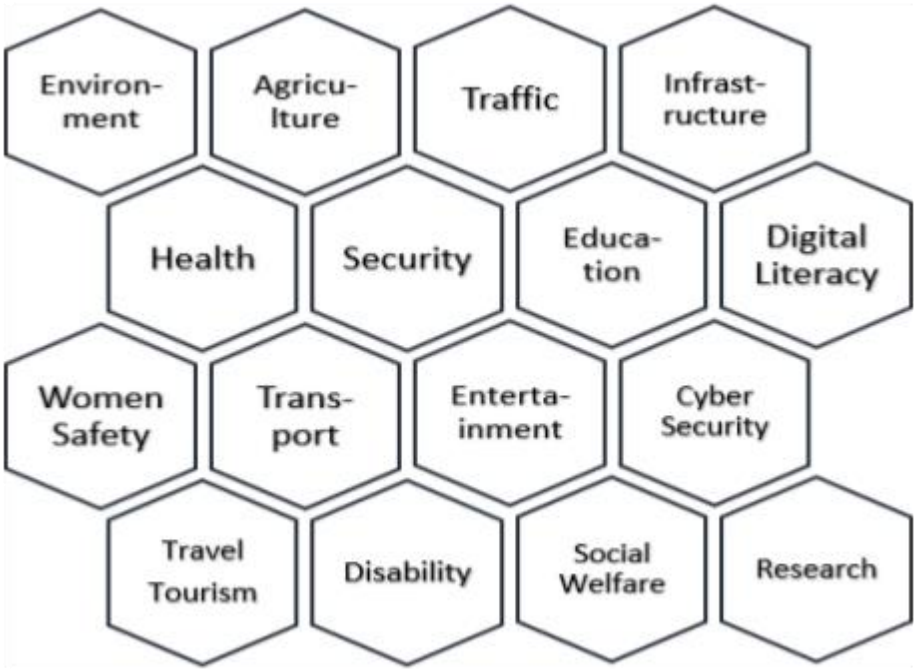
Logistics: For a class of 40 Students [Group activity – Groups of 4]

Purpose: Understanding how to narrow down to a problem statement from a broad theme.

Say: *"Let us now start with the first stage of AI Project Cycle that is – Problem Scoping! As we have understood, Problem Scoping means selecting a problem which we night want to solve using our AI knowledge."*

Brief: *Students will be selecting a theme either out of those mentioned in the handbook or from anywhere outside. They will then look inside the theme and find out topics where problems exist. They need to understand the vastness of a theme because of which one needs to go deeper. After listing down the topics, they will then find out various problems which exist under them. These problems will now be very specific as they have been narrowed down from a broader perspective. Ask the students to select any one problem out of the ones they scoped and write it as the goal of their project. Doing this, gives them a clear vision as to what exactly are they looking forward to solve using their AI knowledge.*

Let us now start scoping a problem. Look around you and select a theme which interests you the most. Suggested themes are:



You can either select any one out of these or you can think of one on your own. For more options, you can also refer to the 17 Sustainable Development Goals we discussed in the Purpose module.

Your selected theme is:

Why did you select this theme?

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_____

_____

_____

As we know, a theme is a broad term which covers all the aspects of relevance under it.

For example:

In Agriculture, there are pest issues, yield rates, sowing and harvesting patterns, etc. all being very different from each other but still a part of the Agriculture theme. Thus, to effectively understand the problem and elaborate it, we need to select one topic under the theme.

Some examples are:

Theme: Digital Literacy **Topics:** Online learning platforms, digital awareness, e-books, etc.
Theme: Health **Topics:** Medicinal Aid, Mobile Medications, Spreading of diseases, etc.
Theme: Entertainment **Topics:** Media, Virtual Gaming, Interactive AVs, Promotions etc.

Our Sun is here to throw more light on this! Go back to your selected

Theme, select various **Topics** related to your theme and fill them up in the rays of this sun.

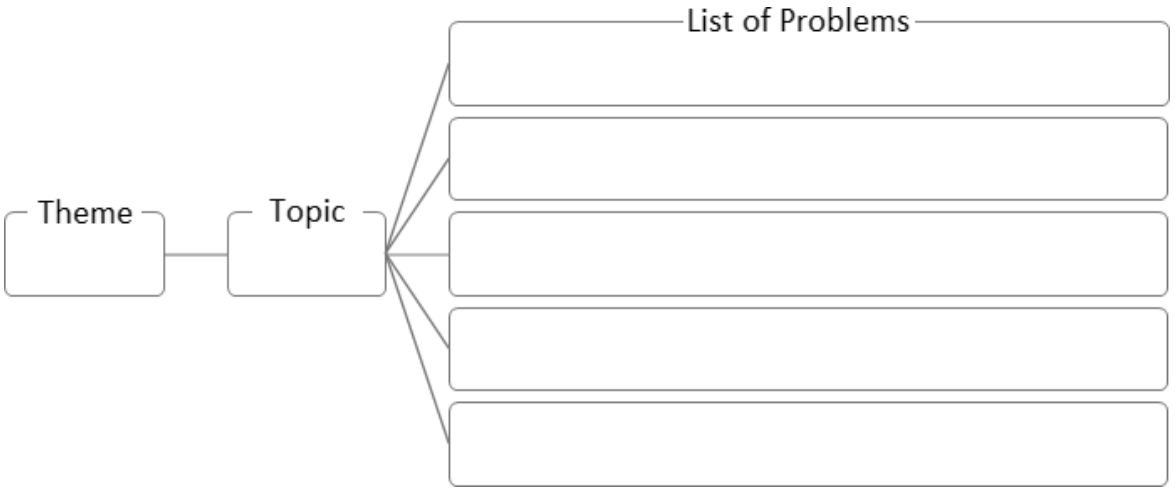


Choose one **Topic** out of the ones mentioned in the rays of the Sun above, and fill it in below:

_____

Let us now list down the problems which come under our **Topic.** You can recall daily life scenarios where you may have witnessed problems related to the Topic of your choice. Also, you can go online and research around your chosen topic.

Fill up the problems that you find under your topic below.



Great! We now know that there exist lot of problems to be solved around us! Thus, to set up the **GOAL** of your project, select **one problem** out of the ones listed above which you want to solve using your AI knowledge. This **Problem** now becomes the target of your AI project and helps you getting a clear vision of what is to be achieved.

Let us now frame the selected problem as a goal. For example, a goal can be stated as *How might we help farmers determine the best times for seeding and for sowing their crops?*

It's your turn now! Write the **Goal** of your project below:

Since you have now determined the **Goal** of your project, let's start working around it.

4Ws Problem Canvas

Purpose: To understand step by step how problem scoping is done using the 4Ws framework.
Say: *"We are now going to go through the 4Ws Problem Canvas. This canvas helps us in identifying 4 crucial parameters we need to know for solving a problem. So, what are the 4Ws? It refers to Who, What, When and Why."*

"Let's start with who. In this stage, we are looking at the person who is having the problem, they are also known as the stakeholders of the problem."

"Next we have what. In this stage, you consider the nature of the problem. What is the problem and how do you know that it is a problem? Is there evidence to support that it is a problem?"

"Next we will ask Where does the problem arise? In this we describe the context of the problem."



The 4Ws Problem canvas helps you in identifying the key elements related to the problem. Let us go through each of the blocks one by one.

Who?

The "Who" block helps you in analysing 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.

Let us fill the "Who" canvas!

Who?

Who are the Stakeholders?

What do you know about them?

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.

Let us fill the "What" canvas!

What?

What is the problem?

How do you know that it is a problem? (Is there any evidence?)

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.

Let us fill the "Where" canvas!

Where?

What is the context/ situation the stakeholders experience the problem?

Where is the problem located?

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.

Let us fill the "Why" canvas!

Why?

Why will this solution be of value to the stakeholders?

How will the solution improve their situation?

Problem Statement Template

Purpose: To understand how to phrase a problem statement using the Problem Statement Template.

Say: *"This is a problem statement template. It is used to frame the 4ws into a paragraph to describe your problem, the stakeholders involved and how solving the problem would benefit them."*

Ask the students to fill the problem statement template on the basis of how they have filled the 4Ws Problem canvas. In the end, they should be able to get a statement describing the problem which they wish to solve considering the stakeholders, context of the problem and benefit of its solution.

After filling the 4Ws Problem canvas, you now need to summarise all the cards into one template. The Problem Statement Template helps us to summarise all the key points into one single Template so that in future, whenever there is a need to look back at the basis of the problem, we can take a look at the Problem Statement Template and understand the key elements of it.

Problem Statement Template with space to fill details according to your Goal:

Our	[stakeholders]	**Who**
has a problem that	[issue, problem, need]	**What**
when / while	[context, situation].	**Where**
An ideal solution would	[benefit of solution for them]	**Why**

Now let us create a problem statement template for our Pest management case study

4W canvas for Pest Management

Our	Farmers	**Who**
has a problem that	Cotton Crops got infected with pest -Pink Ballworm	**What**
when / while	On the crops in the field	**Where**
An ideal solution would	To create an AI-enabled app that aids farmers in – ' Determining the correct amount of pesticides ' Knowing the right time to spray pesticides ' Increase in Production ' Increase in the profit share of the farmers.	**Why**

Revision Time

1. What are the various stages of Al Project Cycle? Can you explain each with an example?
2. How is an Al project different from an IT project?
3. Explain the 4Ws problem canvas in problem scoping.
4. Why is there a need to use a Problem Statement Template during problem scoping?
5. What is Problem Scoping? What are the steps of Problem Scoping?
6. Who are the stakeholders in the problem scoping stage?

1.2.2 Data Acquisition

Lesson Title: Data Acquisition	**Approach:** Interactive Session + System Maps
Summary: Students will learn how to acquire data from reliable and authentic sources and will understand how to analyse the data features which affect their problem scoped. Also, they will learn the concept of System Maps	
Learning Objectives: • Students will learn various ways to acquire data. • Students will learn about data features. • Students will learn about System Maps.	
Learning Outcomes: • Identify data required regarding a given problem. • Draw System Maps.	
Pre-requisites: Basic computer literacy	
Key-concepts: • Develop an understanding of reliable and authentic data sources. • System Mapping	

In the previous module, we learnt how to scope a problem and set a Goal for the project. After setting the goal, we listed down all the necessary elements which are directly/indirectly related to our problem. This was done using the 4Ws problem canvas. 4Ws were:

1. Who?
   a. Who are the stakeholders?
   b. What do we know about them?
2. What?
   a. What is the problem?
   b. How do you that it is a problem? (is there an evidence?)
3. Where?
   a. What is the context/situation the stakeholders experience this problem?
   b. Where is the problem located?
4. Why?
   a. What would hold value for the stakeholders?
   b. How will the solution improve their situation?

To summarise, we then go for the problem statement template where we put in all the details together at one place.

Our [Stakeholders]_____has/have a problem that_____[issue, problem, need]_____when/while_____ [context, situation]. An ideal situation would be_____[benefit of solution for them]_____.

What is Data Acquisition?

As we move ahead in the AI Project Cycle, we come across the second element which is: **Data Acquisition**. As the term clearly mentions, this stage is about acquiring data for the project. Let us first understand what is data. Data can be a piece of information or facts and statistics collected together for reference or analysis. Whenever we want an AI project to be able to predict an output, we need to train it first using data.

For example, If you want to make an Artificially Intelligent system which can predict the salary of any employee based on his previous salaries, you would feed the data of his previous salaries into the machine. This is the data with which the machine can be trained. Now, once it is ready, it will predict his next salary efficiently. The previous salary data here is known as **Training Data** while the next salary prediction data set is known as the **Testing Data**.

For better efficiency of an AI project, the Training data needs to be relevant and authentic. In the previous example, if the training data was not of the previous salaries but of his expenses, the machine would not have predicted his next salary correctly since the whole training went wrong. Similarly, if the previous salary data was not authentic, that is, it was not correct, then too the prediction could have gone wrong. Hence….

For any AI project to be efficient, the training data should be authentic and relevant to the problem statement scoped.

Data Features

Purpose: The purpose of this section is to learn what data features are and how to find them for the problem scoped.
Say: *"We've come to the stage of data acquisition, how do we know what data to get based on the problem statement? We need to visualise the factors which affect the problem statement. For this, we need to extract the Data Features for the problem scoped. Now try to find out what are the parameters which affect your problem statement directly or indirectly and list them down below."*

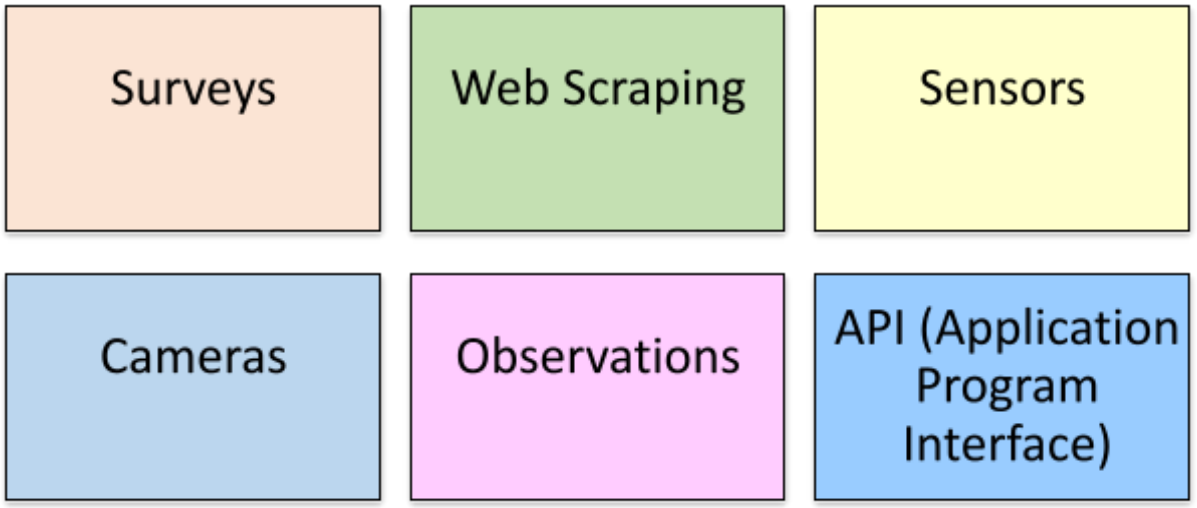
Look at your problem statement once again and try to find the data features required to address this issue. **Data features refer to the type of data you want to collect**. In our previous example, data features would be salary amount, increment percentage, increment period, bonus, etc.

Acquiring Data from reliable sources

Purpose: The purpose of this section is to identify reliable and authentic data sources for its acquisition.

Say: *"After finding out the Data Features, we now need to acquire the same. There exist various sources from which the data can be acquired. Do all the sources have authentic data? What if we do not get appropriate data? Data plays an important part of the AI project as it creates the base on which the AI project is built. Therefore, the data acquired should be authentic, reliable and correct. Also, the acquisition methods shall be authentic so that our project does not create any sort of conflicts with anyone."*

After mentioning the Data features, you get to know what sort of data is to be collected. Now, the question arises- From where can we get this data? There can be various ways in which you can collect data. Some of them are:



Sometimes, you 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 offense. 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.in*

List down ways of acquiring data for a project below:

1.

_____

_____

2.

_____

_____

3.

_____

_____

System Maps

Session Preparation

Logistics: For a class of 40 students [Group Activity – Groups of 4]

Materials Required:

ITEM	QUANTITY
Computers	10
Chart Paper	10
Sketch-Pens	40

Resources:

Link to make System maps Online using an Animated tool: https://ncase.me/loopy/

Purpose: The purpose of this section is to introduce the concepts System Maps and its elements, relationships and feedback loops.

Say: "*Now that we have listed all the Data features, let us look at the concept of System Maps. System Maps help us to find relationships between different elements of the problem which we have scoped. It helps us in strategizing the solution for achieving the goal of our project. Here is an example of a System very familiar to you – Water Cycle. The major elements of this system are mentioned here. Take a look at these elements and try to understand the System Map for this system. Also take a look at the relations between all the elements. After this, make your own system map for the data features which you have listed. You can also use the online animated tool for creating your System Maps.*"

Brief:

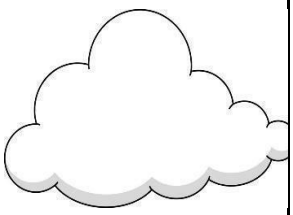
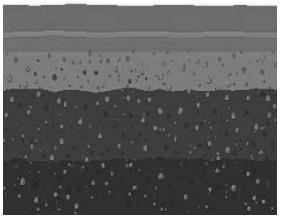
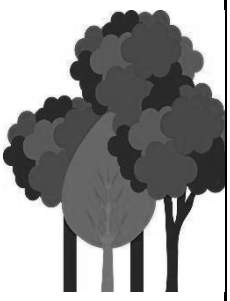
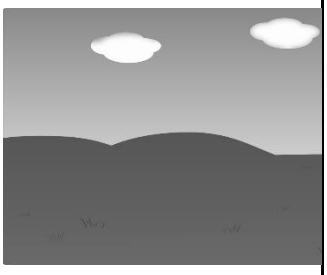
We use system maps to understand complex issues with multiple factors that affect each other. In a system, every element is interconnected. In a system map, we try to represent that relationship through the use of arrows. Within a system map, we will identify loops. These loops are important because they represent a specific chain of causes and effects. A system typically has several chains of causes and effects. You may notice that some arrows are longer than others. A longer arrow represents a longer time for a change to happen. We also call this a time delay. To change the outcome of a system, as a change maker, we have two options - change the elements in a system or change the relationships between elements. It is usually more effective to change the relationship between elements in a system. You may also notice the use of '+' signs and '-' signs. These are an indicator of the nature of the relationship between elements. What we did was a very basic introduction to systems thinking, you can use Google to find more detailed information on how to make systems maps.

A system map shows the components and boundaries of a system and the components of the environment at a specific point in time. With the help of System Maps, one can easily define a relationship amongst different elements which come under a system. Relating this concept to our module, the Goal of our project becomes a system whose elements are the data features mentioned above. Any change in these elements changes the system outcome too. For example, if a person received 200% increment in a month, then this change in his salary would affect the prediction of his future salary. The more the increment presently, the more salary in future is what the system would predict. Here is a sample System Map:

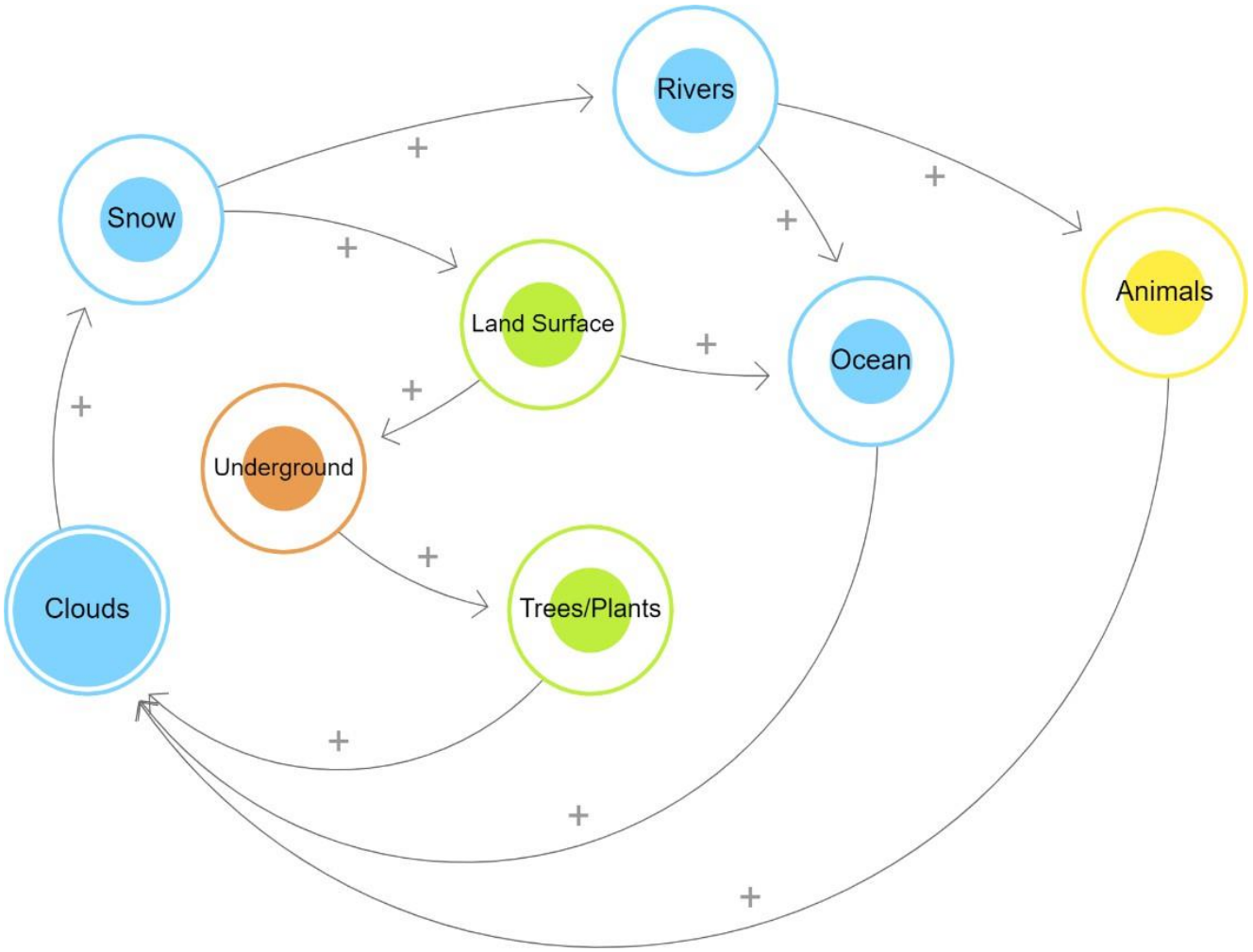
The Water Cycle

The concept of Water cycle is very simple to understand and is known to all. It explains how water completes its cycle transforming from one form to another. It also adds other elements which affect the water cycle in some way.

The elements which define the Water cycle system are:

			
Clouds	**Snow**	**Underground Soil**	**Rivers**
			
Oceans	**Trees**	**Land**	**Animals**

Let us draw the System Map for the Water Cycle now.



In this System Map, all the elements of the Water cycle are put in circles. The map here shows cause & effect relationship of elements with each other with the help of arrows. 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. That is, If X increases, Y also increases and vice versa. On the other hand, If the arrow goes from X to Y with a – sign, it means that both the elements are inversely related to each other which means if X increases, Y would decrease and vice versa.

Now, it's your turn to build your own System Map!

Considering the data features for your problem, draw a system map in the box provided.

(Hint: You can also use this animated tool for drawing and understanding system maps: https://ncase.me/loopy/)

Revision Time

1. How will you differentiate between Training Data and Testing Data? Elaborate with examples.
2. Name various methods for collecting data. For each method, can you name at least one project in which you may use that method of data collection?
3. What must you keep in mind while collecting data so it is useful?
4. Imagine you are responsible to enable farmers from a village to take their produce to the market for sale. Can you draw a system map that encompasses all the steps and factors involved?
5. Name a few government websites from where you can get open-source data.

1.2.3 Data Exploration

Title: Data Exploration	**Approach:** Activity
Summary: Students will explore different types of graphs used in data visualization and will be able to find trends and patterns out of it.	
Learning Objectives: • Students will explore various types of graphical representations. • Students will learn how to visualize the data they have.	
Learning Outcomes: • Recognize different types of graphs used in data visualization. • Exploring various patterns and trends out of the data explored.	
Pre-requisites: Basic computer literacy	
Key-concepts: Data Visualization	

Let us Recap!

Quiz Time!

1. Which one of the following is the second stage of AI project cycle?
    a. Data Exploration
    b. Data Acquisition
    c. Modelling
    d. Problem Scoping
2. Which of the following comes under Problem Scoping?
    a. System Mapping
    b. 4Ws Canvas
    c. Data Features
    d. Web scraping
3. Which of the following is not valid for Data Acquisition?
    a. Web scraping
    b. Surveys
    c. Sensors
    d. Announcements
4. If an arrow goes from X to Y with a – (minus) sign, it means that
    a. If X increases, Y decreases
    b. The direction of relation is opposite
    c. If X increases, Y increases
    d. It is a bi-directional relationship

5. Which of the following is not a part of the 4Ws Problem Canvas?
    a. Who?
    b. Why?
    c. What?
    d. Which?

Let us explore:

Session Preparation

Logistics: For a class of 40 Students. [Group Activity – Groups of 4]

Materials Required:

ITEM	QUANTITY
Computers	10

Resources:

Link to visualisation website: https://datavizcatalogue.com/

Purpose: To understand why we do data exploration before jumping straight into training an AI Model.

Say: "*Why do you think we need to explore and visualize data before jumping into the AI model? When we pick up a library book, we tend to look at the book cover, read the back cover and skim through the content of the book prior to choosing it as it helps us understand if this book is appropriate for our needs and interests. Similarly, when we get a set of data in our hands, spending time to explore it will help get a sense of the trends, relationships and patterns present in the data. It will also help us better decide on which model/models to use in the subsequent AI Project Cycle stage. We use visualization as a method because it is much easier to comprehend information quickly and communicate the story to others.*"

Brief:

In this session, we will be exploring various types of Graphs using an online open- sourced website. Students will learn about various new ways to visualise the data.

When to intervene?

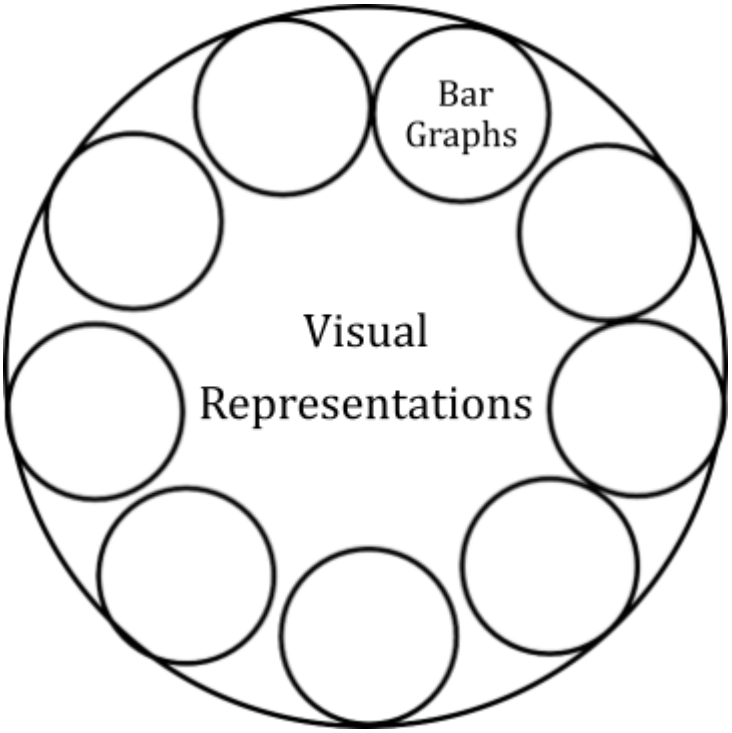
Ask the students to figure out which types of graphs would be suitable for the data features that they have listed for their problem. Let them take their time in going through each graph and its description and decide which one suits their needs the best.

In the previous modules, you have set the goal of your project and have also found ways to acquire data. While acquiring data, you must have noticed that the data is a complex entity – it is full of numbers and if anyone wants to make some sense out of it, they have to work some patterns out of it. For example, if you go to the library and pick up a random book, you first try to go through its content quickly by turning pages and by reading the description before borrowing it for yourself, because it helps you in understanding if the book is appropriate to your needs and interests or not.

Thus, to analyse the data, you need to visualise it in some user-friendly format so that you can:

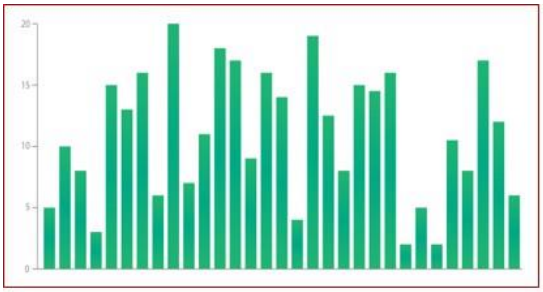
- Quickly get a sense of the trends, relationships and patterns contained within the data.
- Define strategy for which model to use at a later stage.
- Communicate the same to others effectively. To visualise data, we can use various types of visual representations.

Are you aware of visual representations of data? Fill them below:



As of now, we have a limited knowledge of data visualisation techniques. To explore various data visualisation techniques, visit this link: https://datavizcatalogue.com/

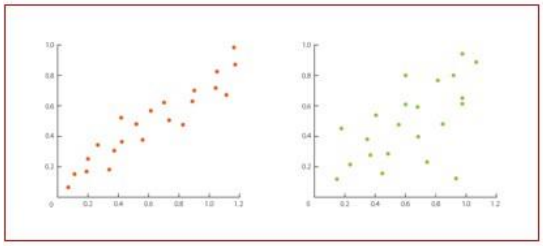
On this website, you will find various types of graphical representations, flowcharts, hierarchies, process descriptors, etc. Go through the page and look at various new ways and identify the ones which interest you the most.



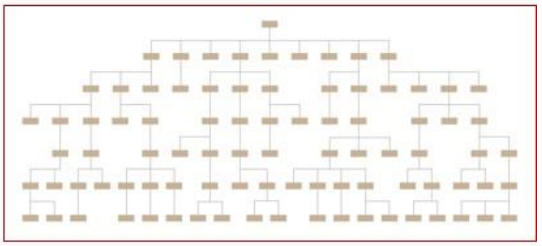
Bar Chart



Line Chart

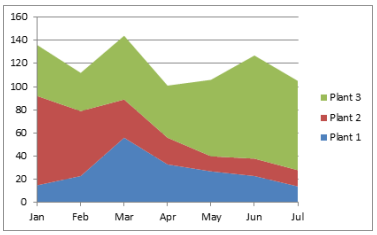


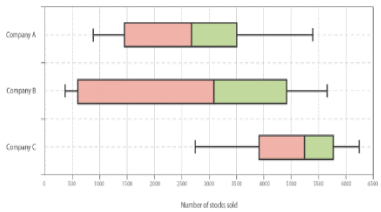
Scatter Plot

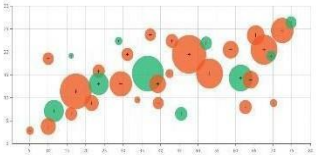


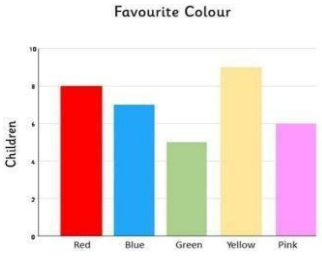
Tree Diagram

Identify the icons of different graphs:









List down 5 new data visualisation techniques which you learnt from https://datavizcatalogue.com

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

Data Visualisation Technique 2	
Name of the Representation	
One-line Description	
How to draw it	
Suitable for which data type?	

Data Visualisation Technique 3	
Name of the Representation	
One-line Description	
How to draw it	
Suitable for which data type?	

Data Visualisation Technique 4	
Name of the Representation	
One-line Description	
How to draw it	
Suitable for which data type?	

Data Visualisation Technique 5	
Name of the Representation	
One-line Description	
How to draw it	
Suitable for which data type?	

Sketchy Graphs

Session Preparation

Logistics: For a class of 40 Students. [Group Activity – Groups of 4]

Materials Required:

ITEM	QUANTITY
Chart Paper	10
Sketch-pens	10
Ruler	10
Basic Stationary	10 Sets

Purpose: To know the different visualization techniques and to use the right graph to display the data.

Say: *"In this activity, we are going to sketch graphs! Now that you have explored various types of graphs and have already chosen the best ones to plot your data features, let us start drawing them out! Select any two data features and plot their graphs on the chart paper provided. Make sure that you are able to relate this graph to the goal of your project. At the end of this activity, you would have to present your representations to all of us and describe what trends or patterns have you witnessed in it. Your time starts now!"*

Let us now look at the scoped Problem statement and the data features identified for achieving the goal of your project. Try looking for the data required for your project from reliable and authentic resources. If you are not able to find data online, try using other methods of acquiring the data (as discussed in the Data Acquisition stage).

Once you have acquired the data, you need to visualise it. Under the sketchy graphs activity, you will visualise your collected data in a graphical format for better understanding.

For this, select one of the representations from the link or choose the ones which you already know. The basis of your selection should be the data feature which you want you to visualise in that particular representation. Do this for all the data features you have for the problem you have scoped. Let us answer the following questions for a better understanding:

1. Which data feature are you going to represent?

_____

_____

_____

_____

2. Which representation are you going to use for this data feature? Why?

_____

_____

_____

_____

_____

Now, let's start drawing visual representations for all the Data features extracted, and try to find a pattern or a trend from it.

For example, if the problem statement is: *How can we predict whether a song makes it to the billboard top 10?*

We would require data features like: *Current trends of music, genre of music, tempo of music, duration of song, popularity of a singer, etc.*

Now to analyse a pattern, we can say that the popularity of the singer would directly have an effect on the output of the system. Thus, we would plot a graph showing the popularity of various singers and the one who is most popular has the maximum chance of getting to the billboard. In this way, the graphical representation helps us understand the trends and patterns out of the data collected and to design a strategy around them for achieving the goal of the project.

Do it yourself:

Take a chart paper and start representing your data features in various types of graphs. After completing this exercise, present your work to your friends and explain to them the trends and patterns you have observed in it.

List down the trends you might have observed in your representations below:

1. _____

_____

_____

2. _____

_____

_____

3. _____

_____

_____

4. _____

_____

_____

5. _____

_____

_____

6. _____

_____

_____

Revision Time

1. What is the significance of Data Exploration after you have acquired the data for the problem scoped? Explain with examples.
2. What do you think is the relevance of Data Visualization in Al?
3. List any five graphs used for data visualization.
4. How is Data Exploration different from Data Acquisition?
5. Use an example to explain at least one Data Visualization technique.

1.2.4 Modelling

Title: Modelling	**Approach:** Session + Activity
Summary: In this module, students' progress from data exploration to AI modeling, learning about key distinctions between Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL). The module introduces two approaches to AI modeling: Rule-Based and Learning-Based.	
Learning Objectives: • Understand and differentiate between AI, ML, and DL. • Explain the differences between Rule-Based and Learning-Based AI approaches. • Develop a basic understanding of how AI models are trained and tested.	
Learning Outcomes: • Define AI, ML, and DL and explain their relationships. • Identify the key differences between Rule-Based and Learning-Based AI models.	
Pre-requisites: Basic understanding of AI concepts from previous modules.	
Key-concepts: • AI, ML and DL • Rule-Based Approach • Learning-Based Approach • AI Modeling	

In the previous module of Data Exploration, you explored the data you had acquired at the Data Acquisition stage for the problem you scoped in the Problem Scoping stage. Now, you have visualised some trends and patterns out of the data which would help you develop a strategy for your project. To build an AI based project, we need to work around Artificially Intelligent models or algorithms. This could be done either by designing your own model or by using the pre-existing AI models. Before jumping into modelling let us clarify the definitions of Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning (DL).

AI, ML & DL

Purpose: To differentiate between Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning (DL).

Say: *"As we enter the world of modelling, it is a good time to clarify something many of you may be having doubts about. You may have heard the terms AI, ML and DL when research content online and during this course. They are of course related, but how?*

Artificial Intelligence, or AI for short, refers to any technique that enables computers to mimic human intelligence. An artificially intelligent machine works on algorithms and data fed to it and gives the desired output.

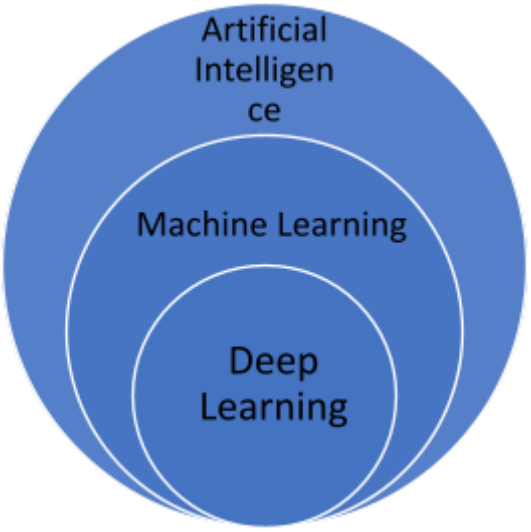
Machine Learning, or ML for short, enables machines to improve at tasks with experience. The machine here learns from the new data fed to it while testing and uses it for the next iteration. It also takes into account the times when it went wrong and considers the exceptions too.

Deep Learning, or DL for short, enables software to train itself to perform tasks with vast amounts of data. Since the system has got huge set of data, it is able to train itself with the help of multiple machine learning algorithms working altogether to perform a specific task.

Artificial Intelligence is the umbrella term which holds both Deep Learning as well as Machine Learning. Deep Learning, on the other hand, is the very specific learning approach which is a subset of Machine Learning as it comprises of multiple Machine Learning algorithms."

As you have been progressing towards building AI readiness, you must have come across a very common dilemma between AI and ML. Many of the times, these terms are used interchangeably but are they the same? Is there no difference between Machine Learning and Artificial Intelligence? Is Deep Learning also Artificial Intelligence? What exactly is Deep Learning? Let us see…

As you can see in the Venn Diagram, Artificial Intelligence is the umbrella terminology which covers machine and deep learning under it and Deep Learning comes under Machine Learning. It is a funnel type approach where there are a lot of applications of AI out of which few are those which come under ML out of which very few go into DL.



Defining the terms:

1. **Artificial Intelligence**, or AI, refers to any technique that enables computers to mimic human intelligence. The AI-enabled machines think algorithmically and execute what they have been asked for intelligently.
2. **Machine Learning**, or ML, enables machines to improve at tasks with experience. The machine learns from its mistakes and takes them into consideration in the next execution. It improvises itself using its own experiences.
3. **Deep Learning**, or DL, enables software to train itself to perform tasks with vast amounts of data. In deep learning, the machine is trained with huge amounts of data which helps it into training itself around the data. Such machines are intelligent enough to develop algorithms for themselves.

Deep Learning is the most advanced form of Artificial Intelligence out of these three. Then comes Machine Learning which is intermediately intelligent and Artificial Intelligence covers all the concepts and algorithms which, in some way or the other mimic human intelligence.

Modelling

Purpose: Classification of Models into Rule-based approach and Learning approach.

Say: *"In general, there are two approaches taken by researchers when building AI models. They either*

take a rule-based approach or learning approach. A Rule based approach is generally based on the data and rules fed to the machine, where the machine reacts accordingly to deliver the desired output. Under learning approach, the machine is fed with data and the desired output to which the machine designs its own algorithm (or set of rules) to match the data to the desired output fed into the machine"

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.

Let us ponder

Use your knowledge and thinking ability and answer the following questions:

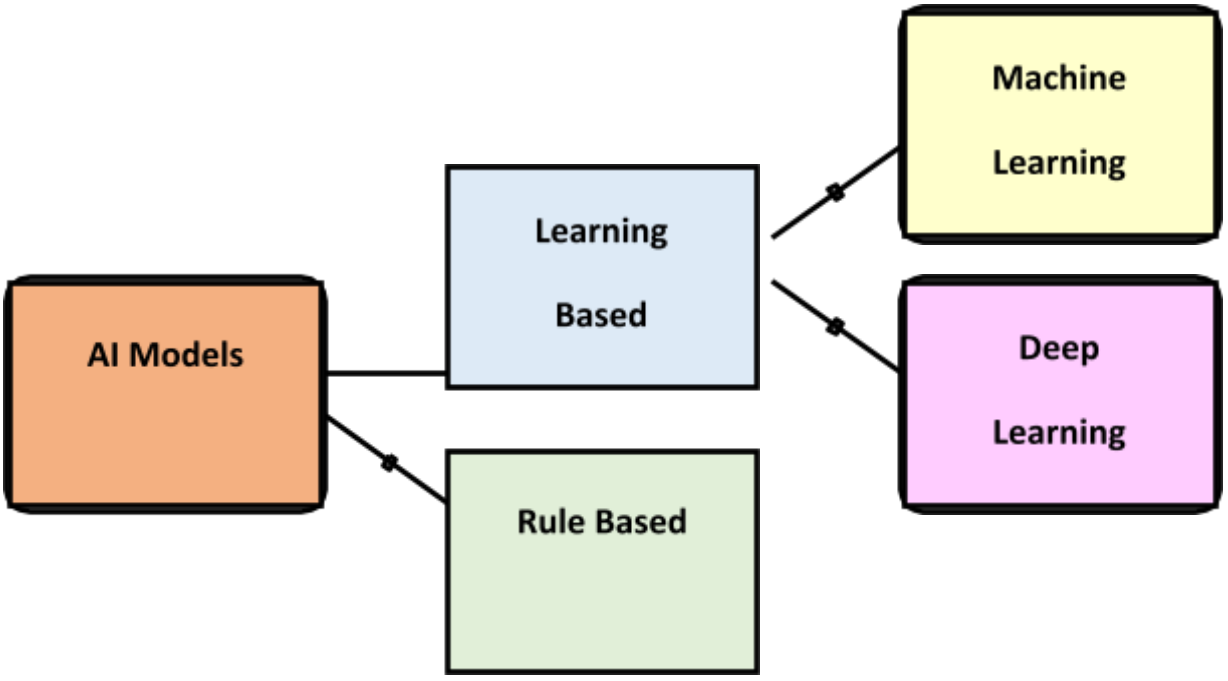
1. What makes a machine intelligent?

2. How can a machine be Artificially Intelligent?

3. Can Artificial Intelligence be a threat to Human Intelligence? How?

In the previous module of Data exploration, we have seen various types of graphical representations which can be used for representing different parameters of data. 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.

Generally, AI models can be classified as follows:

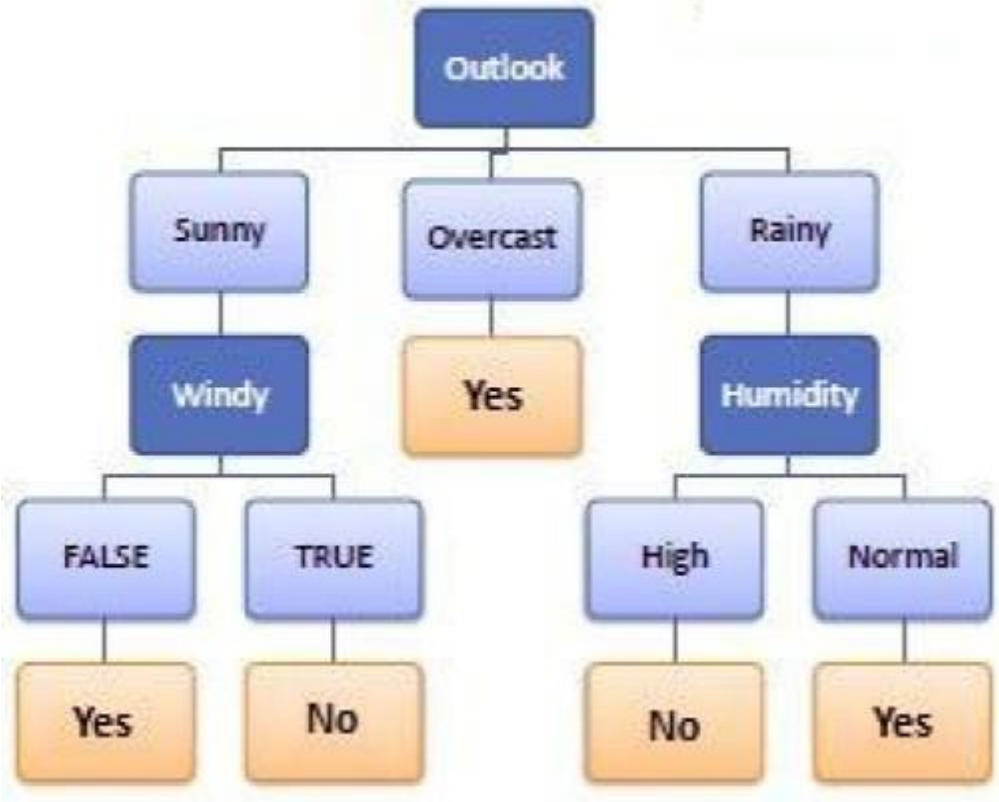


Rule Based Approach

Refers to the AI modelling where the rules are defined by the developer. The machine follows the rules or instructions mentioned by the developer and performs its task accordingly. For example, we have a dataset which tells us about the conditions on the basis of which we can decide if child can go out to play golf or not. The parameters are: Outlook, Temperature, Humidity and Wind. Now, let's take various possibilities of these parameters and see in which case the children may play golf and in which case they cannot. After looking through all the cases, we feed this data into the machine along with the rules which tell the machine all the possibilities. The machine trains on this data and now is ready to be tested. While testing the machine, we tell the machine that Outlook Overcast; Temperature = Normal; Humidity = Normal and Wind = Weak. On the basis of this testing dataset, now the machine will be able to tell if the child can go out to play golf or not and will display the prediction to us. This is known as a rule-based approach because we fed the data along with rules to the machine and the machine after getting trained on them is now able to predict answers for the same. 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.

Rule Based AI Model

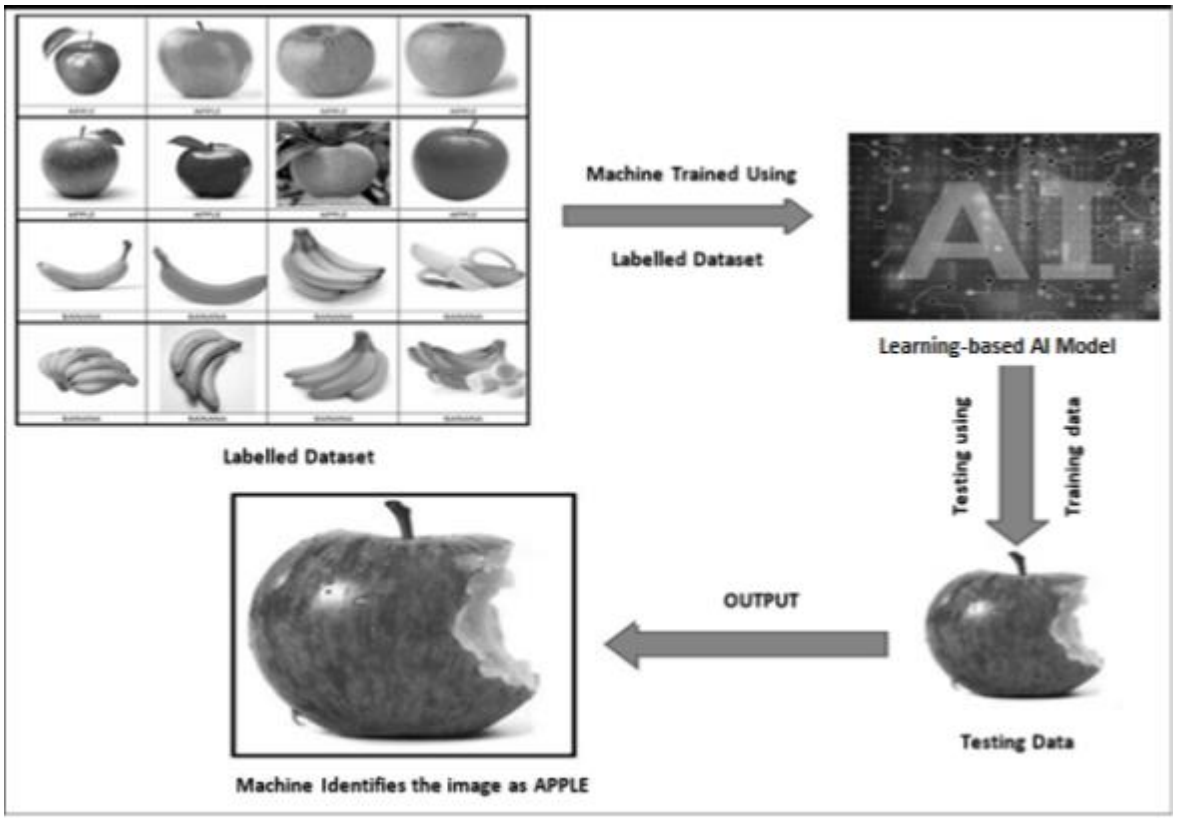
Predictors				Target
Outlook	Temp.	Humidity	Windy	Play Golf
Rainy	Hot	High	False	No
Rainy	Hot	High	True	No
Overcast	Hot	High	False	Yes
Sunny	Mild	High	False	Yes
Sunny	Cool	Normal	False	Yes
Sunny	Cool	Normal	True	No
Overcast	Cool	Normal	True	Yes
Rainy	Mild	High	False	No
Rainy	Cool	Normal	False	Yes
Sunny	Mild	Normal	False	Yes
Rainy	Mild	Normal	True	Yes
Overcast	Mild	High	True	Yes
Overcast	Hot	Normal	False	Yes
Sunny	Mild	High	True	No



Learning Based Approach

Refers to the Al modelling where the machine learns by itself. Under the Learning Based approach, the Al 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. For example, suppose you have a dataset comprising of 100 images of apples and bananas each. These images depict apples and bananas in various shapes and sizes. These images are then labelled as either apple or banana so that all apple images are labelled 'apple' and all the banana images have 'banana' as their label. Now, the Al model is trained with this dataset and the model is programmed in such a way that it can distinguish between an apple image and a banana image according to their features and can predict the label of any image which is fed to it as an apple or a banana. After training, the machine is now fed with testing data. Now, the testing data might not have similar images as the ones on which the model has been trained. So, the model adapts to the features on which it has been trained and accordingly predicts if the image is of an apple or banana.

Learning Based AI Model



Revision Time

1. What are the various stages of the Al Project Cycle? Explain each with examples.
2. What is Artificial Intelligence? Give an example where Al is used in day-to-day life.
3. How is Machine Learning related to Artificial Intelligence?
4. Compare and contrast Rule-based and Learning-based approach in Al modeling indicating clearly when each of these may be used.

1.2.5 Evaluation

In Stage 5, we have Evaluation, the main objective of this stage is to *test different models and choose the best model*.

Lesson Title: Evaluation	**Approach:** Interactive Session + Activity
Summary: In this module youth will be learn concept of evaluation in the AI project cycle. They will also learn that evaluation is essential for assessing the success of AI projects, identifying areas for improvement, and making data-driven decisions.	
Learning Objectives • Students will be able to understand the importance of evaluation in the AI project cycle. • Students will be able to apply evaluation techniques to assess the effectiveness of AI projects. • Students will be able to identify areas for improvement in AI projects through evaluation.	
Learning Outcomes • By the end of this lesson, students should be able to apply evaluation techniques in their own AI projects.	
• **Pre-requisites:** Basic knowledge of Artificial Intelligence and problem solving	
Key-concepts Importance of Evaluation techniques.	

What is evaluation?

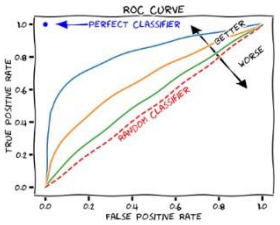
Evaluation is the process of understanding the reliability of any AI model, based on outputs by feeding test dataset into the model and comparing with actual answers. There can be different Evaluation techniques, depending of the type and purpose of the model. Remember that It's not recommended to use the data we used to build the model to evaluate it. This is because our model will simply remember the whole training set, and will therefore always predict the correct label for any point in the training set. This is known as overfitting.

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:



Note: You will learn more about these techniques in grade X.

- We test our models to check their performance and improve our models for best performance.
- The model is tested with collected data.
- We also check if the model is solving the identified AI problem properly.



Model Evaluation Terminologies

There are various new terminologies which come into the picture when we work on evaluating our model. Let's explore them with an example of the Forest fire scenario.

The Scenario

Imagine that you have come up with an AI based prediction model which has been deployed in a forest which is prone to forest fires. Now, the objective of the model is to predict whether a forest fire has broken out in the forest or not. Now, to understand the efficiency of this model, we need to check if the predictions which it makes are correct or not. Thus, there exist two conditions which we need to ponder upon: Prediction and Reality. The prediction is the output which is given by the machine and the reality is the real scenario in the forest when the prediction has been made. Now let us look at various combinations that we can have with these two conditions.

Case 1: Is there a forest fire? Here, we can see in the picture that a forest fire has broken out in the forest.



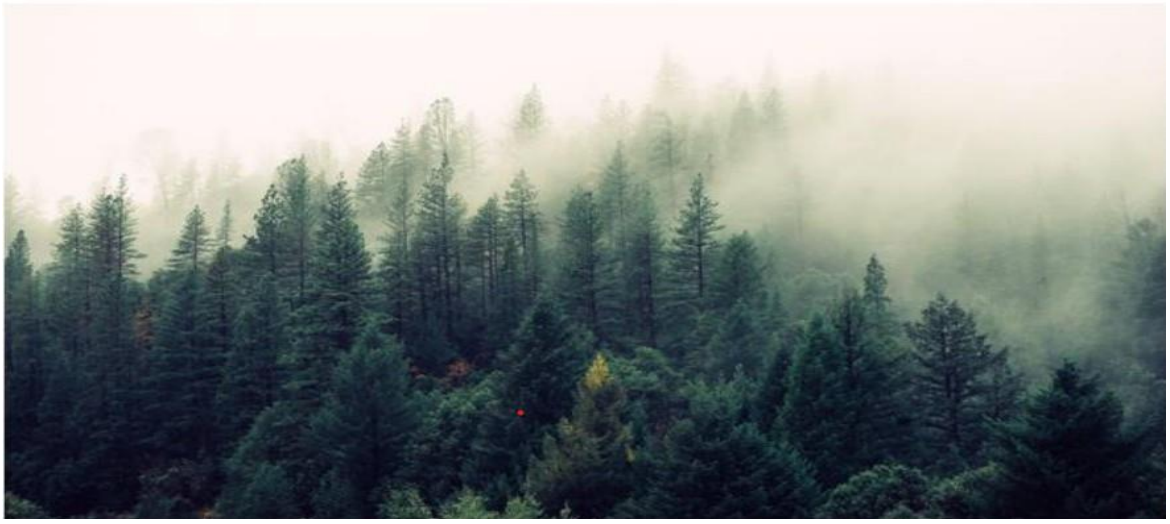
Prediction: Yes

Reality: Yes

True Positive

Here, we can see in the picture that a forest fire has broken out in the forest. The model predicts a Yes which means there is a forest fire. The Prediction matches with the Reality. Hence, this condition is termed as True Positive.

Case 2: Is there a forest fire?



Prediction: No

Reality: No

True Negative

Case 3: Is there a forest fire?



Prediction: Yes

Reality: No

False Positive

Here the reality is that there is no forest fire. But the machine has incorrectly predicted that there is a forest fire. This case is termed as False Positive.

Case 4: Is there a forest fire?

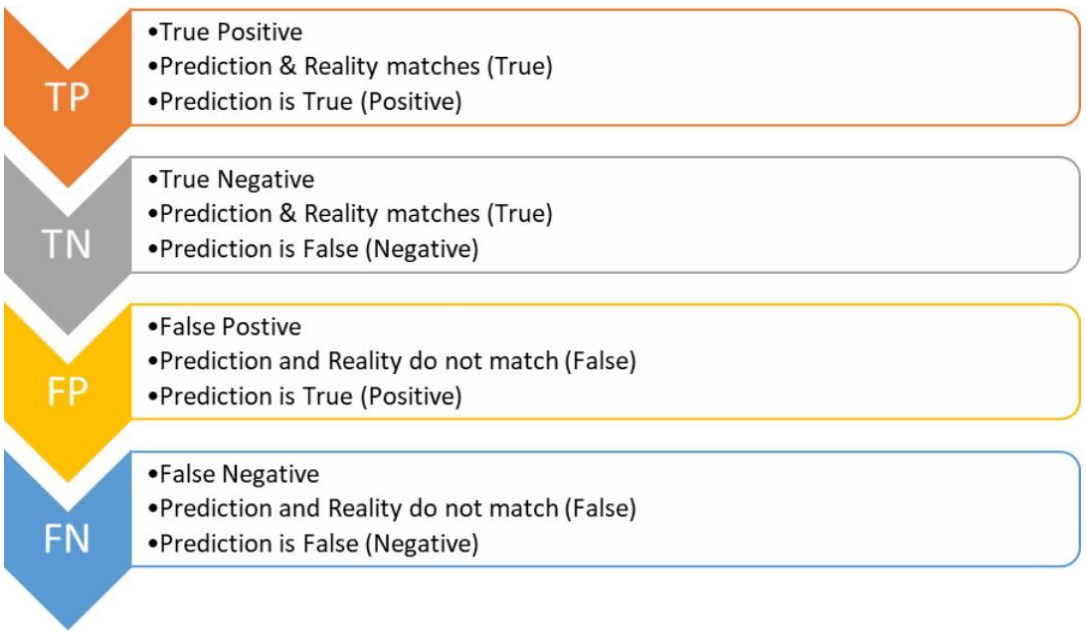


Prediction: No

Reality: Yes

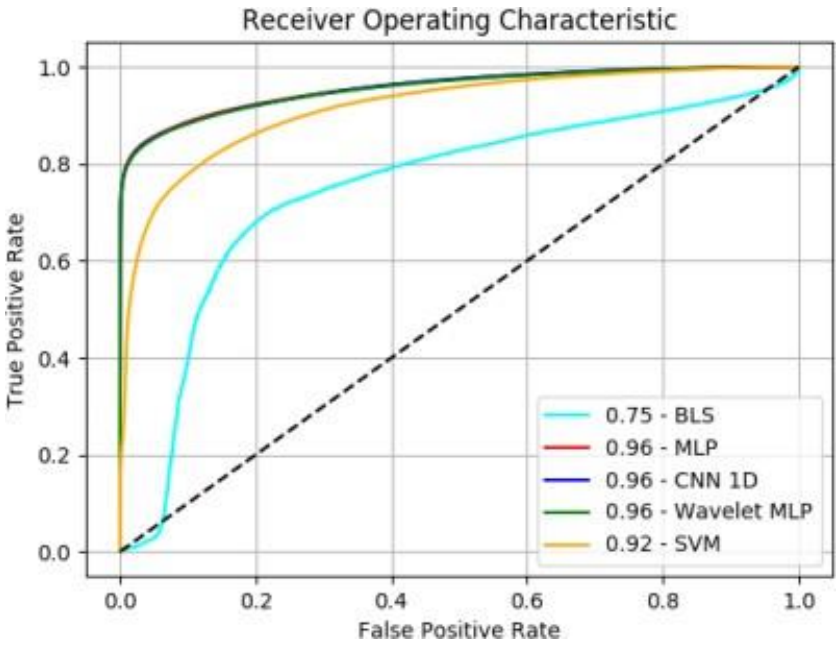
False Negative

Here, a forest fire has broken out in the forest because of which the Reality is Yes but the machine has incorrectly predicted it as a No which means the machine predicts that there is no Forest Fire. Therefore, this case becomes False Negative



Evaluation

- At this particular stage, we may need to evaluate the model to find out which algorithm makes the best prediction.
- The figure shows the accuracy of 5 different algorithms as discussed in the Modeling stage.
- ROC is a metric used to find out the accuracy of a model.



Note: The graph above compares the accuracy of five different algorithms—BLS (Broad Learning System), MLP (Multi-Layer Perceptron), CNN (Convolutional Neural Network), Wavelet MLP (Wavelet Multi-Layer Perceptron), and SVM (Support Vector Machine)—demonstrating how an AI developer can choose the most suitable algorithm for a specific use case. While these algorithms are advanced topics within the curriculum, facilitators are encouraged to prompt learners to explore them further through online resources.

Chapter Review

Q1. What is Evaluation?
Q2. What are various Model evaluation techniques?
Q3. Why is model evaluation important in AI projects?
Q4. What do you understand by the terms True Positive and False Positive?

1.2.6 Deployment

In Stage 6, we have Deployment, the main objective of this stage is to *make our solution ready to be used.*

Lesson Title: Deployment	**Approach:** Interactive Session + Activity
• **Summary**: In this module youth will learn about the term "deployment" in the context of AI projects and why it is an important step. • They will Connect the concept of deployment to real-world examples such as deploying a chatbot on a website or a predictive model in a mobile app.	
Learning Objectives • Students will be able to understand the concept of deployment in the AI project cycle and demonstrate their knowledge through hands-on activities.	
Learning Outcomes • By the end of this lesson, students should be able to emphasize the importance of deployment in the AI project cycle. • Challenge students to think about how they can apply their knowledge of deployment in future AI projects and encourage them to continue exploring different deployment methods.	
• **Pre-requisites:** Basic knowledge of Artificial Intelligence and problem solving	
Key-concepts • Importance of Deployment in Ai project cycle	

What is deployment?

Deployment as the final stage in the AI project cycle where the AI model or solution is implemented in a real-world scenario.

Key Steps in Deployment Process

the key steps involved in the deployment process: a. Testing and validation of the AI model b. Integration of the model with existing systems c. Monitoring and maintenance of the deployed model.

Some examples of successful AI projects that have been deployed in various industries, such as self-driving cars, medical diagnosis systems, and chatbots.

- AI can be used on Mobile Apps, Website Apps, etc.



Mobile Application



Website Application

Revision Time

Choose the correct answer!

1. Does modeling mean creating an AI model?
   a. YES b. NO
2. Can we use AI on mobile phones?
   a. YES b. NO
3. What is deployment in the context of an AI project cycle?
4. Why is deployment an important phase in the AI project cycle?
5. What are some common challenges in deploying AI models?

Case Study: Preventable Blindness



Problem: Prevent loss of vision, and delay in report generation

- Approximately 537 million adults (20-79 years) are living with diabetes.
- Diabetes can lead to Diabetic Retinopathy It damages the blood vessels of the retina and can lead to blurred vision and blindness.
- Lack of qualified doctors and delay in reports increase the risk of Diabetic Retinopathy

One of the early symptoms of the defect is 'Blurred vision' as shown below:



Normal Vision



Blurred Vision

How can we solve this problem with AI?

Solution: Using AI to detect Diabetic Retinopathy in pictures of eyes



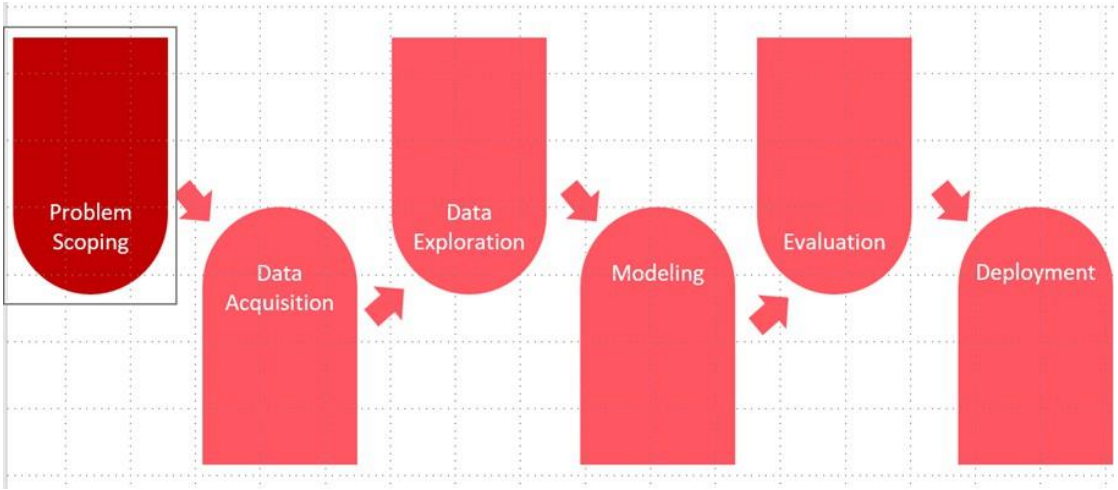
AI solution at Aravind Eye Hospital, India

- An AI eye screening solution is developed in partnership with Google.

- AI models have achieved an accuracy of 98.6% in detecting diabetic retinopathy, on par with the performance of specialist eye doctors.
- Seventy-one vision centers in rural Tamil Nadu, India are using this solution.
- Trained technicians take pictures of patients' eyes with cameras.
- The digital images are analyzed by AI for the presence of Diabetic Retinopathy.
- AI has made the detection of Diabetic Retinopathy quicker.
- Any technician can use this machine, even without a skilled doctor.



More and more parents can be treated at an early stage.
Hence, early detection using AI can significantly benefit rural populations
Let us map this problem to AI project cycle
How would you scope the problem?



AI Project Cycle Mapping Template					
Problem Scoping	**Data Acquisition**	**Data Exploration**	**Modeling**	**Evaluation**	**Deployment**
Blindness due to diabetic Retinopathy that can be prevented	Collecting data from patients from many clinics using retinal cameras.	Validating all the data to make sense out of it and come up with a model.	Creating an AI model to correctly diagnose Diabetic Retinopathy when given a retinal image as input.	Test the model for accuracy and then fine tune the model further to get the desired out -put.	Using the model in tools that can be used in clinics in even the remote and rural parts of the country.

Activity Time!
Purpose: Implementation of AI project cycle to develop an AI Model for Personalized Education.
Activity Introduction:

- In this activity, students use the AI project cycle to conceptualize a solution for the given problem.
- AI project cycle is a 6-step process which aids in problem solving using Artificial Intelligence

Description:

- All individuals have different cognitive levels and personalities.
- Different people need attention towards different parts of their learning.
- A generalized education system often falls short in addressing individual learning needs, whereas personalized education allows students to learn at their own pace, catering to their unique strengths and challenges.

Activity Guidelines:

- Understand the problem.
- Learn the various aspects and developments in the field.
- Fill the AI Project Cycle mapping template for the problem.
- The solution to the problem of personalized education is an AI algorithm that trains over the behavior and choices of a student. Thus, all the requirements specific to a student could be recognized and addressed to.

AI Project Cycle mapping template for Preventable blindness:

Fill the AI Project Cycle mapping template for the discussed problem of personalized education.
[Hint: Take the reference of the above AI Project cycle mapping template]

AI Project Cycle Mapping Template					
Problem Solving	**Data Acquisition**	**Data Exploration**	**Modelling**	**Evaluation**	**Deployment**

Personalised Education: For students, personalized education customizes learning experiences to match their individual needs, abilities, and interests. This approach enables students to progress at their own pace, concentrate on areas needing more attention, and ultimately improve engagement and academic performance.

Revision Time:

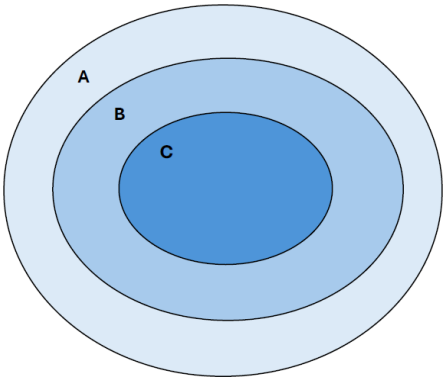
1. Rearrange the steps of AI project cycle in correct order:
    a. Data Acquisition
    b. Problem Scoping
    c. Modelling
    d. Data Exploration
    e. Deployment
    f. Evaluation

2. The process of breaking down the big problem into a series of simple steps is known as:
    a. Efficiency
    b. Modularity
    c. Both a) and b)
    d. None of the above

3. The primary purpose of data exploration in AI project cycle is _____
    a. To make data more complicated
    b. To simplify complex data
    c. To discover patterns and insights in data
    d. To visualize data

4. Deployment is the final stage in the AI project cycle where the AI model or solution is implemented in a real-world scenario. (True/False)

5. Identify A, B and C in the following diagram (Hint: How AI, ML &DL related to each other)



Unit 1.3
Ethics and Morality

Title: AI Ethical Issues	Approach: Interactive Session + Activity
Summary: Students will learn about Morals and Ethics, ethical values related to personal data and ethical steps for a safer AI.	
Objectives: • **Understanding the concept of Ethics and Morals.** • **Students will learn to differentiate between Morality and Ethics.** • **Students will explore various Ethics with Personal Data, Issues around AI Ethics, AI Ethics Principles.**	
Pre-requisites: • **Basic knowledge of AI Project Cycle and its steps.** • **Basic understanding of ethics and ethics in AI.**	
Key- Concepts: • **Familiarizing with AI project cycle, need for using it and how to map it with different projects.** • **Familiarizing with AI ethics and issues around AI ethics.** • **Ethical principles for safer AI**	

Let's take a look at the given ethical scenarios.

Ethical Scenario – I

Imagine a situation where you are a high school teacher. You have to check a lot of essay submissions, which will take a lot of time. You find an AI tool that can correct the essays submissions and assign them grades.



Ask: "learners to imagine themselves in the scenario before moving on to discussion questions."

Let's Discuss:

1. Would you use the tool to grade the essays?

   _____

2. Why would you do that?

   _____

3. What will be the advantages and disadvantages of using the AI tool?

   _____

4. Can you think of any challenges which the AI tool might face?

   _____

Wait for the learners to respond.

Ask them why they choose to respond in a certain way.

Point out different responses from different learners in the same situation.

Say: Watch another interesting reference video on ethical scenarios
https://www.youtube.com/watch?v=nyTmeb4vFqE

Ask learners to imagine themselves in the scenario before moving on to discussion questions.

Watch another interesting reference video on ethical scenarios
https://www.youtube.com/watch?v=nyTmeb4vFqE

Ethical Scenario – II

Burger



- Imagine a situation where you oversee burgers at a fast-food restaurant
- It is a busy day with a lot of orders coming in fast.
- While cooking, you drop a burger on the dirty floor!
- Your boss passes by and says, “Just pick it up and serve it!”
- What would you do?

Ask below questions one by one. Wait for the response from the learners. Let the learners know that these questions do not necessarily have a right answer.

Ethical Questions:

Examples of Ethical questions

- If a shopkeeper gives me back more money than what is due, is it better to return it? Or should I keep it with me?
- Is taking pens from a library considered stealing?
- Is taking extra paper napkins from a restaurant considered theft?
- You order a new dress from Amazon and after wearing it on your friends birthday party, you returned it stating the reason inappropriate fitting.

Moral Questions

Examples of moral questions

- Is it OK to lie? If so, under what circumstances?
- If a family is hungry and has no other way to get food, is it OK to steal food from a rich store owner? Why or why not?
- Is a collective decision made by people, always, right? Or can it be wrong?



Let's Discuss:

1. **What is ethics according to you?**

   _____

2. **What are morals according to you?**

   _____

3. **Did you notice any differences or similarities between ethical and moral questions?**

   _____



Ethics vs Morals

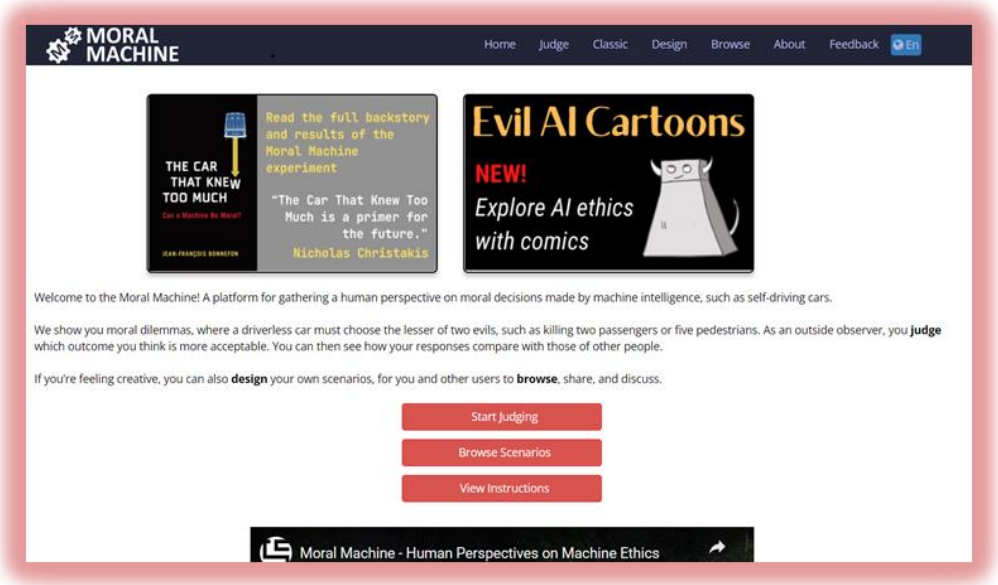
Morals	Ethics
▪ **The beliefs dictated by our society.**	▪ **The guiding principles to decide what is good or bad.**
▪ **Morals are not fixed and can be different for different societies.**	▪ **These are values that a person themselves chooses for their life.**
▪ **Examples:** ▪ **Always speak the truth** ▪ **Always be loyal** ▪ **Always be generous**	▪ **Examples:** ▪ **Is it good to speak the truth in all situations?** ▪ **Is it good to be loyal under all circumstances?** ▪ **Is it necessary to always be generous?**

Say "Different societies or religions can consider different things right or wrong. What might be considered very good by one person, society or religion might not be considered as good by another."

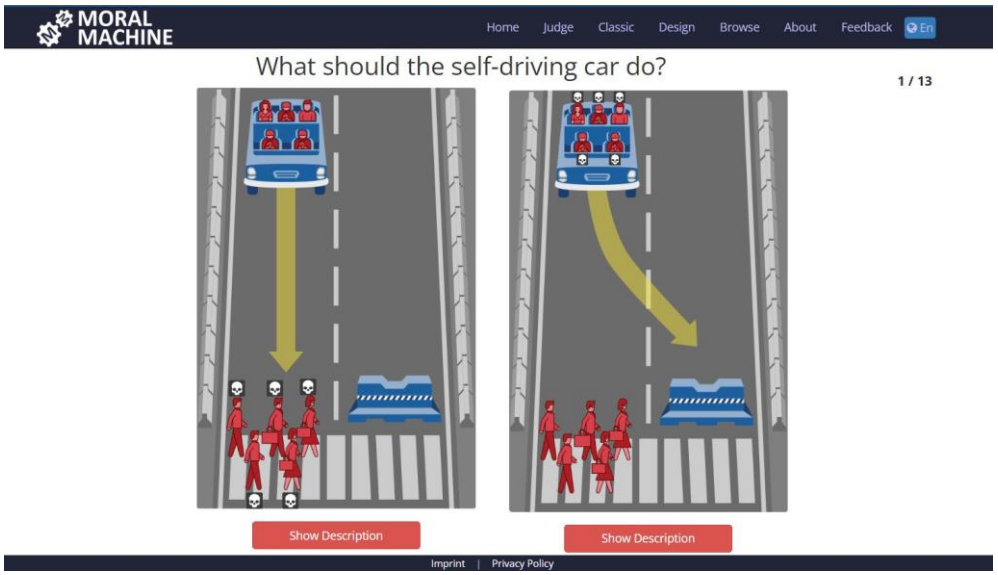
Fun activity:

Purpose: Use Moral Machine Platform to exercise the morality of persons.
Moral Machine is a platform for gathering a human perspective on moral decisions made by artificial intelligence, such as self-driving cars.
At the end, you will be able to see how their responses compare with other people.

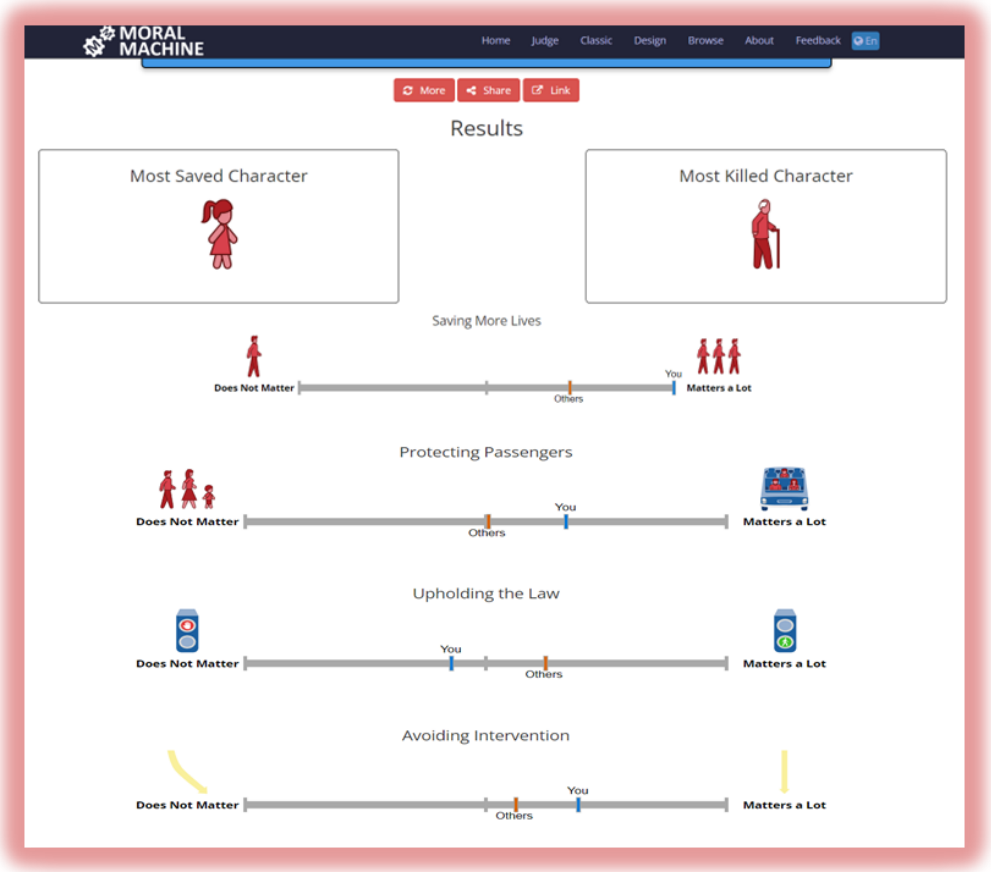
Activity Guidelines:
To perform the activity:
Go to this https://www.moralmachine.net



- Click on 'Start Judging' and you will see a screen as shown.



- Answer the questions till the end.



Let's summarise:

- The results will tell you which characters you preferred over the others.
- Saving more lives matters to you. When given a choice, you would prefer to save as many people as you can.
- It does not matter to you much if a person obeys the law or not when it comes to saving people.
- You will also get to know what beliefs you value with the choices you make in the game.
- You prefer protecting passengers, instead of pedestrians more.
- When an equal number of people are getting hurt, you prefer to not be a part of the consequences, and you do not intervene.

Ethics and Personal Data



There is a student named Jack

- Jack spends a lot of time on the internet every day.
- He does his research assignments, connects with his friends, uses social media, plays his favorite games, and shops on the internet.
- This means that a lot of his personal information is on the internet.



He uses personal voice assistant on his phone to play music and make calls.



He uses his phone camera to click a lot of pictures and store them safely on his phone.



He searches the internet whenever he needs any new information or if he wants to buy something.

Ethics with Personal Data



- There are around 5.34 billion smartphone users in the world as of July 2022, with their information available on the internet.
- AI can help us find out data related to a particular person, from all the available data.
- Such AI solutions are used by organizations to give us customized recommendations for products, songs, videos, etc.
- In this way, AI can influence our decision-making at times
- This calls for a need for ethical principles that govern AI and people who are creating AI.

Say “Try to identify if the learners can relate to Jack and what he uses the internet for. Ask the learners if they also use the voice assistant, phone camera, and internet search just like Jack.

Let’s discuss:

1. Can you think of what kind of personal data might be stored on the internet?

   _____

2. What are some other ways this personal data could be used to influence individuals?

   _____

3. Would it be ethical if governments had access to all the personal data of the citizens?

   _____

Major Issues around AI Ethics

Let’s learn some more about Jack:

- He is an average middle school student.
- His school recently started using an AI-based essay grading system.
- The system takes in an essay and assigns grades after evaluation.
- Jack is worried that he scored a bad grade, even though he wrote a really good essay.

Let’s discuss

- What do you think happened here?

_____

- Why did the AI evaluate Jack’s essay incorrectly?

_____

Ask: “what the learners did if they received lesser marks than they had expected.”

The reason was that the data used by the AI algorithm to learn how to grade essays was faulty.



The AI had learnt from data from students who were in universities.

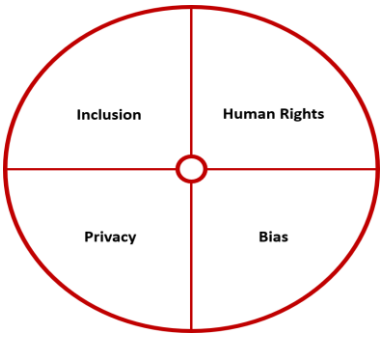
The data had been collected from students who also happened to live in a different country.

This is an example of how AI can be wrong at times, because of faulty or biased data.

What are the principles of AI Ethics?

AI Ethics Principles

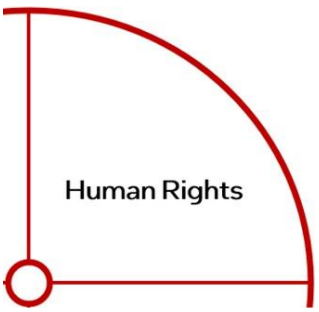
Identifying the principles



- To make AI better, we need to identify the factors responsible for it.
- The following principles in AI Ethics affect the quality of AI solutions
    - Human Rights
    - Bias
    - Privacy
    - Inclusion

Let's look at the AI Ethics principles in detail:

Human Rights

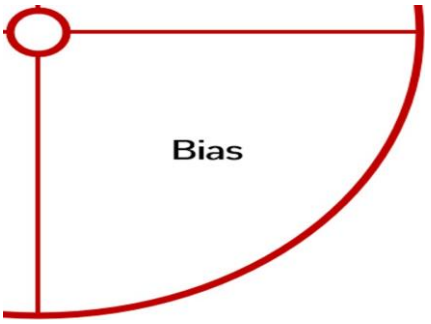


- When building AI solutions, we need to ensure that they follow human rights.
- Here are a few things that you should take care of
    - Does your AI take away Freedom?
    - Does your AI discriminate against People?
    - Does your AI deprive people of jobs?
    - What are some other human rights which need to be protected when it comes to AI?

Brief learners on basic human rights. Ask them some rights that they enjoy and what are the other rights that they think they should have?

Bias

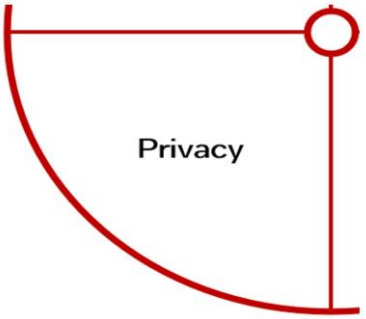
- Bias (partiality or preference for one over the other) often comes from the collected data. The bias in training data also appears in the results.
- Here are a few things that you should take care of
    - Does your data equally represent all the sections of the included populations?
    - Will your AI learn to discriminate against certain groups of people?
    - Does your AI exclude some people?
    - What are some other biases that might appear in an AI?



Ask the learners to recall the discussion on bias from level 0Are there any biases that they have?

Privacy

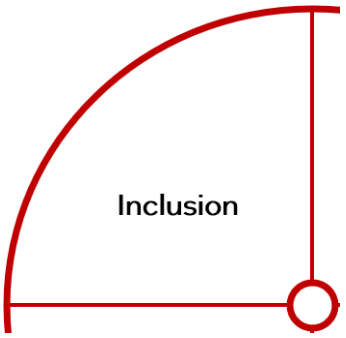
- We need to have rules which keep our individual and private data safe.
- Here are a few things that you should take care of
    - Does your AI collect personal data from people?
    - What does it do with the data?
    - Does your AI let people know about the data that it is collecting for its use?
    - Will your AI ensure a person's safety? Or will it compromise it?
    - What are some other ways in which AI can breach someone's privacy?



Ask learners about their understanding of privacy. Are there things that would want to keep private and not share with others?

Inclusion

- AI MUST NOT discriminate against a particular group of population, causing them any kind of disadvantage.
- Here are a few things you should take care of
    - Does your AI leave out any person or a group?
    - Is a rich person and a poor person benefitted equally from your AI?
    - How easy is it to use your AI?
    - Who does your AI help?
    - How can we make AI more inclusive?



Ask learners, "if they have felt excluded from any group. How does it feel? Why does exclusion happen in the first place?"



Let's discuss:

1. Do you follow some ethics in your life?
2. How does AI Ethics impact us in daily life?
3. Can you think of some examples for each of the 4 AI Ethics principles – Human Rights, Bias, Privacy, Inclusion?

Key Takeaways:

- Each AI problem can be mapped to the AI project cycle.
- AI project cycle simplifies the AI solution development process.
- Morality defines a set of beliefs dictated by society, culture, or tradition e.g., being truthful, loyal etc.
- Ethics defines the principles that decide what is good and what is bad e.g., is it right to speak the truth even if it threatens someone's life?
- AI Ethics principles help us guide to create better and safer AI solutions.

Revision Time

1. The guiding principles to decide what is good or bad is known as _____.
2. When building AI solutions, we need to ensure that they follow _____.
3. Praneet has taken extra packets of mouth freshener after dinner from a restaurant. Is it considered as theft?" Is it -Moral or Ethical concern?
4. Rakshit and Aman are talking about purchasing a new mobile. They discuss various features which they want in their mobile. Aman finds that, he started getting notification of various models of Mobiles that meets his requirement? Write which ethical concern the above example depicts.
5. "Preference for one over the other" is known as _____.
6. Artificial Intelligence and machine learning systems can display unfair behaviour if not trained properly. (True/False)
7. Search for images of personal secretary on Google, displaying predominantly the images of Women is an example of _____.
8. An Ethical AI framework makes sure that transparency, fairness and accountability is develop into the systems to provide unbiased results. (True/False)

Answer the following:

1. Differentiate between Ethics and Moral with suitable examples.
2. Define principles of AI.
3. Explain Data privacy.
4. Craft a description of how considerations for inclusivity are addressed during the development of AI models.
5. Write Major Issues around AI Ethics.
6. A company had been working on a secret AI recruiting tool. The machine-learning specialists uncovered a big problem: their new recruiting engine did not like women chefs. The system taught itself that male candidates are preferable. It penalised resumes that included the word "women chef". This led to the failure of the tool.
    a. What aspect of AI ethics is illustrated in the given scenario?
    b. What could be the possible reasons for the ethical concern identified?
7. As Artificially Intelligent machines become more and more powerful, their ability to accomplish tedious tasks is becoming better. Hence, it is now that AI machines have started replacing humans in factories. While people see it in a negative way and say AI has the power to bring mass unemployment and one day, machines would enslave humans, on the other hand, other people say that machines are meant to ease our lives. If machines over take monotonous and tedious tasks, humans should upgrade their skills to remain their masters always.

    What according to you is a better approach towards this ethical concern? Justify your answer.