ANSWER KEY

Artificial Intelligence

Part-B: Subject Specific Skills

1. Introduction to AI

Exercise

🔒 **Unsolved Questions**

A. 1. Deep Learning 2. Reinforcement 3. Artificial Super Intelligence

4. virtual 5. Machine Learning

B. 1. Machine learning algorithms like Decision Tree is used in fraud detection. This is supervised learning where classification is performed to categorise fraudulent and regular transactions.

2.

Can do	Cannot do
Predictions while commuting - like Traffic Forecasts on Google Maps.	Go beyond their tasks
Product recommendations	Learn on small amounts of data

3. • This layer is responsible for processing the input fed into the system

• Each node of the hidden layer has its functionality and hence, the defined machine learning algorithm gets executed on the data received from the input layer.

• The number of hidden layers in a neural network system depends on the complexity of the function for which the network has been designed.

4. Data Analyst, Data Scientist, Product Manager (any two)

5.

Data	Big Data
The volume of the data is small.	The volume of the data is huge.
Can be handled by traditional DBMS.	Cannot be handled by traditional DBMS.
Data handling is not expensive.	Data handling and management are quite expensive.

C. 1. Machine learning is the process of computers discovering useful information without being directed where to seek. Instead, they use algorithms that learn from data in an iterative process. Machine learning algorithms can process vast volumes of data and extract meaningful

information by utilising various programming techniques. In this approach, they can improve on earlier iterations by learning from the data presented to them.

Types of ML

a. Supervised Learning - One of the most fundamental types of machine learning is supervised learning. The machine learning algorithm is trained on labelled data in this case.

b. Unsupervised Learning - Unsupervised machine learning has the advantage of working with unlabeled data. This means that no human labour is necessary to make the dataset machine-readable, allowing the program to work on much larger datasets. Unsupervised learning lacks labels to deal with, leading in the formation of hidden structures. The program perceives relationships between data points in an abstract fashion, with no human input required.

c. Reinforcement Learning - Reinforcement learning is directly inspired by how humans learn from data in their daily lives. It has an algorithm that uses trial-and-error to better itself and learn from new scenarios. Favourable outcomes are promoted or 'reinforced, whilst unfavourable outcomes are discouraged or 'punished'.

Applications of ML – Image recognition, product recommendation, Email filtering and Spam detection, online fraud detection.

2. No AI and ML are not the same. However, they are definitely connected. AI is a broader term that refers to the creation of intelligent computers that can replicate human thinking capability and behaviour, whereas machine learning is an application or subset of AI that enables machines to learn from data without being explicitly programmed.

Artificial intelligence systems do not need to be pre-programmed; instead, they use algorithms that function with their own intelligence. It employs machine learning methods such as Reinforcement learning and deep learning neural networks. AI is being employed in a variety of applications, including Siri, Google's AlphaGo, and AI in chess playing.

Machine learning allows a computer system to forecast or make judgments based on historical data without being explicitly programmed. Machine learning makes extensive use of structured and semi-structured data in order for a machine learning model to produce reliable results or make predictions based on that data. Machine learning is based on algorithms that learn on their own utilising past data. It only works in certain domains.

3. a. Snapchat filters – Computer Vision : Computer vision is a domain of AI that enables machines to derive meaningful information from digital images, videos, and other visual inputs; and take actions or make recommendations based on that information.

b. Virtual Assistants like Siri and Alexa – Natural Language Processing : NLP employs natural language for interaction between computers and humans. Natural language processing (NLP) aims to extract information from the spoken and written word using algorithms, and natural language refers to the language that is spoken and written by people.

4. Artificial General Intelligence, also known as Strong AI, is the stage at which machines will most likely be able to reason and make decisions in the same way that humans do. Strong AI has a complicated algorithm that allows it to operate in various scenarios, whereas weak AIs have all of their actions pre-programmed by humans. Strong AI-powered devices will have their own minds. They will be able to analyse information and make judgments on their own, whereas weak AI-based computers can merely replicate human behaviour. Till date, there are no known cases of Strong AI.

Examples of weak AI – virtual assistants like Alexa and Siri, autonomous vehicles.

5. Data labelling in machine learning is the process of identifying raw data (pictures, text files, videos, etc.) and adding one or more relevant and useful labels to provide context so that a machine learning model may learn from it.

Labelled data often starts with a set of unlabelled data and then adds some sort of meaningful "tag," "label," or "class" to each item of that unlabelled data that is either informative or desirable to know. After collecting a labelled dataset, machine learning models may be applied to the data so that new unlabelled data can be provided to the model and a likely label for that piece of unlabelled data can be estimated or predicted.

Example - To construct your training dataset for natural language processing, you must first manually identify relevant chunks of text or classify the text with particular labels. For example, you may wish to detect the sentiment or intent of a text blurb, identify parts of speech, classify proper nouns such as locations and people, and recognise text in photos, PDFs, or other media. To accomplish this, draw bounding boxes around text and then manually transcribe the text in your training dataset. Natural language processing models are utilised for sentiment analysis, entity name identification, and optical character recognition.

Δi In Life

Can have multiple solutions

Δi Deep Thinking

Can have multiple solutions

Δi Ready

1. Can have multiple solutions

2. ML algorithms can supplement field data and automate functions mostly linked to regulation and optimization. Furthermore, machine learning and computer vision have enriched numerous sectors, including medical diagnostics, statistical data analysis and algorithms, scientific research, and so on. Such approaches have already been implemented in the fields of smartphone apps, computer equipment, online websites, cybersecurity, and so on. Examples – Google Maps, Email Spam Filter.

3. Can have multiple solutions

4. A hidden layer is positioned between the algorithm's input and output in neural networks, where the function assigns weights to the inputs and guides them through an activation function as the output. Hidden layers allow a neural network's function to be broken down into specific data modifications. Each hidden layer function is tailored to generate a certain result. For example, a hidden layer function that identifies human eyes and ears may be used in concert with succeeding layers to detect faces in photos. While the functions to detect eyes alone are insufficient to distinguish things independently, they can interact together within a neural network.

2. AI Applications and Methodologies

Exercise

🔒 Unsolved Questions

A. 1. NLP   2. machine learning   3. Cognitive Computing
4. Sophia   5. Recommendation system

B. 1. Benefits of driverless cars:
- Reduction of traffic congestion (30% fewer vehicles on the road)
- Reduce CO_2 emissions by 80% worldwide

2. Google calls the technology "Nowcasting" because it is set up to predict weather zero to six hours in advance and focus on weather events like thunderstorms that change rapidly from clear skies to heavy rain to gusty winds and vice versa. In essence, the method turns weather forecasting into a computer vision problem. Based on progressive images of cloud formation and movement over a short period, a machine learning algorithm predicts how the pattern will develop in the next few hours.

3. Semantic segmentation describes the process of assigning each pixel in an image to a class name (for example, flower, person, road, sky, sea, or car). The idea of segmentation is to teach computers to process and understand an image at the pixel level. In simple terms, computers can segment an image, paint objects in the image with different colours, and predict what is in them. For example, an autonomous car recognizes objects on the road and labels them as per the classes already fed into it.

4. Some of the advantages of rule-based chatbots are:
- Easy to train (less expensive)
- Very responsible and safe
- May contain some interactive elements and media
- Not limited to text interactions

5. Some of its characteristics are:

- Has the ability to predict and adapt: its ability to understand data patterns is used to make future decisions and predictions.
- Continuously learns: learns from data patterns.
- AI is reactive: it perceives a problem and acts according to the perception.
- AI's cutting: edge technology will be used in many other areas in the future.

Many applications and tools are using AI, that has a direct impact on our day-to-day life. So, we need to understand the kind of systems that can be developed using AI.

C. 1. Challenges posed by AI include:

- Bias: AI systems learn from data. If the data is biased, i.e., data favours a particular group/gender/class, the resulting decisions made by the AI model are also biased.
- Unemployment: Due to automation, certain jobs will become obsolete. There will be some highly skilled jobs created too, but some jobs will definitely get affected by AI.
- Disparate control over data: Data is AI fuel—the more data you have, the smarter are the AI machines. Tech giants are investing heavily in data collection and AI projects. This gives them an unfair advantage over their smaller competitors.
- Privacy: AI can be used to identify, track and monitor people on multiple devices, whether at work, at home, or in a public place. To make matters worse, AI doesn't forget anything. Once the AI knows you, it remembers you forever!

2. i) Agriculture: Agriculture is a sector that faces numerous challenges, such as weather, water consumption or soil conditions, etc. Real-time data analysis helps farmers to improve their crop yields and in turn their profits too.

ii) Education: Textbooks are digitized with the help of AI, early-stage virtual tutors support human teachers, and facial analytics measure students' emotions to determine who is struggling or bored and to better tailor the experience to your individual needs.

iii) Manufacturing: AI-powered robots work with humans to perform a variety of tasks, such as assembling and stacking, and predictive analytics sensors keep equipment running smoothly.

2. Various applications of NLP are

i) **Text Summarization** - Text summary is a technique for shortening long passages of text into manageable pieces of information. The goal is to develop a logical and fluent summary that only includes the document's major ideas.

ii) **Text Recognition** - In recent years, automatic reading of a vehicle's license plate, billboards, or text recognition has acquired a lot of popularity. Optical Character Recognition (OCR) is a popular text recognition technique that turns scanned images of text into an editable format.

iii) **Speech Processing** - Speech processing uses NLP so that smart devices like smartphones can interact with users through verbal language. One of the best-known examples of speech recognition technology on a mobile device is Apple's Siri speech recognition service.

iv) **Sentiment Analysis** - Positive and negative reviews are powerful because they can build or ruin a brand's reputation. Did you know that 40% of shoppers form an opinion about a business after reading the online reviews? This gives you an idea of the importance of tracking the sentiment of conversations around your brand, whether it's in reviews, surveys, social media, emails, and more.

4. These machines can work tirelessly and can even take over the most monotonous job. An example is SOPHIA. Built by Hanson Robotics, Sophia is a social humanoid robot that can have a conversation with you, answer questions, and remember you. Hanson designed Sophia as a suitable companion for the elderly in nursing homes or to help crowds at major events or in parks.

5. Autonomous systems accomplish tasks by interacting with their surroundings with minimum or no human involvement. These systems must be aware of the world around them. An autonomous car, also known as an autonomous vehicle (AV), is so called because it can sense its surroundings and move safely with little or no human intervention. Self-driving cars work on a combination of technologies as follows:

- **Computer Vision:** Computer vision allows the car to see/perceive its surroundings. It uses 'High Optic Camera', 'Radar' and 'Lidar'.

- **Deep Learning:** This is the car brain that makes driving decisions based on the information gathered through various sources such as computer vision, sensors, etc.

Ai In Life

Can have multiple solutions

Ai Deep Thinking

Can have multiple solutions

Ai Ready

1. a. TIM Brasil – AI powered chatbot

   b. Telefonica de Argentina - AI powered chatbot

   During pandemic, only 50% staff was allowed in organizations. Hence chatbots provided a reduction in burden on call centres and the wait time for users. This also reduced the need for expensive human resource.

2. Can have multiple solutions

3. Both AI and the human. AI can pinpoint erratic behaviour and human can verify or follow it up.

4. Can have multiple solutions

3. Maths For AI

Exercise

Unsolved Questions

A. 1. True   2. True   3. False   4. True   5. True

B. 1. $\frac{1}{2}\left|-3i + j\right|$

$a_{21} \Rightarrow i = 2 \ j = 1 \Rightarrow \frac{1}{2} \times \left|-3(2) + 1\right| \Rightarrow \frac{7}{2}$

$a_{32} \Rightarrow i = 3 \ j = 2 \Rightarrow \frac{1}{2}\left|-3(3) + 2\right| \Rightarrow \frac{11}{2}$

2.
$$A \times B = \begin{bmatrix} 1 \times 2 + 2 \times 1 + 3 \times 5 & 1 \times 2 + 2 \times 0 + 3 \times -1 \\ -1 \times 2 + 4 \times 1 + -2 \times 5 & -1 \times 2 + 4 \times 0 + -2 \times -1 \\ 2 \times 2 + 0 \times 1 + 5 \times 5 & 2 \times 2 + 0 \times 0 + 5 \times -1 \end{bmatrix}$$

$$= \begin{bmatrix} 19 & -1 \\ -8 & 0 \\ 29 & -1 \end{bmatrix}$$

3. $a = (3,4,2)$ and $b = (4,3,2)$

$$a \times b = \begin{vmatrix} i & j & k \\ 3 & 4 & 2 \\ 4 & 3 & 2 \end{vmatrix} \Rightarrow i\begin{vmatrix} 4 & 2 \\ 3 & 2 \end{vmatrix} -j\begin{vmatrix} 3 & 2 \\ 4 & 2 \end{vmatrix} +k\begin{vmatrix} 3 & 4 \\ 4 & 3 \end{vmatrix}$$

$\Rightarrow (8-6)i - (6-8) j + (9-16)k \Rightarrow 2i + 2j -7k$

4. Given that $u = (4, 9, 2)$ and $v = (-2, 5, 0)$

$u.v = (4 \times -2) + (9 \times 5) + (2 \times 0) = 37$

$v.u = (-2 \times 4) + (5 \times 9) + (0 \times 2) = 37$

5. The cartesian product of two relations is the concatenation of tuples belonging to the two relations. The cartesian product is a binary operation and is denoted by (x). The cartesian product of two relations will produce the relation which has a degree = sum of columns of parent relations and a cardinality =product of rows of parent relations.

C. 1. The union operation (Relational Algebra)

	Student	
Rollno	**Name**	**Marks**
100	Prakash	256
102	Sudha	210
103	Punit	269
105	Jimmy	210
106	John	276

	Student 1	
Rollno	**Name**	**Marks**
101	Vivek	256
103	Punit	269
104	Kumar	287
106	John	276

Result of the union operation

Rollno	**Name**	**Marks**
100	Prakash	256
101	Vivek	256
102	Sudha	210
103	Punit	269
104	Kumar	287
105	Jimmy	210
106	John	276

The union operation (Set Theory)

The union of two sets A and B is the set of elements that are in A, in B, or in both A and B. It is denoted by A ∪ B. For example: If A = {20, 21, 22, 23} and B = {23, 24, 25}, then: A ∪ B = {20, 21, 22, 23, 24, 25}. (The common elements occur only once).

Intersection Operation (Relational Algebra)

(Assuming the tables Student and Student1)

Intersection Student ∩ Student1

Result of the Intersection operation

Rollno	**Name**	**Marks**
103	Punit	269
106	John	276

Intersection Operation (Set Theory)

The intersection of sets A and B is the set of elements that are common in A and B. It is denoted by A ∩ B. For example: If A = {21, 22, 23} and B = {23, 24, 25}, then A ∩ B = {23}.

2. Mean = (18 + 22 + 19 + 10 + 12)/5 = 16.2 = 16 (approx)

	18	22	19	10	12
I.	−16	−16	−16	−16	−16
	2	6	3	6	−4

II. Squaring all differences.

22	62	32	(-6)2	(-4)2	Variance = 97
4	36	9	36	$\sqrt{16}$	std. Dev = 97 = 9.84

III. $4 + 36 + 9 + 36 + 16 \Rightarrow 101$

IV. $101 - 4 = 97$

3.

$$P = \begin{bmatrix} 4 & 3 \\ 8 & 7 \end{bmatrix}$$

$$|P| = \begin{bmatrix} 4 & 3 \\ 8 & 7 \end{bmatrix} \Rightarrow (4 \times 7) - (8 \times 3) \Rightarrow 4$$

Adjoint of r = $\begin{bmatrix} 7 & -3 \\ -8 & 4 \end{bmatrix}$

$$P^{-1} = \frac{1}{|P|} \begin{bmatrix} 7 & -3 \\ -8 & 4 \end{bmatrix} = \frac{1}{4} \begin{bmatrix} 7 & -3 \\ -8 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} 7/4 & -3/4 \\ -2 & 1 \end{bmatrix}$$

$$P = \begin{bmatrix} 4 & 3 \\ 8 & 7 \end{bmatrix}$$

$$|P| = \begin{bmatrix} 4 & 3 \\ 8 & 7 \end{bmatrix} \Rightarrow (4 \times 7) - (8 \times 3) \Rightarrow 4$$

Adjoint of r = $\begin{bmatrix} 7 & -3 \\ -8 & 4 \end{bmatrix}$

$$P^{-1} = \frac{1}{|P|} \begin{bmatrix} 7 & -3 \\ -8 & 4 \end{bmatrix} = \frac{1}{4} \begin{bmatrix} 7 & -3 \\ -8 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} 7/4 & -3/4 \\ -2 & 1 \end{bmatrix}$$

$$S = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$$ Expanding along Row 1

$$|S| = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} - 0 \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} + 0 \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$

= 1 so inverse exists

Adjoint of 5 $\Rightarrow$ First row $\Rightarrow$

$$\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \qquad \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \qquad \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$

$\Rightarrow$ 1   1   0

Second row ⟹

$$\begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix} \qquad \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \qquad \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$$

⟹   0   1   1

Third row ⟹

$$\begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix} \qquad \begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix} \qquad \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$$

⟹   0   1   1

Adjoint Matrix with sign

$$\begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 0 \end{bmatrix} \quad A^{-1} = \frac{1}{1} \begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 0 \end{bmatrix}$$

4. Mean = (7+16+12+35+51+10+80+71+16+9+11+16)/12 = 27.83

Median = 12/2 = 6th item = 16

7	9	10	11	12	16	16	16	35	51	71	80

Mode = 16

5.

Height	f	c f
120-130	4	256
130-140	6	256
140-150	12	210
150-160	20	269
160-170	8	287
	50	

Median

Me = size of $\left(\dfrac{N}{2}\right)^{th}$ item

Me = size of $\left(\dfrac{50}{2}\right)^{th}$ item

Median class 150 – 160

$$Me = l_1 + \frac{N/2 - c.f}{f} \times i$$

$$= 150 + \frac{25 - 22}{2\emptyset} \times 1\emptyset$$

$$= 150 + \frac{3}{2} = 150 + 1.5 = 151.5 \text{ cm}$$

Mode

Modal Class 150 – 160

$$Z = l_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

$$= 150 + \frac{20 - 12}{(2 \times 20) - 12 - 8} \times 10$$

$$= 150 + \frac{8}{40 - 20} \times 10 = 150 + \frac{\cancel{8}^{\,4}}{\cancel{20}} \times \cancel{10} = 154 \text{ cm}$$

Δi In Life

Can have multiple solutions

Δi Deep Thinking

Can have multiple solutions

Δi Ready

1. A tensor is a container that can hold N dimensions of data. Tensors are generalisations of matrices to N-dimensional space that are frequently and incorrectly used interchangeably with the matrix (which is precisely a 2-dimensional tensor).

2. A sparse matrix is one that contains largely zero values. Sparse matrices differ from dense matrices, which have a large number of non-zero values.

3. Artificial Neural Network (ANN) - Each layer of an ANN is made up of many perceptrons or neurons. Because inputs are exclusively processed in the forward direction, ANN is also known as a Feed-Forward Neural Network. This sort of neural network is one of the most basic neural network versions. They send data in one way, through multiple input nodes, until it reaches the output node. The network may or may not contain hidden node layers, which makes its operation more understandable.

   Convolutional neural networks (CNN) are among the most widely used models today. This neural network computational model employs a variant of multilayer perceptrons and includes one or more convolutional layers that can be completely linked or pooled. These convolutional layers provide feature maps that capture a portion of an image, which is then divided into rectangles and sent out for nonlinear processing.

   Recurrent neural networks (RNN) are more complex. They record the results of processing nodes and input them back into the model (they do not pass the information in one direction only). The model is said to learn to anticipate the outcome of a layer in this manner. Each node in the RNN model functions as a memory cell, continuing calculation and operation implementation. If the network's forecast is erroneous, the system self-learns and continues to backpropagate towards the correct prediction.

4. AI Values

4.

Exercise

🔒 Unsolved Questions

A. 1. False   2. True   3. True   4. True   5. False

B. 1. Societal AI bias occurs when an AI acts in ways that reflect social intolerance or institutional discrimination. Initially, the algorithms and data themselves seem unbiased, but their results reinforce societal biases.

    2. • Amazon discovered in 2015 that their algorithm for hiring staff was skewed against women. The explanation for this was that the algorithm was trained to prefer men over women based on the amount of resumes submitted over the previous 10 years, and because the majority of the candidates were men.

    • The COMPAS (Correctional Offender Management Profiling for Alternative Sanctions) algorithm, which is used in US court systems to forecast the possibility of a defendant becoming a recidivist, is arguably the most well-known example of AI bias. The model predicted twice as many false positives for recidivism for black criminals (45 percent) as white offenders due to the data collected, the model chosen, and the whole process of constructing the algorithm (23 percent).

    3. **Structured data collection** that allows for a variety of viewpoints. For a single data point, there are frequently numerous correct opinions or labels. Your model will be more adaptable if you collect their viewpoints and allow for valid, often subjective, conflicts.

    Recognize your training data. There are classifications and labels in both academic and commercial datasets that can introduce bias into your algorithms. You're less likely to be surprised by unwanted labels if you understand and own your data.

    Recruit a diversified ML team to ask a variety of questions. We all bring unique perspectives and ideas to the office. People with various backgrounds — colour, gender, age, experience, culture, and so on – will naturally ask different questions and interact with your model in different ways.

    4. Following are some of the issues related to driverless cars:

      1. The engineers need to strike a balance between safety and speed of the car. It can't be too slow or too fast.

      2. Engineers must balance mobility and environmental impact.

      3. It is difficult for the cars to recognize hand-gestures, signals given by cyclists or pedestrians.

      4. It is difficult for self-driving cars to decide between the lives of its passengers and the lives of pedestrians in case of accidents.

4. AI bias is a discrepancy in the output of machine learning algorithms caused by flawed assumptions made during the algorithm development process or biases in the training data.

C. 1. i) In 2019, Facebook was found to be in violation of the United States constitution for enabling advertisers to target ads based on gender, ethnicity, and religion, all of which are protected categories under the country's legal system. Job advertisements for nursing and secretarial positions were targeted predominantly towards women, but job advertisements for janitors and taxi drivers were targeted mostly at men, particularly those from minority backgrounds.

ii) When translating from languages with gender-neutral pronouns, Google Translate is prejudiced against women. The app's AI engine is more likely to produce translations like "he invests" and "she looks after the children" than vice versa.

2. i) i)Unemployment. What happens when a job comes to an end?

ii) Inequality. What is the best way to disperse the money generated by machines?

iii) Humanity. What impact do machines have on human interactions and behaviour?

iv) Artificial insanity What can we do to avoid making mistakes?

v) Robots that are racist. How can we get rid of AI bias?

vi) Security. How can we keep AI safe from outside threats?

vii) Singularity. How can we keep a sophisticated intelligent system under our control?

viii) Robots have certain rights. What does it mean to treat AI with humanity?

3. Can have multiple solutions. Teacher can discuss points from the following website.

Refer: https://techcrunch.com/2018/01/06/the-light-and-dark-of-ai-powered-smartphones/

4. The first step is to make a list of all the algorithms in use. Stakeholders should be consulted by developers to learn how and when algorithms are employed.

The second stage identifies the key to tackling algorithmic bias. Make certain that you understand what the algorithm's goal should be. It's a lot easier to make sure the algorithm is hitting the current target if you have that understanding. Organizations are encouraged to do a table screening for label choice bias. Organizations will fill up the table with information on the algorithm, the ideal target, the actual target, and the risk of bias.

Step three is either updating or removing any inefficient algorithms that are no longer serving the organisation well.

Finally, researchers should keep an eye on the algorithms and conduct audits to make sure they're on track to meet their objectives.

5. 1. Invest in end-user education to increase AI confidence.

Inform your leaders and teams about what you're doing and how artificial intelligence works. Your customers must be able to see how AI will benefit them.

2. Set the stage for AI predictions by providing context and transparency.

Always provide openness about how the machine arrived at a forecast to foster user trust. Show users which of your model's top predictive factors were responsible for the forecast.

3. Provide ongoing feedback to encourage involvement and progress.

Markets change, and predictions are probabilities. To increase your team's faith in AI, provide an easy way for them to provide input on predictions.

Δi In Life

Can have multiple solutions

Δi Deep Thinking

Can have multiple solutions

Δi Ready

Can have multiple solutions

5. Introduction to Storytelling

Exercise

Unsolved Questions

A. 1. False   2. True   3. True   4. False   5. True

B. 1. A story can be used to persuade, motivate and inspire in ways cold facts, bullets, and guidelines cannot. The seven key points to make our stories compelling, engaging, and interesting are:

- Engage your audience in your story
- Make a connection to your personal story
- Create suspense until the end
- Bring characters to life
- Show, not tell
- Create an 'aha' moment
- The climax is expected to have a positive outcome

2. Traditional storytelling is an important way for Indigenous peoples to express their knowledge, culture, and oral traditions. Traditional storytelling values holistic connection, collaboration, fairness, spirituality, and humility, and it has a positive impact.

3. The transition from oral to written culture occurred simultaneously, but is best represented in ancient Greece, where the earliest inscriptions date from 770 to 750 B.C. According to History of Information, scholars believe that "The Iliad" by Homer is the oldest extant work in the Greek language that originated from oral tradition. The invention of mass printing, which would make news and other information more accessible to all, would be the next big milestone in communications history. Printing aided in the spread of literacy among the general public. The usage of technology has impacted the way that we engage with others and how we tell tales. Since approximately the year 1800, technology has contributed to the development of photography, motion pictures, telephones, radio, television, digital media, mobile media, and social media; social media is the current most influential form of storytelling.

4. Data storytelling acts as an emotional glue to connect a diverse audience. Storytelling reshapes knowledge and helps communicate something meaningful. It can be motivating for the audience. We already know that the three key elements of any story are: Data, Visuals, Narrative. All these three key elements- data, visuals, and narrative have the power to drive change and influence.

C. 1. Following are some of the factors that make storytelling powerful:
   1. It makes information more compelling.
   2. It helps with learning because stories are easy to remember.
   3. It works for all types of listeners.
   4. It allows interaction between the storyteller and the listener.
   5. It shapes, empowers and connects people by doing away with judgement.
   6. It flows with the theme which is the story itself.
   7. It facilitates openness for embracing differences.
   8. It has ability to present a window in order to take a peek at the past.

2. Conflict can be defined as a clash between two opposing forces that creates the narrative thread for a story. It is the most exciting and engaging drive in any story. In a business or our daily life, users or the audience are always trying to resolve a conflict. All decisions must be made after the conflict is resolved. Each question answered in the data narrative is finding evidence of a conflict. The resolution is the end of the storytelling. The following skills can be used to resolve conflict in data storytelling:
   1. Communication   2. Teamwork   3. Problem Solving
   4. Stress management   5. Emotional agility

3. The elements that make data storytelling interesting, fruitful, and insightful:
   - Characters - who populate the story.
   - Plot - what happens in the story.
   - Setting - where the story takes place.
   - Point of view - participation of narrator and/or audience.
   - Style - skills acquired for telling the story.
   - Literacy devices - acquaintance with technology.

4. Data visualisation is the display of information using standard images such as charts, plots, infographics, and even animations. These easy-to-understand visual displays of data explain complex data relationships and data-driven insights. Advantages of data visualisation are:

- We can spot developing trends and respond quickly based on what we see thanks to data visualisation.
- A better technique
- Data sharing made simple
- In-depth investigation
- Identifying connections between events
- Examining patterns and openings

5. To find compelling stories in datasets, the following steps should be followed:

- Collect the data and organise it.
- Use proper visualization tools to visualize the data.
- Then observe the relationships between the data.
- Finally, develop a simple narrative that is hidden in the data to be communicated to the audience.

  Begin with creating a 3-minute story from the data. This should hold the key points. Then expand as per requirement.

Δi In Life

Can have multiple solutions

Δi Deep Thinking

No, it is not a good story. No visualization or relevant data in the form of facts or figures.

Δi Ready

Can have multiple solutions

6. Critical & Creative Thinking

Exercise

Unsolved Questions

A.
1. Design Thinking
2. Brainstorming
3. Empathy Map
4. Ideate
5. Brainwriting

B. 1. Problem solving entails employing general or ad hoc procedures in an ordered manner to solve problems.

Some problem-solving approaches are employed in philosophy, medicine, mathematics, engineering, computer science, and artificial intelligence in general. These could be mental problem-solving methods or a computerised approach.

2. An empathy map can assist a design team map out what they know about a possible audience. This tool aids in gaining a thorough understanding of the reasons behind certain actions taken by a user. This tool aids in the development of empathy for users.

Advantages:
- A better understanding of the intended audience
- More well-organized data in an easy-to-understand manner
- Quick and low-cost
- Simple Customization
- Everyone in the team has the same understanding and approach.
- The empathy map expresses what users think, say, feel, and do.

3. Ideation is the design process mode in which you focus on idea generation. In terms of concepts and outcomes, it symbolises a mental process of "going broad." Ideation serves as both the fuel and the source material for prototyping and delivering creative solutions to your users.

The Ideation stage's major goal is to employ creativity and innovation to generate solutions. By broadening the solution space, the design team will be able to look beyond the traditional ways of issue solving in order to develop better, more elegant, and gratifying answers to challenges that affect a product's user experience.

4.

Creative Thinking	Critical Thinking
The goal of creative thinking is to generate fresh, novel, or helpful ideas.	Critical thinking is the ability to consider information in a clear and logical manner.
Many possible, plausible solutions	Often only one possible outcome
Requires imagination	Requires analysis, reflection

C. 1. **Stage 1: Empathize—Research the Needs of Your Users**

Typically, user research should be used to get a sympathetic grasp of the problem you're attempting to solve. Empathy is essential in a human-centered design approach like design thinking because it allows you to lay aside your own worldview assumptions and acquire actual insight into people and their needs.

Stage 2: Define—State Your Users' Needs and Problems

It's time to compile the information obtained during the Empathize stage. You then examine and synthesise your observations to define the fundamental issues that you and your team have found. These definitions are known as problem statements.

Stage 3: Ideate—Challenge Assumptions and Come Up With New Concepts

You are now ready to produce ideas. Because you have a firm foundation of information from the prior two phases, you can begin to "think outside the box," explore for alternate perspectives on the problem, and identify unique solutions to the problem statement you've created. Brainstorming is especially effective in this situation.

Stage 4: Prototype—Begin Creating Solutions

This is an exploratory phase. The goal is to find the best solution for each problem that is discovered. To study the concepts you've created, your team should create several low-cost, scaled-down prototypes of the product (or certain features found within the product). This might be as simple as paper prototyping.

Stage 5: Test—Put Your Solutions to the Test

The prototypes are thoroughly tested by evaluators. Despite the fact that this is the final phase, design thinking is iterative: The outcomes are frequently used by teams to redefine one or more additional problems. As a result, you can go back to prior stages to make further iterations, changes, and improvements – to identify or rule out alternate alternatives.

2. Defining or identifying the problem is the initial stage in practically every problem-solving process. It is the most challenging and crucial of all the steps. It implies diagnosing the situation so that the focus is on the actual problem rather than its symptoms.

   Finding or recognising a problem is frequently more important than finding a solution. Galileo, for example, recognised the challenge of needing to know the speed of light but did not devise a solution. This measurement problem required improvements in mathematics and science to solve. Nonetheless, Galileo was credited with discovering the problem. Sometimes the art of asking the appropriate questions at the right time is all that is required to define a problem.

3. The shorthand for the following six questions is 5W1H: What? Who? Where? When and why? How? This strategy entails asking a systematic set of questions in order to collect all of the facts required to create a report of the current situation with the goal of discovering the true nature of the problem and precisely defining the setting.

   - What - A description of the task, activity, problem, and project goal.
   - Who - Determine the stakeholders involved, as well as the people who are responsible or affected.
   - Where- Describe the location or place in question.
   - When- Determine the time when the situation occurred, is occurring, or will occur.
   - Determine how to proceed, including the steps and method to be used.

4. Brainstorming is a technique used by design teams to develop ideas for solving clearly specified design issues. Teams address a topic under controlled conditions and in a free-thinking environment by asking "How Might We?" questions. They generate a wide range of ideas and connect them to uncover viable answers.

   It's particularly popular among design teams because it allows them to grow in all directions.

Although teams have guidelines and a facilitator to keep them on pace, they are free to apply unconventional and lateral thinking to find the best solutions to any design problem. By brainstorming, people can pursue a wide range of approaches—the more, the better— rather than only examining conventional ways and encountering the related challenges.

Δi In Life

Can have multiple solutions

Δi Deep Thinking

Can have multiple solutions

Δi Ready

Can have multiple solutions

7. Data analysis

Exercise

🔒 Unsolved Questions

A. 1. Median   2. variable   3. symmetric

4. data matrix   5. positive skewed

B. 1. Frequency Table

Class	Tally	Frequency
6	||||	4
5	|||	3
4	₦	5
3	||||	4
2	|||	3
1	₦	5
	24	24

2. The tabular format to present cases and variables used in statistical study is known as a data matrix. As data is collected in each case, it is stored in a data matrix that contains a certain number of rows and columns. The data is generally organized so that each row in the data matrix contains details about the case. Therefore, the rows represent the case or the samples, while the columns represent the variable.

3.

Nominal Measurement	Ordinal Measurement
In certain circumstances, this scale is used for classification — the numbers linked with the variables on this scale are simply tags for categorization or division. Calculations based on these figures are pointless because they have no quantitative meaning.	Ordinal Scale is defined as a variable measuring scale that is used to simply display the order of variables rather than the difference between each variable.
In research surveys and questionnaires, when only variable labels are significant, nominal scale is frequently utilised. For example, consider a poll that asks customers, "Which brand of cellphones do you prefer?" Options - "Apple" - A, "Samsung"- B, and "OnePlus" - C.	These scales are commonly used to represent non-mathematical concepts such as frequency, contentment, happiness, pain level, and so on. Because the origin of this scale is missing, there is no set start or "genuine zero." In general, these scales are used in market research to collect and assess relative input on product satisfaction, changing perceptions with product updates, and so on. For example, how pleased are you with our services? 1 - Unsatisfied – 2 Neutral – 3 Satisfied – 4 Very Dissatisfied 5 stars – Extremely Satisfied This is where the ordinal scale excels over the nominal scale — the order of the outcomes, as well as their nomenclature, is important.

4. In statistics, the mode is the value that appears most often in a given list of numbers.

Mode of the given list of numbers - 3 and 7. This is bimodal data.

5. A scatter plot (also called a scatterplot, scatter graph, or scatter diagram) is a type of graph which uses Cartesian coordinates to display values of mainly two variables in a dataset. It typically consists of an X-axis (the horizontal axis), a Y-axis (the vertical axis), and a series of dots. Each dot on the scatterplot signifies one observation from a data set. The position of the dot on the scatterplot represents its value on the X-axis and Y-axis respectively.

C. 1. Measurement levels are used to identify and categorise values within a data collection obtained through surveys and questionnaires. Understanding the four levels of measurement might help you better understand the results of your surveys. There are 4 levels of measurement-

- The nominal level of measurement categorises the values in a data set but does not rank or evaluate those categories.

- Ordinal measurement assigns a value to each category and ranks the variables in a data set.

- The interval measurement level rates numerical values and identifies the relationship between variables in a data set.

- The ratio measurement classifies values and their differences, including zero.

  Levels of measurement assist researchers in determining how to interpret data from a variable. For example, if researchers issue the labels "one," "two," and "three" to three persons, understanding the level of measurement helps explain onlookers what those labels represent. The numbers are placeholders if the measure is nominal.

2.

Case	Variable
A case is a type of experimental unit.	A variable is a measurable property that can take on a variety of values. In other words, something that fluctuates from situation to case.

Example - A researcher is curious whether dogs fed just canned food have different body mass indexes (BMI) than dogs fed only hard food. They gather BMI data from 100 dogs who exclusively eat canned food and 100 dogs who only eat hard food. Here, the cases are the canines. There are two variables: dietary type and BMI.

3. Scatter plots are used to inspect the relationship between two variables. These help to analyse how much one variable affects the second variable. This relationship between the two variables is called correlation.

   If a change in X has no effect on Y, there is no correlation. The two variables do not have any link. For example, how much time I spend watching television has no bearing on my water bill.

4. A bar chart (also known as a bar graph) is a graphical tool that uses bars to compare data between categories. The length of the bar is directly proportional to the value it represents. The bars in the diagram can run horizontally or vertically and are the same width.

   Using a bar chart has many advantages:

   - It is useful for comparing facts
   - It provides a graphical representation for quick comparison of quantities in various categories
   - It also helps to easily identify relationships.
   - Bar charts also show big changes over time.

5. Structured data is formatted, and has a predefined data type and arrangement. Some examples of structured data that we find in everyday life are names, dates, addresses, credit card numbers, stock information, etc. We can add, search, modify and manipulate structured data easily.

   Types of Structured Data

   - Date and Time Datatype - As the name suggests, this datatype is used to date and time respectively.
   - String Datatype - A string is a sequence of characters that include

- alphabets A-Z and a-z
- numbers 0-9
- Special characters including spaces, @, *, ? etc.
- Categorical Datatype - Categorical data is a datatype with two or more categories.

🤖 Ai In Life

Measures of central tendency (mean, median, and mode) are used to understand data from a sample or population. The central tendency measures provide information about the average value of a group of values, hence their aim is to show where the data set is located. They can also be used to compare or understand data.
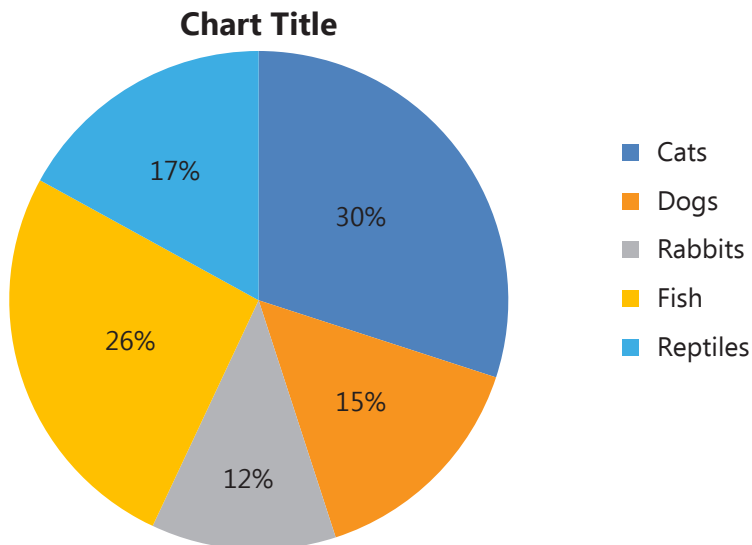
Students can explore further.

🧠 Ai Deep Thinking

Can have multiple solutions

🤖 Ai Ready

1. Mean - 61.386   Median - 60   Mode - 65
2. Pie Chart

Chart Title

- 🟦 Cats
- 🟧 Dogs
- ⬜ Rabbits
- 🟨 Fish
- 🟦 Reptiles

8. Regression

Unsolved Questions

A. 1. Outliers   2. Regression Line   3. 0.0

    4. Linear and Logistic   5. discrete

B. 1. True   2. True   3. False

    4. False   5. False

C. 1.
- Positive Correlation (r=1) : Positive correlation is the relationship between two variables, in which both variables have a linear relationship. As one variable increases/decreases, the second variable too increases/decreases. For example, when fuel prices increase, prices of airline tickets also increase.

- Negative Correlation (r=-1) : Negative correlation is the relationship between two variables, where one variable increases as the second variable decreases, and vice versa. For example, more exercising leads to a decrease in body weight.

- No Correlation (r=0) : No correlation means that there is no relationship between two variables. If the value of a variable is changed, another variable is not affected. For example, shirt size and monthly expense, body weight and intelligence, etc.

2. No, correlation does not imply causation. This means that the relationship between two variables cannot be reasonably deduced based solely on their observed association. If two things are related, does not, necessarily mean that one thing leads to the other. For example, just because Indians tend to eat more in cold weather and less in hot weather does not mean that cold weather leads to crazy shopping for eatables.

3.
- Agricultural scientists frequently employ linear regression to assess the impact of fertiliser and water on crop yields. Scientists might experiment with varied amounts of fertiliser and water on different fields to observe how they effect crop yield.

- Medical researchers frequently employ linear regression to better understand the relationship between drug dosage and patient blood pressure. Researchers may give different doses of a medicine to patients and see how their blood pressure responds.

4. A residual is a measure of how distant a point is from the regression line vertically. Simply put, it is the difference between an anticipated and observed value. If data points are closer to the line of best fit (less residual error), it means the correlation between the two variables

is higher. That means, the relationship between the two variables is strong. The lower the residual errors, the better.
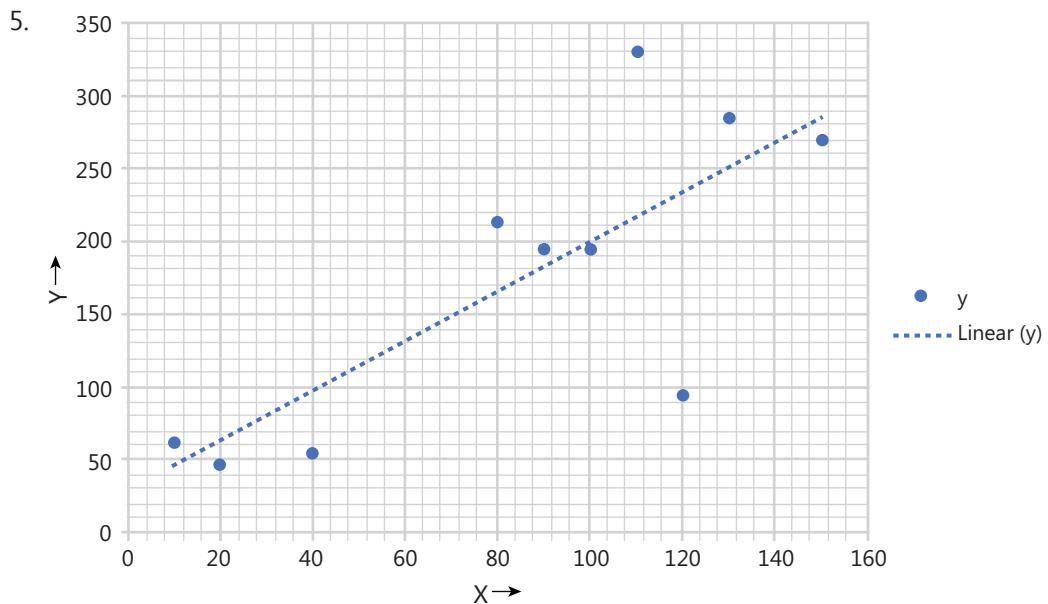
5. (a) Positive Correlation   (b) Negative Correlation   (c) No Correlation

D. 1. (a) Regression Line 8.4x - 16872

(b) Predicted Sales in 2015 8.4(2015) - 16872 = 54 lakhs

2. r=0.99 This shows a strong positive relationship between X and Y. Both variables have a linear relationship. As one variable increases/decreases, the second variable too increases/decreases.

3. a. Line of best fit - A line of best fit is a line that runs across a scatter plot of data points and best reflects the relationship between those points. Statisticians often utilise the least squares method to calculate the geometric equation for the line, either manually or through regression analysis software. A simple linear regression study of two or more independent variables will provide a straight line.

b. Independent variable - Independent variables (IVs) are those that you put in the model to explain or forecast changes in the dependent variable. These variables are self-contained. In this case, independent means that they stand on their own and are unaffected by other variables in the model. Independent variables are frequently referred to as predictors.

c. Dependent variable - The model's dependent variable (DV) is what you seek to explain or forecast. This variable's values are determined by other variables. You're looking at the end result. It is also referred to as the response variable.

d. Outlier - Outliers are single data points within your dataset that do not follow the usual pattern. Outliers can have a great impact on the line of best fit and the Pearson correlation coefficient, leading to very difficult inferences regarding the data. Therefore, it is best to have no outliers or keep them to a minimum.

e. Residual Error - A residual is a measure of how distant a point is from the regression line vertically. Simply put, it is the difference between the predicted and observed value.

4.

Linear Regression	Logistic Regression
Used to predict values such as price, salary, age, etc.	Used to group values such as Male/Female, True/False, Spam/Not Spam into classes.
The graph is a straight line.	The graph is a Sigmund curve.

5.

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{100 - 60}{40 - 20} = \frac{40}{20} = 2$$

Since the slope is positive, this represents an increase of 2 units with every increase of 20 units of X.

Ai In Life

Can have multiple solutions

Ai Deep Thinking

Can have multiple solutions

Ai Ready

1. a. 97/244 = 39.75% (40% approx)

    b. 97/244 = 39.75% (40% approx)

    c. 39/97 = 40%

    d. 16/59 = 27%

2. Regression is a supervised learning technique that allows us to predict the continuous output variable based on one or more predictor variables.

3. Correlation depicts the relationship between two variables, whereas regression demonstrates how one influences the other. The regression data indicates a cause and effect relationship; when one changes, so does the other, although not always in the same manner. The variables move together when there is correlation.

9. Classification & Clustering

Exercise

🔒 **Unsolved Questions**

A. 1. Centroid   2. Credit card fraud detection and Medical imaging analysis

     3. Confusion Matrix   4. Type 1   5. manual similarity measure

B. 1. False   2. True   3. True

     4. False   5. False

C. 1. Medical Imaging Analysis   b. application of Clustering

     2. False Positive   d. indicates false alarm

     3. Handwriting recognition   e. application of Classification

     4. Decision Trees   a. Binary Classification

     5. collaborative filtering   c. recommender systems

D. 1. The biggest advantage of the k-means algorithm is that it can cluster large data sets quite efficiently. Even to cluster naturally imbalanced clusters one can modify or generalize the k-means algorithm. This greatly improves the result too.

     2. Even if your machine learning model is highly accurate, it is likely that it is prone to other sorts of error. Consider the classification of email as spam (the positive class) or not spam (the negative class) (the negative class). The email you get is not spam 99 percent of the time, but it may be spam 1 percent of the time. If we trained a machine learning model to always forecast an email as not spam (negative class), it would be 99 percent correct despite never detecting the positive class.

     In situations like this, it's useful to consider what percentage of the positive class we're truly forecasting, as measured by the Precision and Recall metrics.

     3.

Supervised Learning	Unsupervised Learning
Logistic Regression	K Means Clustering
Decision Trees	Hierarchical clustering
K-Nearest Neighbors	
Support Vector Machine	

     4. A recommendation engine is a data filtering tool (technique) that uses machine learning algorithms to recommend the most relevant products to a certain user or customer. It works on the premise of discovering patterns in customer behaviour data, which can be collected either implicitly or explicitly.

     Based on a customer's previous purchasing history, recommendation engines filter out the things that he or she would be interested in or purchase. The more information there is

about a customer, the more accurate the recommendations.

5. K-means is a clustering algorithm that is either centroid-based or partition-based. This algorithm divides all of the points in the sample space into K similarity groups. The Euclidian Distance is commonly used to measure similarity.

The key feature of density based clustering technique is that each point in a cluster's neighbourhood that is within a defined radius (R) must have a minimum number of points (M). This algorithm has proven to be exceptionally effective in detecting outliers and dealing with noise.

E. 1. Classification is the process of labelling a set of data (structured or unstructured) into different classes or groups where we can assign a label to each class. For example, cities in India have different coloured dustbins for different types of waste: green coloured dustbins for biodegradable waste, blue dustbins for non-biodegradable or plastic waste, yellow dustbins for paper waste and red dustbins for metallic waste. Hence, we classify the waste into different categories while also labelling each category.

Classification is a supervised learning concept which groups a set of data into classes. It is mainly of two types –
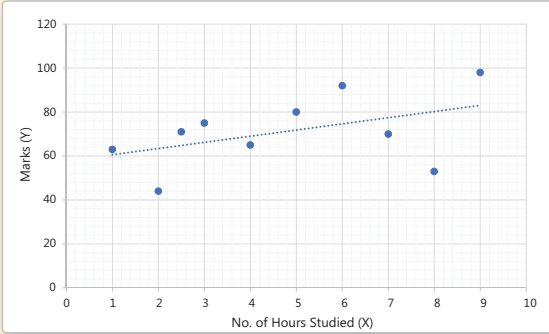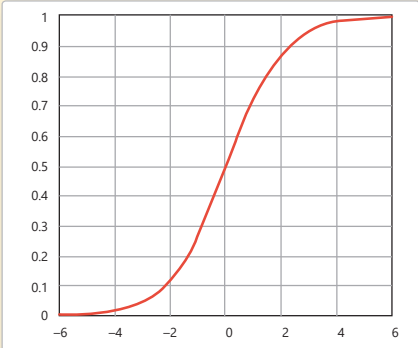
- Binary Classification - refers to classification problems/tasks that have only two class labels. For example, Email spam detection (spam or not), churn prediction (whether customers will stop doing business on a particular website).

- Multi-class Classification –implies those classification tasks that have more than two class labels. For example, face classification, animal species classification, optical character recognition. The examples are classified as belonging to one of the several known classes.

2. In the field of machine learning, a confusion matrix (NxN matrix) is used to validate the performance of a classification model i.e. how good are the classifier's predictions, where N is the number of target classes. The confusion matrix compares the actual target values with those predicted by the classifier. This tells us how well the classification model is performing and what kind of error it is making.

Benefits:

- It provides information about the classifier's errors and the types of faults that are occurring.

- It reflects how unorganised and confusing a categorization model is when making predictions.

3. • Centroid-based clustering arranges the data into non-hierarchical clusters. K-means clustering is the most popular centroid-based clustering algorithm.

- Density-based clustering groups high density areas into clusters. Hence, arbitrary-shaped distributions occur so that dense areas can be connected.

- Distribution-based Clustering - It is a clustering model in which we try to fit the data on the probability that it can belong to the same distribution. The grouping done may be normal or gaussian.
- Hierarchical clustering builds a tree of clusters. The aim of the algorithm is to produce a tiered series of nested clusters. Each cluster is different from every other cluster, and the objects within each cluster are mostly similar to each other.

4.

Linear Regression	Logistic Regression
Used to predict values such as price, salary, age, etc.	Used to group values such as Male/Female, True/False, Spam/Not Spam into classes.
The graph is a straight line.	The graph is a Sigmund curve.

5.

CONFUSION MATRIX		REALITY	
		TRUE	FALSE
PREDICTION	TRUE	893	317
	FALSE	410	480

Total No. of cases = 2000

FN = 2000 − (TP+TN+FP) = 410

$$\textbf{Accuracy} = \frac{(TP+TN)}{(TP+TN+FP+FN)} \times 100\%$$

$$= (893+480)/2000 \times 100 = 68.65\%$$

$$\text{Precision} = \frac{TP}{TP+FP} \times 100\%$$

$$= 893/(893+317) = 73.8\%$$

$$\text{Recall} = \frac{TP}{TP+FN} = 893/(893+410) = 0.68$$

$$\text{F1 Score} = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}} \qquad 2 \times \frac{0.73 \times 0.68}{0.73 + 0.68} = 0.70$$

Δi In Life

Can have multiple solutions

Δi Deep Thinking

Can have multiple solutions

Δi Ready

1. Medical Diagnosis and Animal Recognition
2. Qualitative output and Predefined classes
3. predictors
4. • similar
   • dissimilar
5. different and useful

10. AI Values

Exercise

🔒 Unsolved Questions

A. 1. UNI Global Union 2. Bias 3. ConvNetQuake
4. AI Ethics framework 5. Drones

B. 1. Medicine, Natural Disaster (like earthquake) detection, Agriculture, education, criminal and fraud detection.

2. i) Healthcare is one of the most vital sectors where AI is making a significant difference in saving lives. As potentially life-saving technology for a wide range of clinical circumstances, Health Catalyst has developed catalyst.ai, healthcare.ai, and its healthcare analytics platform. For example, its machine-learning capabilities can detect patients who are at high risk of readmission and give physicians with information, allowing them to intervene and treat the issue. The technique has also aided in the prevention of hospital-acquired infections, the prediction of chronic disease, and the reduction of mortality rates.

ii) Delta 8.7 is an organisation that uses artificial intelligence and computer science to track down and arrest human traffickers. To identify new methods to employ technology to address this crucial societal issue, the group is collaborating with the United Nations University Centre for Policy Research, the Alan Turing Institute, the Computing Community Consortium, Tech Against Trafficking, and others.

(Students can explore more ways in which AI is helping)

3. A young student saw a friend being bullied at school but was afraid to speak out. She realized that a student's drawing can often express what he or she is experiencing in life. Therefore, she developed a solution to identify and support students who have experienced violence and bullying. She and her mother teamed up to create 'My Drawings Speak Up', an app that utilizes machine learning to examine drawings to determine if a child is experiencing violence.

4. Artificial intelligence (AI) is a broad field of computer science concerned with creating intelligent machines capable of doing activities that normally require human intelligence.

As Artificial intelligence enters our workplace, unions, multinational worker alliances in companies should take steps, to safeguard workers' interests and maintain a healthy balance of power in workplaces. AI Ethics framework is important because it highlights the risks and benefits of artificial intelligence tools. An AI Ethical framework is required for the following reasons:

- Achieve reliable and fairer results for everyone
- Reduce the risk of negative impact on those affected by AI systems
- Companies and governments follow the highest ethical standards while designing, developing, and implementing AI systems.

C. 1. AI is becoming more sophisticated at doing what people do, but more efficiently, swiftly, and cheaply. Both AI and robotics have enormous potential in healthcare. AI and robotics are gradually becoming a component of our healthcare eco-system, just as they are in our daily lives.

AI Improves Health Care

i) Virtual doctors and therapists use AI to help offer diagnosis and treatment advice for people who may not be able to see a doctor in person.

ii) Surgical robots using computer vision make it possible for doctors to perform delicate medical procedures.

iii) Machine learning and sensors are used by Bionic limbs and exoskeletons to read body position and terrain to improve mobility.

2. • Transparency
   • AI Systems Must be Equipped with an "Ethical Encoder"

- Human-centred values
- Take an individual-in-control approach
- Safeguard a genderless, unbiased AI
- Sharing the benefits of AI systems
- Ensure a just transition and support for fundamental freedoms and rights
- Establish a mechanism of global governance
- Prohibition of assigning responsibilities to robots
- Prohibit AI arms race

3. Thibaut Perol is a deep learning scientist who leads an AI project called ConvNetQuake. The system uses machine learning algorithms to analyse seismograms to determine whether the seismic activity is an earthquake or low noise. Testing in Oklahoma was successful. The number of earthquakes detected was 17 times better than when conventional methods were used. This makes ConvNetQuake the world's first neural network that can detect earthquakes, even if they are weak earthquakes that cannot be captured by traditional methods.

Δi In Life

Can have multiple solutions

Δi Deep Thinking

Can have multiple solutions

Δi Ready

Can have multiple solutions