आर्टिफिशियल इंटेलिजेंस
Artificial Intelligence

कक्षा / Class X

2025-26

विद्यार्थी सहायक सामग्री
Student Support Material

केन्द्रीय विद्यालय संगठन~Kendriya Vidyalaya Sangathan

संदेश

विद्यालयी शिक्षा में शैक्षिक उत्कृष्टता प्राप्त करना एवं नवाचार द्वारा उच्च - नवीन मानक स्थापित करना केन्द्रीय विद्यालय संगठन की नियमित कार्यप्रणाली का अविभाज्य अंग है। राष्ट्रीय शिक्षा नीति 2020 एवं पी. एम. श्री विद्यालयों के निर्देशों का पालन करते हुए गतिविधि आधारित पठन-पाठन, अनुभवजन्य शिक्षण एवं कौशल विकास को समाहित कर, अपने विद्यालयों को हमने ज्ञान एवं खोज की अद्भुत प्रयोगशाला बना दिया है। माध्यमिक स्तर तक पहुँच कर हमारे विद्यार्थी सैद्धांतिक समझ के साथ-साथ, रचनात्मक, विश्लेषणात्मक एवं आलोचनात्मक चिंतन भी विकसित कर लेते हैं। यही कारण है कि वह बोर्ड कक्षाओं के दौरान विभिन्न प्रकार के मूल्यांकनों के लिए सहजता से तैयार रहते हैं। उनकी इस यात्रा में हमारा सतत योगदान एवं सहयोग आवश्यक है - केन्द्रीय विद्यालय संगठन के पांचों आंचलिक शिक्षा एवं प्रशिक्षण संस्थान द्वारा संकलित यह विद्यार्थी सहायक-सामग्री इसी दिशा में एक आवश्यक कदम है । यह सहायक सामाग्री कक्षा 9 से 12 के विद्यार्थियों के लिए सभी महत्वपूर्ण विषयों पर तैयार की गयी है। केन्द्रीय विद्यालय संगठन की विद्यार्थी सहायक- सामग्री अपनी गुणवत्ता एवं परीक्षा संबंधी सामग्री संकलन की विशेषज्ञता के लिए जानी जाती है और शिक्षा से जुड़े विभिन्न मंचों पर इसकी सराहना होती रही है। मुझे विश्वास है कि यह सहायक सामग्री विद्यार्थियों की सहयोगी बनकर निरंतर मार्गदर्शन करते हुए उन्हें सफलता के लक्ष्य तक पहुँचाएगी।
शुभाकांक्षा सहित ।

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CURRICULUM 2025-26

PART A

EMPLOYABILITY SKILLS

UNIT 1- COMMUNICATION SKILLS – II

Learning outcomes:

- Demonstrate knowledge of various methods of communication
- Provide descriptive and specific feedback
- Apply measures to overcome barriers in communication
- Apply principles of communication
- Demonstrate basic writing skills

Main points:

1. Methods of Communication
    - Face-to-face informal communication
    - e-mail
    - Notices/Posters
    - Business Meetings
2. Verbal Communication
    - Interpersonal Communication
    - Written Communication
    - Small Group Communication
    - Public Communication
3. Non-verbal Communication
    - Gestures
    - Expressions
    - Body Language
4. Communication Cycle and Importance of Feedback
    - Feedback is an important part of the communication cycle.
    - A good feedback is always specific, helpful and kind.
5. Barriers to Effective Communication
    - Physical Barriers - Environmental and natural condition that act as a barrier in communication in sending message from sender to receiver.
    - Linguistic Barriers - The inability to communicate using a language is known as language barrier to communication.

- Interpersonal Barriers - Barriers to interpersonal communication occur when the sender's message is received differently from how it was intended.
- Organizational Barriers - Superior-subordinate relationships in a formal organizational structure can be a barrier to free flow of communication.
- Cultural Barriers - Cultural barriers is when people of different cultures are unable to understand each other's customs, resulting in inconveniences and difficulties.

6. Writing Skills — Parts of Speech
   - Capitalization
   - Punctuation
   - Basic Parts of Speech – Noun, Pronoun, Adjectives, Verbs, Adverbs
   - Supporting Parts of Speech Types - articles, conjunctions, prepositions, interjections

7. Writing Skills — Sentences
   - Parts of a Sentence – Subject, verb, object
   - Types of Objects – Direct and Indirect
   - Types of Sentences – Active and Passive

Multiple Choice Questions (MCQs)

Q1. Oral communication is based on _____.

(a) Facial expressions (b) Listening and Hearing
(c) Body language (d) Language and tone of voice

Q2. Visual communication among the people are dependent on _____ .

(a) Signs, symbols and pictures (b) Text messages
(c) Posture (d) Body language

Q3. _____ feedback is specific information, in the form of written comments or verbal conversations that help the learner understand what she or he needs to do to improve.

(a) Descriptive (b) Specific
(c) General (d) Sign

Q4. _____ communication is the use of body language, gestures and facial expressions to convey information to others.
(a) Verbal (b) Written
(c) Non-verbal (d) Visual

Q5. There are many reasons why interpersonal communications may fail. While communicating, the message may not be received exactly the way, the sender intended and therefore it is important that the communicator seeks, _____ to check that their message is clearly understood.
(a) description (b) feedback
(c) channel (d) sign

Q6. Which one of the following is not a barrier to effective communication?
(a) Physical barrier (b) Linguistic barrier
(c) Interpersonal barrier (d) Subjective barrier

Q7. It is a word used in place of noun that is _____.
(a) Adverb (b) Verb
(c) Pronoun (d) Preposition

Q8. A word used to express emotion and is often followed by an exclamation mark is called _____.
(a) Preposition (b) Conjunction
(c) Interjection (d) Adverb

Q9. _____ is an instance of non-verbal communication.
(a) A speech (b) Proximity
(c) A notice (d) An e-mail

Q10. Which of the following is the process in which the receiver interprets and understands the message?
(a) Decoding (b) Encoding
(c) Feedback (d) None of these

Q11. Speaking louder to drown out the noise is a _____ barrier to communication.

(a) type of (b) factor causing a

(c) measure to overcome a (d) None of these

Q12. If we take into consideration both the viewpoints as well as the feelings of the receiver of a communication, which of the 7 C 's are we fulfilling?

(a) Clarity (b) Consideration

(c) Courtesy (d) Correctness

Q13. Remya travelled to Sweden from India to pursue her higher education. But she doesn't know how to speak Swedish (language of Sweden). Because of this, she was unable to find a part time job. This is an example of _____.

(a) Interpersonal barrier (b) Physical barrier

(c) Organizational barrier (d) Linguistic barrier

Q14. _____ is the final component in the process of communication as it defines the response given by the receiver to the sender.

(a) Response (b) Request

(c) Feedback (d) Notice

Q15. Assertion (A) Non-verbal communication is related to expression of feelings and emotions.

Reason (R) Body language is a kind of verbal communication.

(a) Both (A) and (R) are correct and (R) is correct explanation of (A)

(b) Both (A) and (R) are correct. But (R) is not correct explanation of (A).

(c) (A) is correct but (R) is incorrect

(d) (A) is incorrect but (R) is correct

Multiple Choice Questions (MCQs) - Answers:

1. b	2. a	3. a	4. c	5. b	6. d	7. c	8. c
9. b	10. a	11. c	12. c	13. d	14. c	15. c	

Short answer type questions:

Q1.Define verbal communication.

Answer:

Verbal communication means communication through spoken and written words. It implies use of words which make up a language.

Q2.What do you understand by feedback?

Answer:

It is the receiver's response to the message, which enables the sender to evaluate the effectiveness of the message sent.

Q3. Describe the term descriptive feedback.

Answer:

Descriptive feedback can be written, oral or may even be the response of students to a question while they are working. It is relevant to the task students are performing and allows them to re-focus and improve their mastery of the subject. This form of feedback is most suited to teacher-student interactions when the students are attending a course taught by the teacher.

Q4. Which measures must be adopted to overcome the factors causing communication barriers?

Answer:

Some measures must be adopted to overcome the factors causing communication barriers and these include:

- Be prepared before communicating the message to the receiver.
- The message should not be communicated fast so sufficient time must be taken to communicate the message correctly to the receiver.
- It is better to use simplified language with easily understood words and simple ideas.
- There should be mutual respect for each other by the sender and the receiver for a message to be successfully communicated.

Q5. Explain the principle of conciseness and correctness in detail.

Answer:

Conciseness: It means communicating what you want to convey in the least possible words so that there are no unnecessary bits of information in it. A concise communication is both time-saving as well as cost-saving. It highlights the main message, thus making it more appealing and

comprehensible to the audience.

Correctness: It implies that there are no grammatical, spelling or punctuation errors in the communication being sent. The message should also be sent at the correct time. A correct message has a greater impact on the receiver if the facts and figures mentioned in the communication are also accurate and true.

Q6. What are the various methods of communication? Describe them in one sentence each with examples.

Answer:

The various methods of communication are:

- Verbal: This is communication through spoken and written words such as making sounds, using language and changing tone of voice etc.
- Non-verbal: It consists of various non-verbal cues such as physical movements, gestures, colours, signs, symbols, body language etc., to express feelings, attitudes or information.
- Visual: It conveys ideas and information in forms that can be seen, such as facial expressions, personal appearance, gesture, posture, printed picture, sign, signal, symbol, map, poster etc.

Q7. In a communication cycle, explain the term 'medium'. What problems may the medium create and how?

Answer:

In a communication cycle, the term 'medium' means the channel through which the message is sent.

Some messages are more effective if sent through the medium of being in written form, others may be more effective if given verbally on the telephone, while some others may be more effective if sent via the electronic media such as e-mail. The medium may create a problem such as noise, which may interfere with the communication.

The noise introduced may cause misunderstanding of the message or even disrupt the message completely so that it is not even received.

Q8. Describe the three types of barriers to communication in one sentence each with examples.

Answer:

The three types of barriers to communication are:

- Physical: These are environmental factors which prevent or reduce the sending and receiving of communications, such as physical distance, distracting noises and similar interferences.

- Personal: These cause a psychological distance between people similar to the physical distance, as they include judgments, emotions and social values of people, which change or distort the communication.
- Semantic: These barriers refer to symbols or visuals used in the message, such as those related to languages, pictures and actions.

Q9. Which principle of effective communication is covered by the five question method? List three aspects of this principle which need to be covered by these questions.

Answer:

The communication principle of 'Completeness' is covered by the five question method. Three aspects of this principle which need to be covered by these questions are:

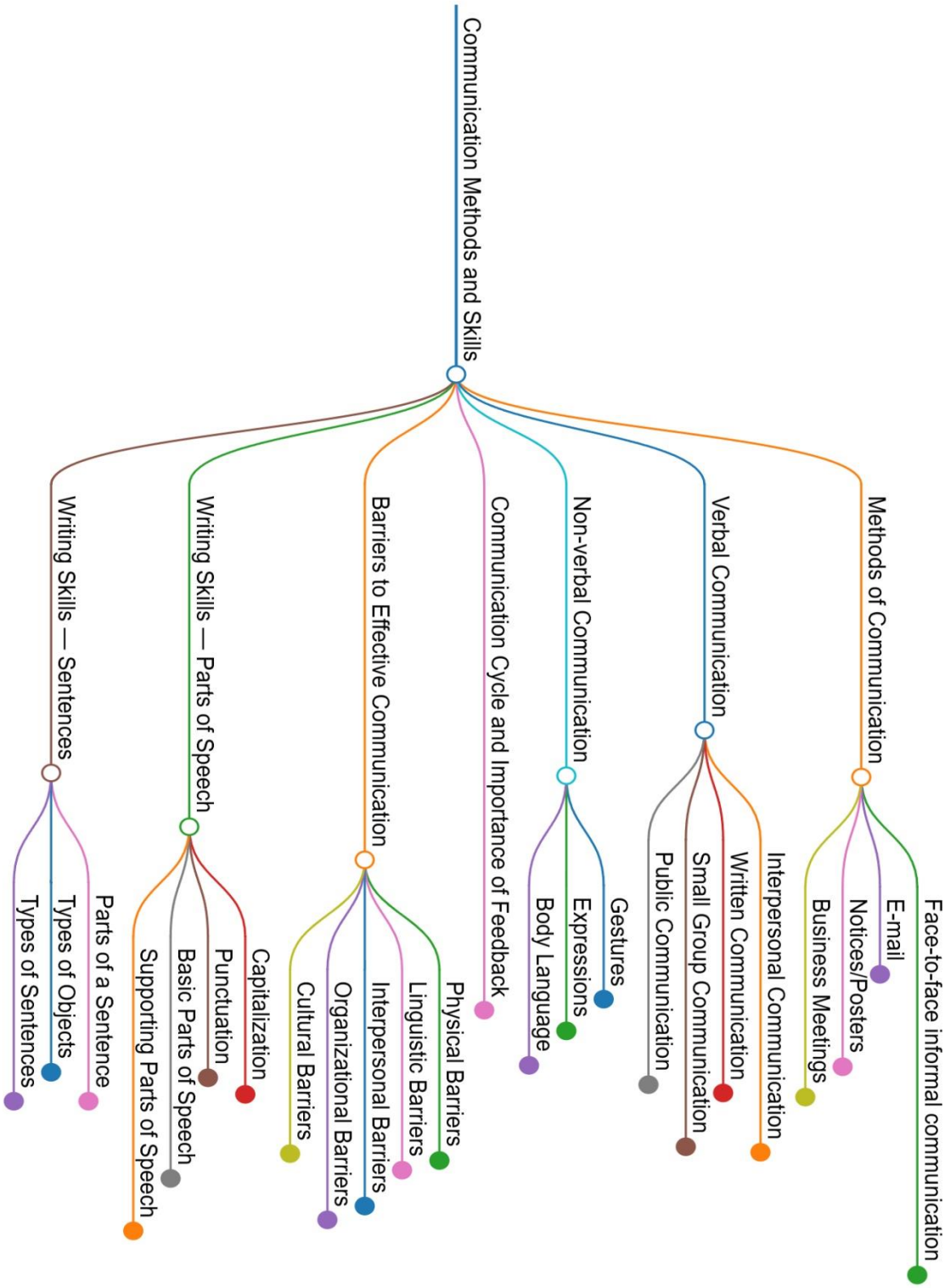
- The message should convey all the information required by the receiver.
- Nothing which may be required by the receiver should be left out of the message.
- The sender of the message must take into consideration the requirements of the receiver while making the message.

Q10. List the best practices for effective communication.

Answer:

- Use simple language
- Be respectful of others' opinions
- Do not form assumptions on culture, religion or geography
- Try to communicate in person as much as possible
- Use visuals
- Take help from a translator to overcome differences in language.

MIND MAP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Parts of a Sentence
Types of Objects
Types of Sentences

Unit II - Self Management Skills II

Learning Outcomes

- Apply stress management techniques
- Demonstrate the ability to work independently

Main points

What is Self – Management?

Self-management, also referred to as 'self-control,' is the ability to control one's emotions, thoughts and behaviour effectively in different situations. This also includes motivating oneself, and setting goals. People with strong self-management skills are better in doing certain things better than others.

Following are some of the skills you must master to succeed in life:

- ✓ Self-awareness
- ✓ Responsibility
- ✓ Time Management
- ✓ Adaptability

Importance of Self-Management:

- Self-sufficient and independent
- Ownership and accountability lead to self-confident
- Goal-oriented and strategy maker
- Self-monitoring and discipline reinforce good habits and behaviours
- Organise life and remove **stress**

What is Stress?

Stress can be defined as our emotional, mental, physical and social reaction to any perceived demands or threats. These demands or threats are called stressors. Stressors are the reason for stress.

Always keep in mind the ABC of stress management

A: Adversity or the stressful event

B: Beliefs or the way you respond to the event

C: Consequences or actions and outcomes of the event

Three Steps to Manage Stress

- **Step 1: Be aware that you are stressed** : Look out for signs of stress, such as headache, sleeplessness, sadness, excessive worrying, nervousness, etc

- **Step 2: Identify what is causing you stress:** Find out the reason for your stress. Is it because of exams, family pressures, money issues, not eating good food, etc.?
- **Step 3: Apply stress management methods:** Use time management tools to manage your time well. Focus on the important tasks and get them done.

Here are a few simple stress management techniques.

- ✓ **Time management:** Proper time management is one of the most effective stress-relieving techniques.
- ✓ **Physical exercise and fresh air:** A healthy lifestyle is essential for students. Stress is generally lower in people who maintain a healthy routine. Doing yoga, meditation and deep breathing exercises help in proper blood circulation and relaxes the body.
- ✓ **Healthy diet:** Having a healthy diet will also help you reduce stress. Eating a balanced diet, such as Dal, Roti, vegetables and fruits will give you the strength to do your daily work efficiently.
- ✓ **Positivity:** Focussing on negative aspects of life will add more stress. Instead, learn to look at the good things and stay positive.
- ✓ **Organising academic life; no delaying:** By keeping class notes organised, finishing in assignments on time, and keeping track of all deadlines, stress can be reduced to a great extent.
- ✓ **Sleep:** We should get a good night's sleep for at least 7 hours so that your brain and body gets recharged to function better the next day.
- ✓ **Holidays with family and friends:** Going to a relative's place, such as your grandparents' house or a new place during your summer vacations can help you break from the normal routine and come back afresh

Stress management can help you to

- Have a joyful life.
- Focus and complete tasks on time.
- Be a happy person as you are stress free.
- Be more energetic and spend quality time with your friends and family.

Ability to Work Independently

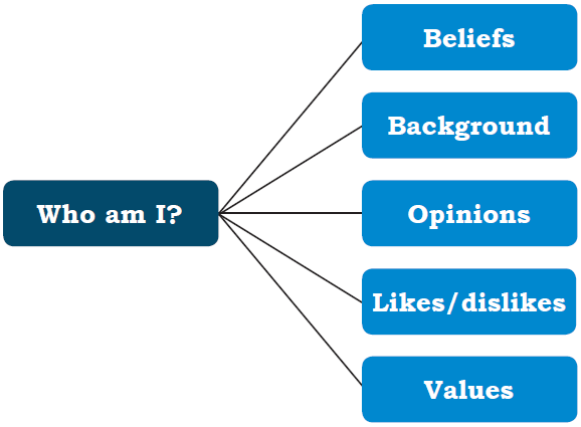
If you can become a calm and relaxed person, you will be have the ability to work independently, which means.

- Becoming self-aware, self-monitoring and self-correcting.
- Knowing what you need to do.
- Taking the initiative rather than being told what to do.
- Recognising your mistakes and not blaming others.
- Having the ability and the will to learn continuously

Self-Awareness

Being self-aware means that you can identify your strengths and weaknesses

Know Yourself: Belief, Background, Opinion, Choice, Values



Realising Strength and Weakness:

- Identify skills, abilities, interests, what you are good at and successful
- Identify shortcomings, apathies, where you face difficulty and defeat
- Consider honest feedback from others
- Continue practising skills
- Overcome weakness and improvise

Self-motivation

Self-motivation is simply the force within you that drives you to do things. Self-motivation is what pushes us to achieve our goals, feel happy and improve our quality of life.

Types of Motivation

- ***Internal Motivation (LOVE):*** We do things because they make us happy, healthy and feel good.
- ***External Motivation(REWARD) :*** We do things because they give us respect, recognition and appreciation

Qualities of Self-Motivated People:

- Aware of expectations from life
- Focused towards goal
- Aware of importance of things
- Dedicated to fulfil dream

Know what they want from life

Are focussed

Know what is important

Are dedicated to fulfill their dreams

Self-regulation

Self-regulation is the ability to manage your thoughts, emotions, and behaviours in ways that help you **achieve goals**, stay aligned with your values, and adapt to different situations.

Goal setting is a very essential factor in your personal life. The process of goal setting in your life helps you decide on how to live your life, where you want to be, and how you want to be in the future. It is all about finding and listing your goals and then planning on how to achieve them

Goals: They are a set of dreams with a deadline to get them, for example, saving pocket money to buy a favourite mobile phone by a particular date.

How to Set Goals?

We can use **SMART** method to set goals. SMART stands for

- **Specific**: A specific and clear goal answers six questions.
  1. **Who** is involved in the goal?
  2. **What** do I want to do?
  3. **Where** do I start?
  4. **When** do I start and finish?
  5. **Which** means do I use?
  6. **Why** am I doing this?
- **Measureable** : A measureable goal answers the questions

- “How much?”,
- “How many?” and
- “How do I know that I have achieved results?”

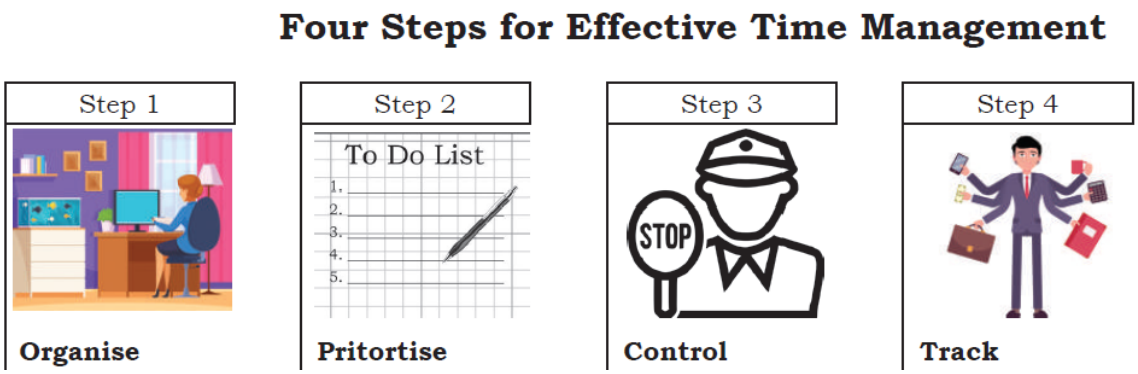
- **Achievable** : Breaking down big goals into smaller parts will make the goal achievable
- **Realistic**: A realistic goal would be something that we want to achieve and can work towards.
- **Time bound:** A SMART goal should have a timeframe by when the goal needs to be achieved.

Self-regulation — Time Management

Time management is the ability to plan and control how you spend the hours of your day well and do all that you want to do.

Time management is the thinking skill that helps you to

- Complete tasks on time.
- Make a daily timetable.
- Make a good guess at how long it will take you to do something.
- Submit homework and assignments on time.
- Not waste time during the day.



Four Steps for Effective Time Management

1. **Organise:** We plan our day to- day activities.
2. **Prioritise:** We make a to-do list that has all our activities and we rank them in the order of importance.
3. **Control**: We have a control over our activities and time.
4. **Track:** We identify and note where we have spent our time.

Multiple Choice Questions (MCQs)

Q1. Parvathi gets up at 4.30 am and goes to her badminton classes. Then she comes home and finishes her homework before going to school. She does this all

by herself. No one tells her to do it. This is an example of

a) Self-motivation
b) External motivation
c) Both self and external motivation
d) Not any specific type of motivation

Q2. Which of the following can cause stress?

a) Yoga and meditation b) Driving during rush hour
c) Organized academic life d) Enjoying holidays with family

Q3. _____ is a series of postures and breathing exercises practiced to achieve control of body and mind.

a) Meditation b) Nature Walk c) Yoga d) Physical Exercise

Q4._____ is not the quality of self-confident people.

a) Dependent b) Hard Working
b) Positive Attitude d) Commitment

Q5. _____ability of a person to do the things that need to be done without someone or something influencing us.

a) Self-Motivation b) Self Discipline
c) Self Awareness d)Self-Regulation

Q6. Deepika is always tense during exam time. She is a sincere and studious student, but the thought of exams creates anxiety in her. Which stress management technique that you would suggest to help her?

a) Yoga b) Exercise c) Vacation with Family d)All of these

Q7. Gokul participated in a 100m race and won a prize. What type of motivation is this?

a) Internal b) External c) Both Internal and External d)None of these

Q8.Manoj is able to control his emotions, thoughts and behaviour effectively in different situations. Identify his skill.

a) Stress management. b) Self-control. c) Self-awareness. d)None of these

Q9. At the mental level which symptoms may reflect stress

a) Irritation b) Impatience c) Loneliness d) All of these

Q10. _____ refers to focusing human efforts for maintaining a healthy body and mind capable of better withstanding stressful situations.

a) Self-Motivation b) Stress Management
c) Self-Awareness d)Self-Regulation

Q11.High expectations from self can leave with chronic anxiety and stress, thus leading to _____ stress.

a) Physical b) Emotional c) Mental d) Financial

Q12. 'Prepare yourself for new changes, so that you can transition seamlessly'. Which term can you relate the given sentence to?

a) Self-awareness b)Responsibility
c) Adaptability d) Time-management

Q13. _____ the work is all about identifying and noting how we spent our time, and analysing how to spend our time effectively.

a) Organising b) Prioritising c) Controlling d)Tracking

Q14. What are the ABC of Stress Management?

a) Avertible, Belief, Consequences
b) Adversarial, Being, Control
c) Adversity, Belief, Consequences
d) Adversity, Belief, Control

Q15. Which ancient practice includes a series of postures and breathing exercises practiced to achieve control of body and mind ?

a) Meditation b)Physical Exercise
c) Listening music d) Yoga

ANSWER KEY

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
a	b	c	a	a	d	b	b
Q9	Q10	Q11	Q12	Q13	Q14	Q15	
d	b	c	c	d	c	d	

Short Answer Questions (2 Marks)

Q1. What is the importance of setting goals in life?

Answer

1. The process of goal setting in your life helps you decide on how to live your life, where you want to be, and how you want to be in the future.
2. It helps you to focus on the end result instead of less important work.
3. This will make you successful in your career and personal life.

Q2. In SMART goals, what does 'R' stand for? Explain.

Answer

'R' stands for Realistic. A realistic goal would be something that we want to achieve and can work towards. For example, "I spend 3 hours every day of the year after school to revise my subjects to get good marks in the exams."

Q3. How is self-regulation connected to the ability to work independently?

Answer

The ability to work independently can be enhanced by being self-regulated. Self-regulation guides independent individuals as it help them to consider long term consequences rather than just transient feelings. It leads to a responsible and a value driven behaviour. It teaches self-control and well-directed efforts to reach the goal. Self-regulated includes discipline that helps in consistent efforts to move towards the goal

Q4. Stress management can help someone in following ways: (any two)

Answer

i. He/she can have a joyful life
ii. He/she can focus and complete tasks on time
iii. He/she can be a happy person as he/ she is stress free.
iv. He/ she can be more energetic and spend quality time with your friends and family

Q5. State any two recreational activities which can help individuals transcend to a happier mental state and help manage stress.

Answer

Recreational activities like watching movies, attending concerts, playing games, involving in adventure sports, singing, dancing or even sketching can help individuals transcend to a Happier mental state and help manage stress

Q6. M have to perform his best in the next cricket match so to get a chance to play for his school at the national level cricket tournament. He have been anxious (worried or stressed) for the upcoming match Give him any two benefits of stress

management which makes it vital for him to perform.

Answer

- Improves mood
- Boosts immune system
- Promotes longevity
- Leads to burst of physical strength, which is vital for goal achievement
- Complete mental and physical engagement for task accomplishment
- Increases efficiency and effectiveness
- Prevents psychological disorders and behavioral problems

Q7. All people look forward to vacations for de-stressing and rejuvenation. State any other two ways by which people can manage stress Ways for stress management (any two):

Answer

i. **Physical exercise** -Physical exercise in the form of walking, skipping or any sports relieves stress by stabilizing mood, improving self -esteem and inducing sleep.

ii. **Yoga** - Yoga includes a series of postures and breathing exercises practiced to achieve control of body and mind.

iii. **Meditation** – By meditation, an individual is able to focus his/her mind to achieve a calm mental state reducing stress.

iv. **Enjoying** -Recreational activities such as watching movies, attending concerts, playing games singing, dancing, sketching etc help individuals transcend to a happier mental state and help manage stress.

Q8. What is self-motivation?

Answer

Self-motivation is simply the force within you that drives you to do things. Self-motivation is what pushes us to achieve our goals, feel happy and improve our quality of life. In other words, it is our ability to do the things that need to be done without someone or something influencing us

Q9. Enlist any two advantages of stress management. Stress management can help someone in following ways: (any two)

Answer

i. He/she can have a joyful life
ii. He/she can focus and complete tasks on time

Q10. What is the importance of self-awareness in analyzing strengths and weaknesses?

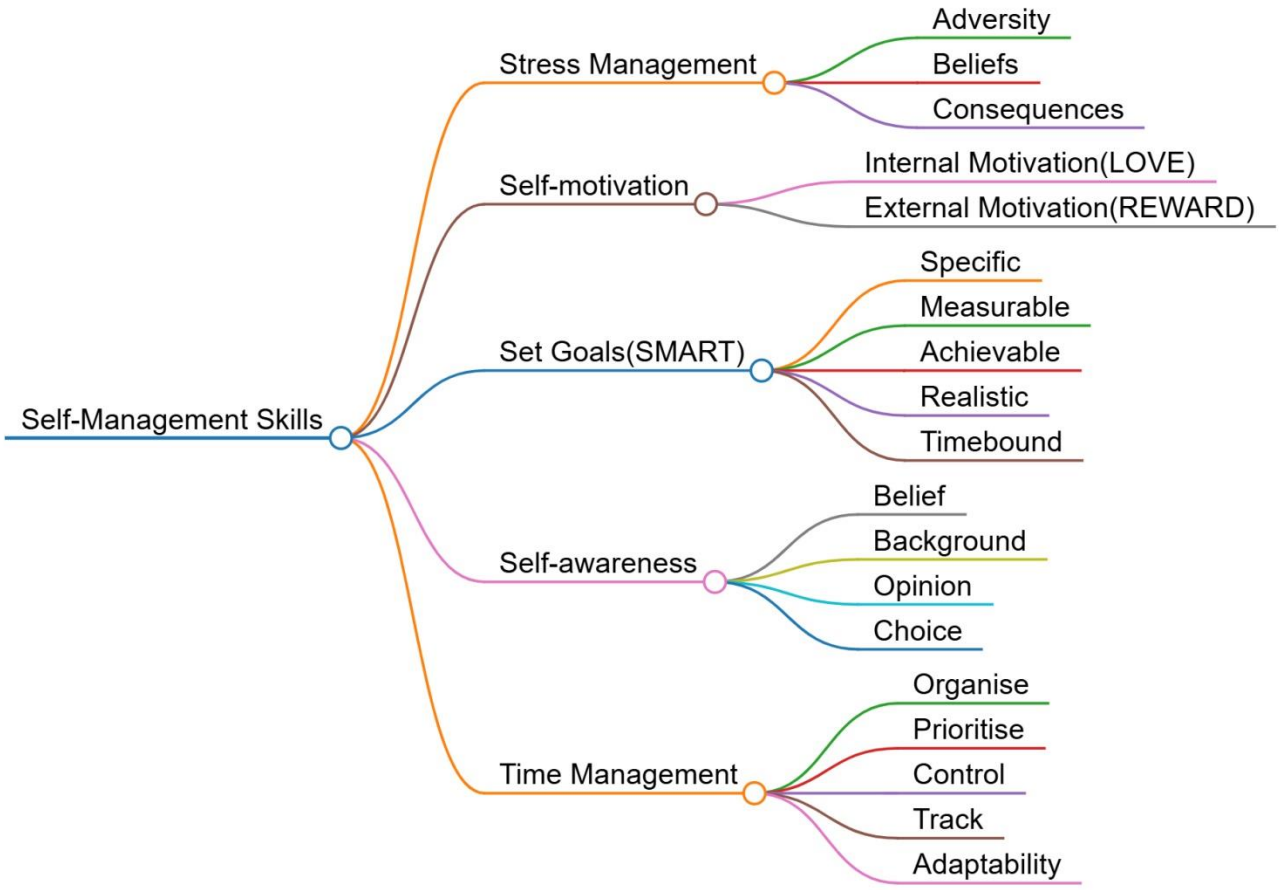
Answer

Self-awareness is crucial in analyzing strengths and weaknesses because it allows individuals to identify their inner strengths, hidden talents, skills, and weaknesses. Understanding one's preferences, beliefs, and abilities helps in measuring and converting weaknesses into strengths and strengths into exceptional talents, ultimately leading to personal and professional success.

Activity

1. Exercises on stress management techniques – yoga, meditation, physical exercises during physical education period/Yoga period
2. Preparing a write-up on an essay on experiences during a holiday trip during this summer vacation
3. Demonstration on working independently and explain any situation you have worked independently
4. Group discussion on setting goals and plan a talk show
5. Demonstration on the qualities required for working independent. Ask ambition of each child and plan a role play activity.

MIND MAP


Self-Management Skills
Stress Management
Adversity
Beliefs
Consequences
Self-motivation
Internal Motivation(LOVE)
External Motivation(REWARD)
Set Goals(SMART)
Specific
Measurable
Achievable
Realistic
Timebound
Self-awareness
Belief
Background
Opinion
Choice
Time Management
Organise
Prioritise
Control
Track
Adaptability

UNIT 3

Information and Communication Technology Skills – II

Learning Outcomes

- Distinguish between different operating systems
- Apply basic skills for care and maintenance of computer

Main points:

The Significance of Developing ICT Proficiency

Gaining and improving **ICT (Information and Communication Technology)** skills is vital for **efficient communication**, **smooth business processes**, and staying **connected with others**. As technology rapidly evolves, it becomes imperative for individuals to **consistently update their skills** to adapt to new **applications** and **software tools**.

Components of a Computer System

A computer consists of two main categories:

- **Hardware**: These are the **tangible** elements like the **monitor**, **keyboard**, and **CPU** that you can physically interact with.
- **Software**: These are **intangible** elements that allow the hardware to operate.

Operating System (OS)

The **OS acts as a bridge** between the user and computer, managing resources and executing programs. It performs several **critical roles**:

1. Monitors hardware and its usage.
2. Ensures smooth functioning of hardware components.
3. Manages software applications.
4. Allocates and monitors memory usage for each task.
5. Organizes system files and folders.
6. Keeps track of disk usage.
7. Facilitates **file operations** like creating, copying, moving, and deleting files.

Types of Operating Systems

- **Single-user, single-task OS**: Handles one task by a single user at a time.
- **Single-user, multi-task OS**: Common in laptops and desktops; allows multiple applications to run concurrently (e.g., **Windows**, **macOS**).
- **Multi-user OS**: Supports multiple users on the same system, simultaneously or sequentially.
- **Real-time OS**: Designed for **time-sensitive operations** (e.g., **Lynx OS**, **Windows CE**).
- **Distributed OS**: Connects multiple computers over a network to function as one system (e.g., **UNIX**, **Linux**, **Windows**).
- **GUI-based (Graphical User Interface) OS**: Enables interaction through mouse clicks and visuals, like **Windows**.

Understanding Windows Desktop Elements

- **Taskbar**: Located at the screen's bottom, containing the **Start button** on the left and **time/date** on the right, along with shortcut icons.
- **Start Button**: Gives access to various programs and system settings.
- **Recycle Bin**: Temporarily stores deleted files and folders for recovery before permanent deletion.

Managing Files and Folders

- **File**: A unit of data saved on the computer.
- **Folder**: A container to organize files and even other folders (**subfolders**).

Creating a File:

1. Right-click in an empty area.
2. Select **New > File type** (e.g., Text Document, Word).

Renaming:

- Right-click > **Rename**, or
- Select and press **F2**.

Creating a Folder:

1. Open "This PC" or "Computer".
2. Choose the drive (e.g., Local Disk D:).
3. Click **New Folder** on the toolbar.
4. Enter a name when prompted.

Deleting:

- Select file/folder > Press **Delete**, or
- Right-click > Choose **Delete**.

Essential Keyboard Shortcuts

- **CTRL + Z** – Undo
- **CTRL + Y** – Redo
- **CTRL + A** – Select All
- **CTRL + X** – Cut
- **CTRL + C** – Copy
- **CTRL + V** – Paste
- **CTRL + P** – Print
- **CTRL + S** – Save

Basic Computer Care and Maintenance

Regular upkeep ensures that the system runs smoothly and lasts longer.

General Tips:

1. **Keep the system clean** and dust-free.
2. **Avoid eating/drinking** near the computer.
3. Wash hands before using peripherals.
4. Store **CDs/DVDs** properly.
5. Use a **cover for the keyboard** when not in use.

Cleaning Hardware Components

- **Turn off the system** before cleaning.
- Never spray liquid directly—**apply it on a cloth** first.
- Use **anti-static tools** to prevent damage.

Specific Components:

- **Monitor**: Use soft, lint-free cloth and avoid liquid contact with seams.
- **Keyboard**: Shake gently upside down to remove debris.
- **Mouse**: Clean the lens and surface with a dry cloth or air.
- **CD/DVDs**: Clean in a circular motion from center outward.

Maintenance Schedule

Daily:

- Organize emails.
- Download and store attachments properly.

Weekly:

- Clean keyboard and monitor.
- Dust CPU and printer.
- Backup data to external drive.

Monthly:

- Transfer and organize photos.
- Clean the 'Downloads' folder.

- Uninstall unused apps.
- Run virus and disk cleanup scans.

Yearly:

- Update OS and antivirus.
- Clean up contact lists.
- Check hardware for replacements.

Backup and Recovery

- Back up essential data to **CD/DVDs**, **external drives**, or **cloud**.
- Regular backups ensure **data safety** during crashes or disasters.

System Optimization

- Clean **temporary files** (use **%temp%** via Windows + R).
- Remove **unwanted emails and SPAM**.
- Uninstall unnecessary programs.
- Limit background apps for better speed.

Threats to Computer Systems

- **Physical Theft**: Hardware stolen.
- **Identity Theft**: Personal data is misused.
- **Software Piracy**: Unauthorized software usage.
- **Virus**: Damages or steals data.

Types of Viruses:

- **Worms**: Self-replicating and widespread.
- **Trojan Horse**: Disguised as helpful but is destructive.

Cybersecurity Measures

- Use **strong passwords** with a mix of characters.
- **Install antivirus** and **firewalls**.
- **Encrypt data** using tools like **BitLocker**.
- Use **HTTPS websites** for safe transactions.

Online Safety Risks

- **Online Predators**: Pretend to be friends to manipulate or exploit.
- **Internet Scams**: Fake lottery wins or offers to steal money and data.

Multiple Choice Questions

Q1. **Which of the following is an example of system software?**

a) MS Excel b) Windows 10

a. c) Adobe Photoshop d) VLC Player

Q2. **What is the shortcut key to paste copied content?**

a) Ctrl + C b) Ctrl + V c) Ctrl + X d) Ctrl + Z

Q3. **The Recycle Bin in Windows stores deleted files for how long?**

a) Permanently deletes instantly b) Stores temporarily until emptied c) Stores for 30 days only d) None of the above

Q4. **What does an operating system do?**

a) Manages hardware and software resources b) Helps to create documents c) Provides antivirus protection d) Manages internet speed

Q5. **Which of the following is NOT an operating system?**

a) Windows b) Linux c) Microsoft Word d) macOS

Q6. **Which key combination is used to undo the last action?**

a) Ctrl + Y b) Ctrl + Z c) Ctrl + S d) Ctrl + A

Q7. **Which of the following protects a computer from unauthorized access?**

a) Firewall b) Keyboard c) Printer d) Operating system

Q8. **What does Ctrl + S do in most applications?**

a) Save the file b) Select all content c) Close the application d) Open a new window

Q9. **Which of the following is an example of application software?**

a) Linux b) MS Word c) BIOS d) Windows 10

Q10. **What is the purpose of creating backups?**

a) To improve system speed b) To recover lost data c) To upgrade software d) To delete unwanted files

Q11. **Which key combination is used to copy selected text or files?**

a) Ctrl + C b) Ctrl + V c) Ctrl + X d) Ctrl + P

Q12. **Which of the following is NOT a preventive maintenance practice?**

a) Keeping software updated b) Using antivirus software c) Eating food near the computer d) Cleaning hardware regularly

Q13. **Which hardware component is used for input?**

a) Monitor b) Keyboard c) Speaker d) Printer

Q14. **What is the function of the Start button in Windows?**

a) Shuts down the computer b) Opens the Start menu c) Minimizes all windows d) Opens Control Panel

Q15. **Which key combination is used to cut selected content?**

a) Ctrl + X b) Ctrl + C c) Ctrl + V d) Ctrl + A

Answer Key

1	2	3	4	5	6	7	8	9	10
b	b	b	a	c	b	a	a	b	b
11	12	13	14	15					
a	c	b	b	a					

Short Answer Type Questions (2 Marks)

Q1. What is an operating system? Give two examples.
Answer: An operating system (OS) is software that manages computer hardware and software resources and provides common services for computer programs. Examples: Windows, Linux.

Q2. Explain the function of the Recycle Bin in Windows.
Answer: The Recycle Bin temporarily stores deleted files and folders, allowing users to restore accidentally deleted items or permanently delete them later.

Q3. Name any two preventive maintenance practices for a computer.
Answer: Regularly updating antivirus software to protect against malware.
Cleaning hardware components like keyboard and CPU to avoid dust buildup
.

Q4. What are system software and application software? Give one example each.
Answer: System software helps run the computer hardware and system (e.g., Operating System like Windows).
Application software performs specific tasks for users (e.g., Microsoft Word).

Q5. Why is it important to create backups of data?
Answer: Backups prevent data loss due to accidental deletion, hardware failure, or virus attacks by keeping copies of important files in a safe place.

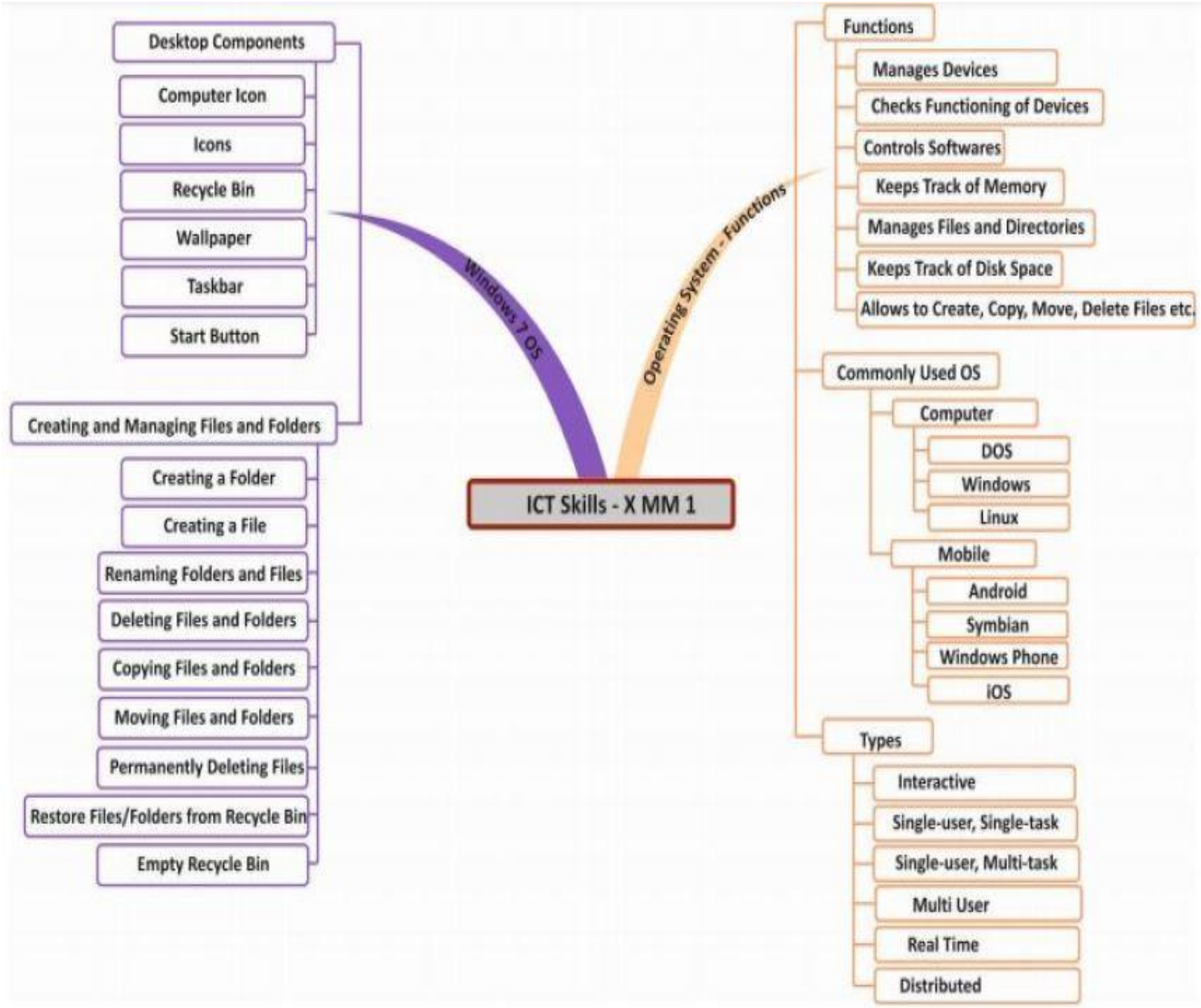
Q6. What is the shortcut key to save a file? Explain its use.
Answer: The shortcut key to save a file is Ctrl + S. It quickly saves the current document or file without needing to use the mouse or menu options.

Q7. Explain the function of a firewall in computer security.
Answer: A firewall acts as a security barrier between a trusted network and untrusted networks, blocking unauthorized access and protecting the computer from malicious attacks.

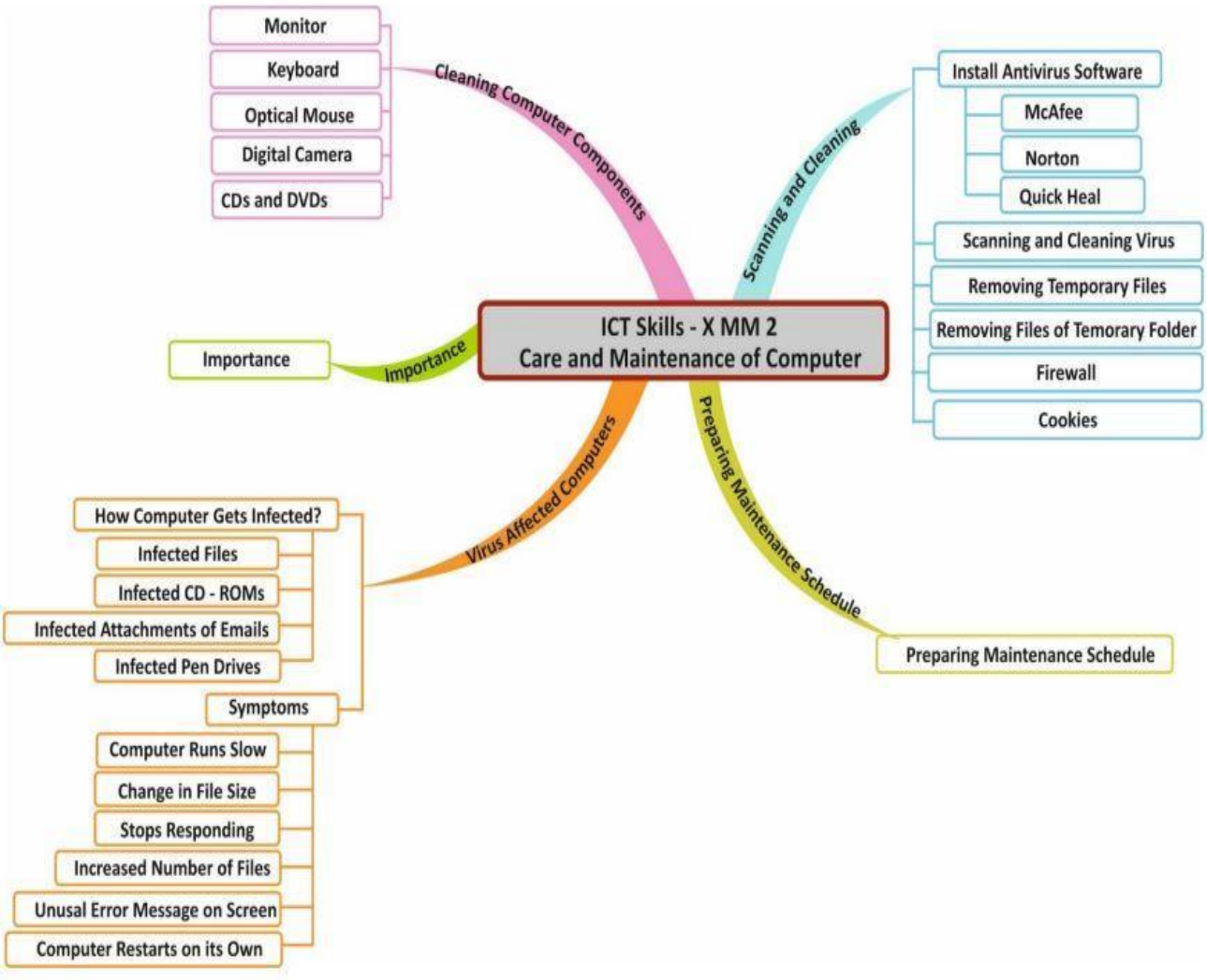
Q8. Describe two functions of the Start menu in Windows.
Answer: Provides quick access to installed programs and applications.
Allows users to search files, settings, and access system features.
Q9. What is the difference between 'Cut' and 'Copy' commands?
Answer: Cut removes the selected content from its original place and moves it to the clipboard.
Copy duplicates the selected content without removing it and stores it in the clipboard.

Q10. List any two hardware components used for input and output.
Answer: Input hardware: Keyboard, Mouse Output hardware: Monitor, Printer

ICT SKILLS -II MIND MAP-1



ICT SKILLS -II MIND MAP-2



UNIT 4 Entrepreneurial Skills- II

Learning Outcomes

- List the characteristics of successful entrepreneur
- Demonstrate the knowledge of importance, problems and solutions related to sustainable development

Main Points

Topic 1: Entrepreneurship and Society

➢ **How Entrepreneurs Help Society**

1. **Fulfil Customer Needs**
   They create **useful products/services** based on what people **need or want**.
2. **Use Local Resources**
   They use **local materials and workers**, which **saves cost** and supports the **local economy**.
3. **Create Jobs**
   As business grows, they **hire more people**, providing **employment**.
4. **Lower Prices**
   Competition among businesses **reduces product prices**.
5. **Better Living**
   New and affordable products **improve lifestyle**.
6. **Boost Economy**
   Business growth leads to **more income** and **nation's development**.

Topic 2: Qualities and Functions of an Entrepreneur

➢ **Qualities of a Good Entrepreneur**

- **Confidence**: They believe in their ideas and stick to them even when times are tough.
- **Innovative Thinking**: They come up with **new and smart ideas** that can change the way businesses work.
- **Creativity**: They try to find **better solutions** and improve products or services.
- **Patience**: They don't expect success overnight. They wait and keep trying.
- **Perseverance**: They **don't quit** when things get hard; they keep going.
- **Responsibility**: They **own their work** and make sure the business runs well.

- **Leadership**: They guide the team and **set goals** for the business.
- **Hard Work**: They put in **a lot of effort**, especially at the start.
- **Risk-taking**: They are ready to **take risks**, but only after thinking things through.
- **Never Give Up Attitude**: They keep trying even when they fail.

❖ **<u>What Entrepreneurs Do (Functions)</u>**

- **Make Decisions**: They make all kinds of decisions—**technical, managerial, and strategic**.
- **Run the Business**: They **plan and manage** everything to keep the business going.
- **Handle Money**: They take care of payments, salaries, and business expenses.
- **Take Risks**: They take **calculated risks** after thinking about the possible rewards and losses.
- **Bring New Ideas**: They launch **new products or services** that can shake up the market.

Topic 3: Myths About Entrepreneurship

➢ **Common Misconceptions (False Beliefs)**

1. **"The idea must be unique"**

   Not true! Even a common idea can work if you **do something differently**.

   Example: inDrive allowed users to **negotiate fares** unlike Ola/Uber.

2. **"You need lots of money to start a business"**

   Some businesses start with **small capital**.

   Example: *Bittoo Tikki Wala* began on the street and grew by using profits.

3. **"Only big businesses count"**

   Not true. Even a **small business** owner is an entrepreneur.

4. **"Entrepreneurs are born, not made"**

   Wrong! **Entrepreneurship can be learned** and developed with practice and training.

Topic 4: Entrepreneurship as a Career Option

- **Steps in the Entrepreneurial Journey**

1. **Entry Stage**: When the person **starts the business**.
2. **Survival Stage**: Competing in the **market to stay in business**.
3. **Growth Stage**: Expanding the business after it becomes stable.

Why Choose Entrepreneurship? (Advantages)

- **Freedom**: You're **your own boss**.
- **Satisfaction**: You can **follow your dreams**.
- **Wealth Creation**: You help the **economy grow** and earn profits.
- **Work-Life Balance**: You can **decide your own schedule**.

Challenges in Entrepreneurship (Disadvantages)

- **Risk**: You use your **own money and time**.
- **Workload**: It requires **a lot of effort** to start and run.
- **Difficulties**: You might have to face **stress, late nights, and lack of funding**.
- **Uncertainty**: The **market, laws, and customer needs** may change suddenly.

Multiple Choice Questions (MCQs)

Q1. **Entrepreneurs contribute to society by —**

a) Generating employment b) Creating income and wealth
c) Improving standard of living d) All of the above

Q2. **Which of the following is a quality of an entrepreneur?**

a) Confidence b) Laziness
c) Indecisiveness d) Procrastination

Q3. **Entrepreneurs take —**

a) Uncalculated risk b) Calculated risk
c) No risk d) Random risk

Q4. **The money used to start a business is called —**

a) Loan b) Capital c) Income d) Profit

Q5. **Entrepreneurs are —**

a) Born, not made b) Made, not born
c) Both born and made d) None of the above

Q6. **Which of the following is not an entrepreneurial skill?**
a) Creativity b) Patience c) Laziness d) Hard work

Q7. **An example of a cooperative society in India is —**
a) Reliance b) Amul c) Tata d) Infosys

Q8. **The process of bringing new ideas to market is called —**
a) Innovation b) Imitation c) Investment d) Development

Q9. **The stage when an entrepreneur expands business after stabilizing is called —**
a) Entry b) Survival c) Growth d) Decline

Q10. **Which of the following is NOT a function of an entrepreneur?**
a) Managing the business b) Taking risks
c) Avoiding decisions d) Making decisions

Q11. **Entrepreneurs create jobs by —**
a) Selling products b) Hiring people as business grows
c) Ignoring market trends d) Avoiding competition

Q12. **What is the main reason entrepreneurs take calculated risks?**
a) To lose money b) To avoid responsibilities
c) To get good rewards d) To avoid work

Q13. **Which term means patience and continuing despite difficulties?**
a) Perseverance b) Laziness c) Hesitation d) Fear

Q14. **The type of decision that involves company policies is called —**
a) Technical Decision b) Managerial Decision
c) Strategic Decision d) Routine Decision

Q15. **Entrepreneurs improve the standard of living by —**
a) Making better products b) Increasing prices
c) Reducing work hours d) Avoiding competition

Answer Key

1	2	3	4	5	6	7	8	9	10
d	a	b	b	c	c	b	a	c	c
11	12	13	14	15					
b	c	a	c	a					

Short Answer Questions (2 Marks)

Q1: List any two qualities of a successful entrepreneur.

Answer: Two qualities of a successful entrepreneur are:

- Creativity: Ability to generate innovative ideas.
- Risk-taking: Willingness to take calculated risks.

Q2: Explain any two functions of an entrepreneur.

Answer: Two functions of an entrepreneur are:

- Innovation: Introducing new products or services.
- Organization: Assembling and coordinating resources effectively.

Q3: What is meant by 'risk-taking' in entrepreneurship?

Answer: Risk-taking in entrepreneurship refers to the willingness to undertake business ventures with uncertain outcomes, with the aim of achieving potential rewards.

Q4: Differentiate between 'innovation' and 'invention'.

Answer: Invention is the creation of a product or introduction of a process for the first time. Innovation is the improvement or significant contribution to an existing product, process, or service.

Q5: Mention any two benefits of being an entrepreneur.

Answer: Two benefits of being an entrepreneur are:

- Autonomy: Being your own boss.
- Financial rewards: Potential to earn profits from the business.

Q6: Explain the term 'self-motivation' in the context of entrepreneurship.

Answer: Self-motivation in entrepreneurship refers to the internal drive that propels an entrepreneur to initiate and sustain business activities without

external encouragement.

Q7: List any two sources from which an entrepreneur can generate business ideas.

Answer: Two sources for generating business ideas are:

- Market research: Understanding consumer needs.
- Observation: Noticing gaps in the market or inefficiencies.

Q8: What is meant by 'entrepreneurial attitude'?

Answer: Entrepreneurial attitude refers to a mindset that embraces innovation, risk-taking, and proactive problem-solving to achieve business objectives.

Q9: State any two challenges faced by entrepreneurs.

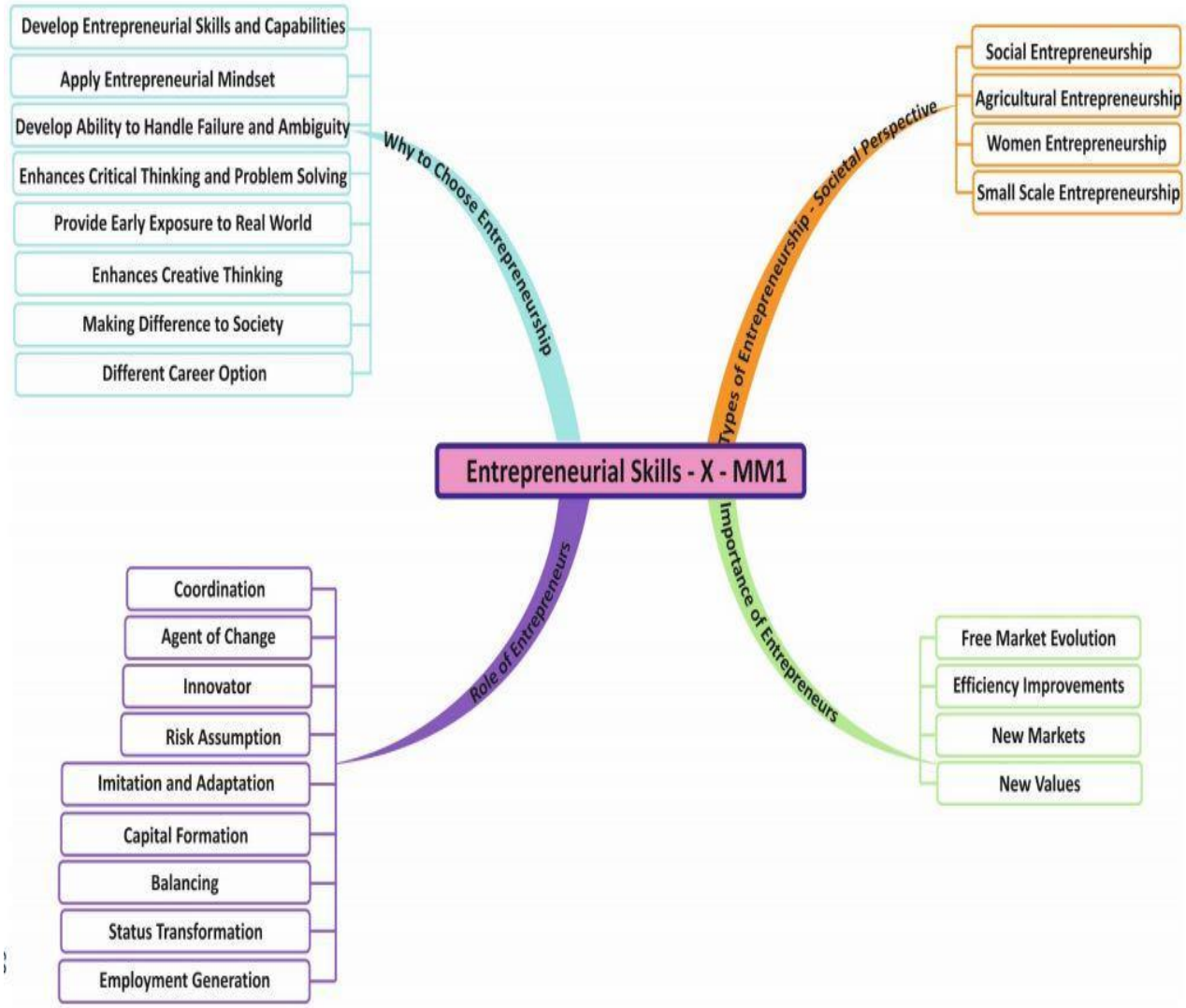
Answer: Two challenges faced by entrepreneurs are:

- Financial constraints: Difficulty in securing funding.
- Market competition: Facing established competitors in the market.

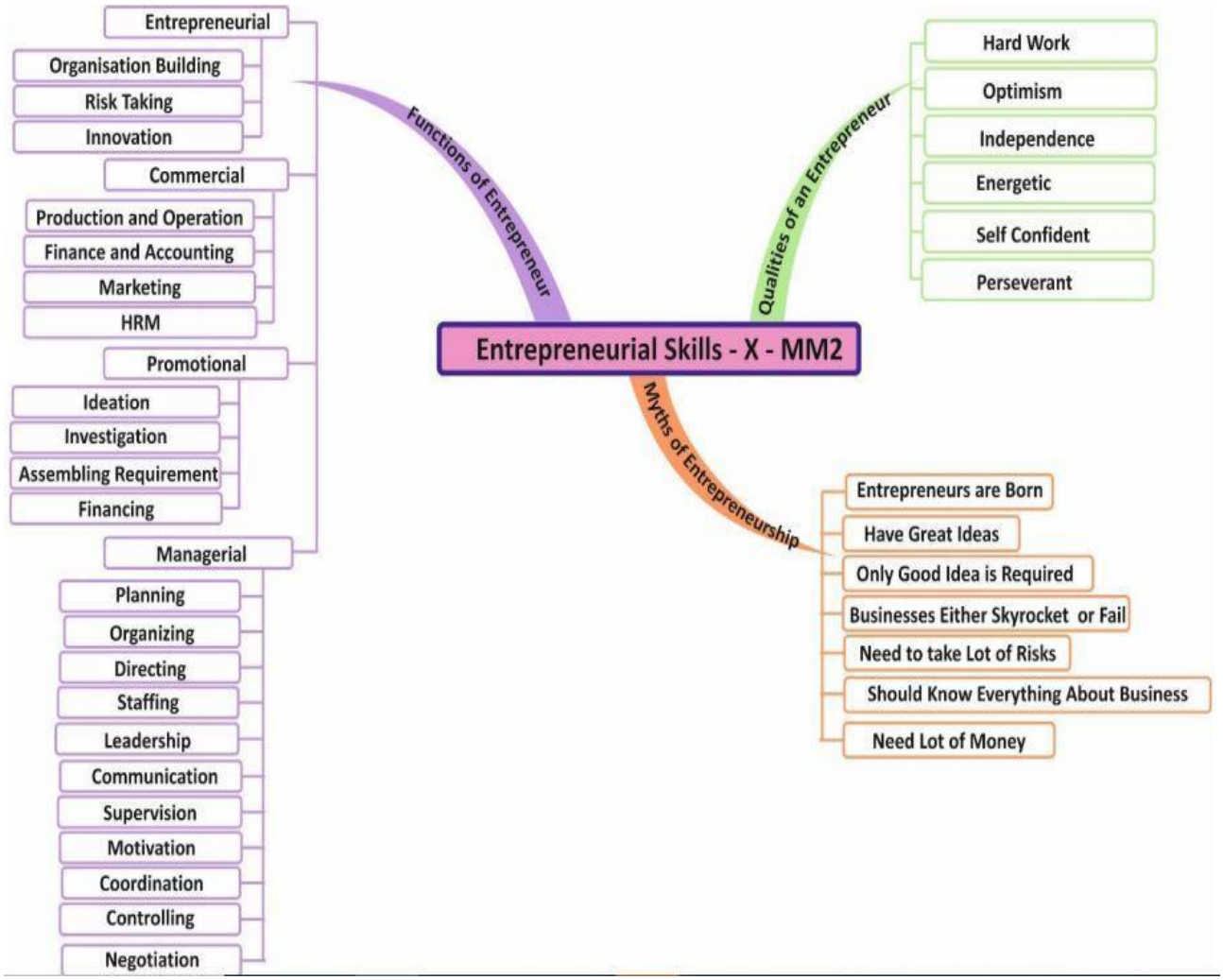
Q10: Define the term 'entrepreneur'.

Answer: An entrepreneur is an individual who identifies a need in the market, creates a business to fill that void, and assumes the risk and rewards of the venture.

Entrepreneurial Skills II Mind Map-1



Entrepreneurial Skills II Mind Map-2



UNIT 5 Green Skills – II

Learning Outcomes of Green Skills – II

- Demonstrate the knowledge of importance, problems and solutions related to sustainable development

Main points:

Session 1: Sustainable Development

What is Sustainable Development?

Sustainable Development means **growing and meeting our needs today** without harming the ability of **future generations** to meet their own needs.

Main Areas of Sustainable Development

- **Economic Growth:** Earning money and building resources.
- **Environmental Protection:** Saving nature and natural resources.
- **Social Well-being:** Helping everyone live a good and fair life.

Why is Sustainable Development Important?

- **Saves Natural Resources** so we don't run out of them.
- **Protects the Environment** by reducing pollution and damage.
- **Supports Future Generations** by keeping nature healthy for them.

What Problems Stop Sustainable Development?

- **Food Problems:** Soil losing nutrients due to chemicals.
- **Water Shortage:** Dirty water reduces clean water supply.
- **Energy Problems:** Using coal and oil harms the environment.

How Can We Promote Sustainability?

- **Use Resources Wisely:** Don't waste water, fuel, etc.
- **Waste Management:** Recycle and reuse instead of throwing away.
- **Use Renewable Energy:** Like **solar** and **wind energy**.
- **Plant Trees:** Helps keep the balance of nature.
- **Eco-friendly Farming:** Use natural fertilizers and avoid chemicals.

Sustainable Development Goals (SDGs) by the UN

There are 17 Global Goals made in 2015 to improve the world by 2030.

Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9
No Poverty	Zero Hunger	Good Health & Well-being	Quality Education	Gender Equality	Clean Water & Sanitation	Affordable & Clean Energy	Decent Work & Economic Growth	Industry, Innovation & Infrastructure

Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Reduced Inequalities	Sustainable Cities & Communities	Responsible Consumption & Production	Climate Action	Life Below Water	Life on Land	Peace, Justice & Strong Institutions	Partnerships for the Goals

Session 2: Our Role in Sustainable Development

Why Should We Care?

- More people = more need for food, water, and electricity.
- **Overuse** of resources and **pollution** is destroying nature.
- **Cutting trees**, **plastic use**, and **global warming** are big threats.
- If we don't act now, **future generations** will suffer.

Human Activities That Harm Nature

- **Air Pollution:** Smoke from factories and cars.
- **Water Pollution:** Dumping garbage into rivers.
- **Deforestation:** Cutting trees for buildings.
- **Plastic Waste:** Plastic kills marine animals in the ocean.

How Can We Help?

Individual Contributions

- Support **education**, **hygiene**, and **clean water use**.
- Use **energy-saving** lights and **renewable energy**.
- Learn new **skills** to earn and help society.
- Buy **eco-friendly products** and reduce **waste**.
- Use public transport or cycles to reduce **carbon footprint**.
- Take part in **community cleaning** and **tree plantation**.

Community and National Level Efforts

- **Use biodegradable materials** like clay kulhads.
- Build **solar power plants** (e.g., Gujarat Solar Park).

- Promote **recycling** and proper **waste disposal**.
- Spread **awareness** through campaigns and eco clubs.

Indian Initiatives for Sustainability

- **Charanka Solar Park (Gujarat)** – A large solar plant.
- **Clay Kulhads in Railways** – Replace plastic cups.
- **Edible Spoons** – Made from grains, safe to eat.
- **Biodegradable Plastic Bags** – Dissolve in hot water.

GREEN SKILLS OBJECTIVE QUESTIONS

Q1. **Which of the following is a renewable source of energy?**
a) Coal b) Petrol c) Solar energy d) Natural gas

Q2. **The concept of sustainable development emphasizes:**
a) Economic growth only b) Environmental protection only c) Social equity only d) Balanced integration of economic growth, environmental protection, and social equity

Q3. **Which of the following practices contributes to sustainable development?**
a) Overuse of chemical fertilizers b) Deforestation c) Rainwater harvesting d) Excessive industrialization

Q4. **The term 'intergenerational equity' in sustainable development refers to:**
a) Equal rights for all age groups b) Fair distribution of resources between current and future generations c) Equal employment opportunities d) Uniform taxation policies

Q5. **Which of the following is a Sustainable Development Goal (SDG) set by the United Nations?**
a) Zero Hunger b) Unlimited Industrial Growth c) Space Exploration d) Nuclear Armament

Q6. **Afforestation helps in:**
a) Increasing pollution b) Depleting groundwater c) Restoring ecological balance d) Urbanization

Q7. **Which of the following is NOT a challenge to sustainable development?**
a) Water scarcity b) Energy crisis c) Biodiversity conservation d) Food security

Q8. **Sustainable agriculture practices include:**

a) Use of chemical pesticides b) Monoculture farming c) Organic farming d) Slash and burn agriculture

Q9. **The main aim of sustainable development is to:**

a) Increase industrial output b) Meet present needs without compromising future generations' ability to meet their needs c) Maximize resource exploitation d) Focus solely on economic growth

Q10. **Which of the following is a strategy for promoting sustainable development?**

a) Overfishing b) Deforestation c) Waste management d) Excessive mining

Q11. **What does the term carbon footprint mainly refer to?**

a) The carbon taken in by plants from the air b) The total greenhouse gases people release through their activities c) Turning carbon into usable fuels d) The oxygen that trees produce

Q12. **What is the main purpose of learning Green Skills?**

a) To increase fossil fuel usage b) To support nature and grow the economy in a healthy way c) To produce more industrial waste d) To reduce jobs in environment-friendly fields

Q13. **Which of these is not a renewable energy source?**

a) Wind power b) Sunlight (solar power) c) Coal d) Water-based energy (hydropower)

Q14. **What is one eco-friendly step industries can take?**

a) Using machines that save energy b) Making more plastic products c) Throwing waste into rivers d) Cutting down forests

Q15. **What do the 3Rs in sustainability mean?**

a) Reuse, Repair, and Restore b) Reduce, Reuse, and Recycle c) Reform, Rebuild, and Reuse d) Redesign, Replace, and Renew

Answer Key

1	2	3	4	5	6	7	8	9	10
c	d	c	b	a	c	c	c	b	c
11	12	13	14	15					
b	b	c	a	b					

Short Answer Type Questions (2 Marks)

Q1. How can companies contribute to protecting the environment?
Ans. Businesses can protect the environment by using renewable energy, reducing factory waste, recycling materials, and encouraging employees to follow eco-friendly habits.

Q2. What does sustainable transportation mean? Give examples.
Ans. Sustainable transportation means using ways of travel that reduce pollution and save fuel. Examples are cycling, walking, electric vehicles, public transport, and carpooling.

Q3. What are Green Skills?
Ans. Green Skills are the knowledge and abilities needed to protect the environment and use resources carefully. These skills help people support eco-friendly industries and reduce harm to nature.

Q4. How do Green Skills help in sustainable development?
Ans. Green Skills encourage people and industries to follow environmentally safe practices, reduce pollution, save resources, and create jobs that help the economy grow without damaging the planet.

Q5. What is climate change and how does it affect Earth?
Ans. Climate change means long-term changes in weather and temperatures caused by activities like burning fossil fuels. It leads to extreme weather events, rising sea levels, and loss of wildlife.

Q6. What are renewable and non-renewable resources?
Ans. Renewable resources, like solar energy and wind power, can be replaced naturally. Non-renewable resources, such as coal and oil, are limited and take millions of years to form.

Q7. Name three ways to save energy at home.
Ans. (i)Turn off appliances when not in use. (ii)Use energy-saving LED bulbs. (iii)Limit use of heating and cooling systems.

Q8. How does pollution affect plants and animals?

Ans. Pollution harms natural habitats, pollutes water and air, endangers species, lowers animal and plant populations, and disrupts the balance of nature.

Q9. What are some eco-friendly alternatives to plastic bags?

Ans. Some better options than plastic bags are cloth bags, jute bags, paper bags, and biodegradable bags that break down naturally.

Q10. Give any two examples of how individual choices and behaviours can contribute in achieving sustainable development?

Ans. i. Using reusable bags instead of plastic
ii. Conserving electricity and water at home

GREEN SKILLS -II MIND MAP

PART B

SUBJECT SPCIFIC SKILLS

Unit I: Revisiting AI Project Cycle & Ethical Frameworks for AI

Learning Outcomes

- Understand the stages of the AI Project Cycle.
- Understand the concept of Artificial Intelligence (AI) domains and the illustrations of practical applications within each AI domain.
- Learn about the ethical framework for AI and its category. Explore Bioethics, a popular framework that is used in the healthcare industry.

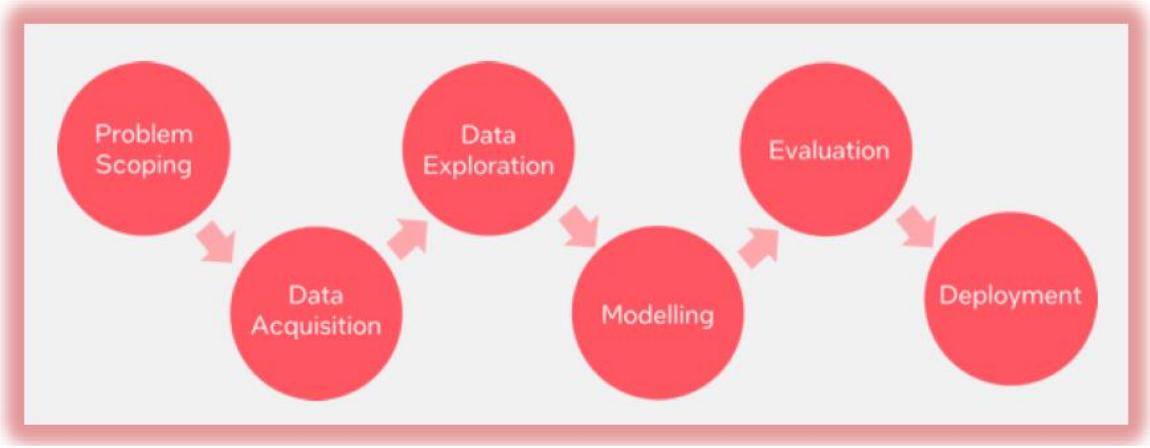
What is an AI Project Cycle?

Project Cycle is a step-by-step process to solve problems using proven scientific methods and drawing inferences about them.

Components of the project cycle are the steps that contribute to completing the Project.

The Components of AI Project Cycle are:

1. **Problem Scoping** - Understanding the problem
2. **Data Acquisition** - Collecting accurate and reliable data
3. **Data Exploration** - Arranging the data uniformly
4. **Modelling** - Creating Models from the data
5. **Evaluation** - Evaluating the project
6. **Deployment** - It's where the solution transitions from development to real-world application



Starting with Problem Scoping, you set the goal for your AI project by stating the problem which you wish to solve with it. Under problem scoping, we look at various parameters which affect the problem we wish to solve so that the picture becomes clearer.

To proceed,

● You need to acquire data which will become the base of your project as it will help you understand what the parameters that are related to problem scoping are.

● You go for data acquisition by collecting data from various reliable and authentic sources. Since the data you collect would be in large quantities, you can try to give it a visual image of different types of representations like graphs, databases, flow charts, maps, etc. This makes it easier for you to interpret the patterns which your acquired data follows.

● After exploring the patterns, you can decide upon the type of model you would build to achieve the goal. For this, you can research online and select various models which give a suitable output.

● You can test the selected models and figure out which is the most efficient one.

● The most efficient model is now the base of your AI project and you can develop your algorithm around it.

● Once the modeling is complete, you now need to test your model on some newly fetched data. The results will help you in evaluating your model and improving it.

● Finally, after evaluation, the deployment stage is crucial for ensuring the successful integration and operation of AI solutions in real-world environments, enabling them to deliver value and impact to users and stakeholders.

With respect to the type of data fed in the AI model, AI models can be broadly categorized into **three domains**

1. **Statistical Data**: Statistical Data is a domain of AI related to data systems and processes, in which the system collects numerous data, maintains data sets and derives meaning/sense out of them.
   Application: Price Comparison Websites

2. **Computer vision**: abbreviated as CV, is a domain of AI that depicts the capability of a machine to get and analyze visual information and afterwards predict some decisions about it. The entire process involves

image acquiring, screening, analyzing, identifying and extracting information.

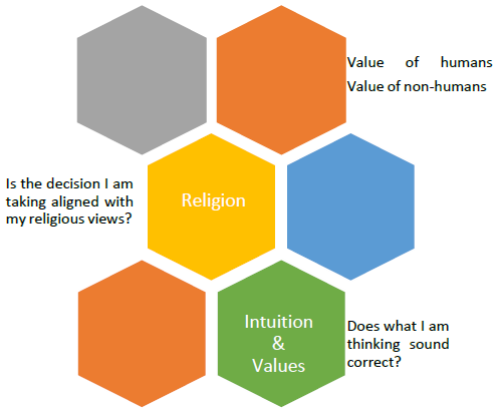
Applications

- Agricultural Monitoring
- Surveillance Systems

3. **Natural Language Processing**: Natural Language Processing, abbreviated as NLP, is a branch of artificial intelligence that deals with the interaction between computers and humans using the natural language.
   Applications
   - Email filters
   - Machine Translation

Ethical Frameworks for AI

- **Frameworks** are a set of steps that help us in solving problems. It provides a step-by-step guide for solving problems in an organized manner
- **Ethics** are a set of values or morals which help us separate right from wrong. Frameworks are **step-by-step** guidance on solving problems.
- **Ethical frameworks** are frameworks which help us ensure that the choices we make do not cause unintended harm.
- **Why do we need?** Ethical frameworks ensure that AI makes morally acceptable choices. If we use ethical frameworks while building our AI solutions, we can avoid unintended outcomes, even before they take place!



Ethical frameworks for AI can be categorized into two main types:

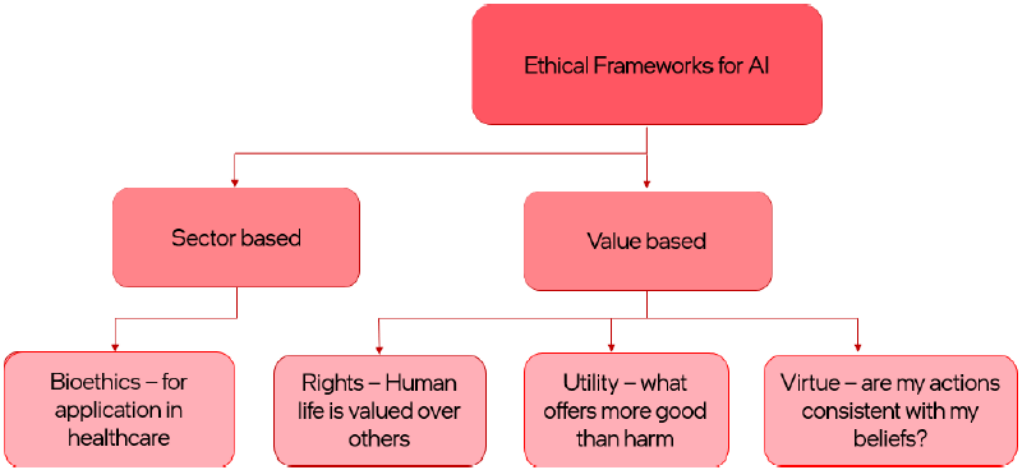
1. **Sector-based:** These are frameworks tailored to specific sectors or industries. In the context of AI, one common sector-based framework is Bioethics, which focuses on ethical considerations in healthcare.
2. **Value based frameworks**: Value-based frameworks focus on fundamental ethical principles and values guiding decision making. It reflects the different moral philosophies that inform ethical reasoning

They can be further classified into **three categories**

i. **Rights-based**: Prioritizes the protection of human rights and dignity, valuing human life over other considerations

ii. **Utility-based:** Evaluates actions based on the principle of maximizing utility or overall good, aiming to achieve outcomes that offer the greatest benefit and minimize harm.

iii. **Virtue-based:** This framework focuses on the character and intentions of the individuals involved in decision-making.



Bioethics is an ethical framework used in healthcare and life sciences. It deals with ethical issues related to health, medicine, and biological sciences, ensuring that AI applications in healthcare adhere to ethical standards and considerations.

Principles of bioethics:

- Respect for Autonomy.
- Do not harm.
- Ensure maximum benefit for all.
- Give justice.

- "**Non-maleficence**" refers to the ethical principle of avoiding causing harm or negative consequences
- "**Maleficence**" refers to the concept of intentionally causing harm or wrongdoing.
- "**Beneficence**" refers to the ethical principle of promoting and maximizing the well-being and welfare of individuals and society.

The ***four principles*** of bioethics can be used to ensure an ethical AI solution for the *healthcare problem*

i. **Respect for autonomy**: Enabling users to be fully aware of decision-making. E.g., users of an AI algorithm should know how it functions.

ii. **Do not harm**: Harm to anyone (be it human or non–human) must be avoided at all costs

iii. **Maximum benefit**: Not only should we avoid harm our actions must focus on providing the maximum benefit possible

iv. **Justice:** All benefits and burdens of a particular choice must be distributed in a justified manner across people irrespective of their background.

OBJECTIVE QUESTIONS

Q1. What is the purpose of defining the problem statement during the Problem Scoping stage in an AI project cycle?

a) To collect data b) To understand the aim and objective of the project
c) To train the model d)To process data

Q2. In what ways can AI models be categorized based on the type of data fed into them?

a) Two domains b) Four domains c) Three domains d) Five domains

Q3. In Statistical Data, what is the primary function of the system in relation to data?

a) Generating large datasets b) Analyzing data to extract insights

c) Converting data into images d) Distributing data across networks

Q4. What is the main goal of Computer Vision projects?

a) Translating audio data into visual descriptions
b) Converting digital data into analogue signals
c) Teaching machines to understand textual information
d) Converting digital visual data into computer-readable language

Q5. What is the primary focus of NLP?

a) Analyzing computer languages
b) Interacting between computers and humans using artificial language
c) Dealing with the interaction between computers and humans using natural language
d) Enhancing human-to-human communication

Q6. What do frameworks provide in the context of problem-solving?

a) Random solutions b) Step-by-step guidance
c) Legal advice d) Ethical justifications

Q7. How are Ethical Frameworks for AI categorized?

a) Into legal and illegal frameworks
b) Into sector-based and value-based frameworks
c) Into historical and contemporary frameworks
d) Into theoretical and practical frameworks

Q8. What is the central focus of virtue-based value-based frameworks?

a) Maximizing utility
b) Protecting human rights
c) Aligning actions with ethical principles and beliefs
d) Ensuring compliance with legal regulations

Q9. Which of the following best describes rights-based value-based frameworks?

a) Prioritizing human rights and dignity, valuing human life over other considerations
b) Evaluating actions based on maximizing overall good and minimizing harm
c) Centering on the character of the decision-maker and the alignment of actions with personal or societal virtues
d) Focusing on achieving outcomes that offer the greatest benefit

Q10. What is the primary domain of application for Bioethics?

a) Agriculture b) Healthcare and life sciences

c) Information technology d) Environmental conservation

Q11. Assertion: Ethics provide guidance in distinguishing right from wrong.
Reasoning: Ethics consist of a set of values and morals that aid individuals in making moral judgments and decisions.

a) Both Assertion and Reasoning are true, and Reasoning is the correct explanation of the Assertion.
b) Assertion is true, but Reasoning is false.
c) Both Assertion and Reasoning are true, but Reasoning is not the correct explanation of the Assertion.
d) Assertion is false, but Reasoning is true.

Q12. Assertion: Value-based frameworks in ethics provide guidance by focusing on fundamental ethical principles and values.
Reasoning: These frameworks reflect different moral philosophies guiding ethical reasoning and are concerned with assessing the moral worth of actions.

a) Both Assertion and Reasoning are true, and Reasoning is the correct explanation of the Assertion.
b) Assertion is true, but Reasoning is false.
c) Both Assertion and Reasoning are true, but Reasoning is not the correct explanation of the Assertion.
d) Assertion is false, but Reasoning is true.

Q13.You would feed the data into the machine. This is the data with which the machine can be trained. Now, once it is ready, it will predict his next data efficiently. This previous data is known as _.

a) Testing Data b) Training Data

c) Exploring Data d) All of the above

Q 14.How you can identify the problem scoping in the project.

a) Understand why the project was started
b) Define the project's primary objectives
c) Outline the project's work statement.
d) All of the above

Q15.For better efficiency of an AI project Training data should be _____
i) Relevant ii) Scattered iii) Structured iv) Authentic
Choose the correct option:

a) Both i and ii b) Both i and iv

c) Only I d) Only iv

Q16. Which one of the following is the second stage of AI project cycle?

a) Data Exploration b) Data Acquisition

c) Modelling d) Problem Scoping

Q17. Which of the following comes under Problem Scoping?

a) System Mapping b) 4Ws Canvas

c) Data Features d) Web scraping

Q18. 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

Q19. How you can identify the problem scoping in the project.

a) Understand why the project was started
b) Define the project's primary objectives
c) Outline the project's work statement.
d) All of the above

Q20._____ summarizes all of the important points in one place.

a) Problem statement template b) Problem statement document

c) Problem statement files d) None of the above

ANSWER KEY

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
b	c	b	b	c	b	b	c	a	b
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
a	a	b	d	b	b	b	c	d	a

Short Answer Type Questions

Q1. What is the major role of an AI Project Cycle?

Answer

The major role of AI Project Cycle is to distribute the development of AI project in various stages so that the development becomes easier, clearly understandable and the steps / stages should become more specific to efficiently get the best possible output.

Q2. What roles does computer vision play in agricultural monitoring systems?

Answer

Computer vision is employed in agriculture for crop monitoring, pest detection, and yield estimation. Drones with cameras capture aerial images of farmland, which are then analysed to assess crop health and optimize farming practices.

Q3. Mention the factors which knowingly or unknowingly influence our decision-making.

Answer

- Value of humans Value of non-humans
- Religion: Is the decision I am taking aligned with my religious views?
- Intuition &Values: Does what I am thinking sound correct?
- Identity of the charity recipient.
- Location of the recipient.
- Bias towards relatives.
- Uncovering information available.

Q4. What is the necessity for Ethical Frameworks in AI development?

Answer

Ethical frameworks in AI development are necessary to ensure that AI is safe, fair, trustworthy, accountable, and aligned with human values. They act as guardrails in an evolving landscape, helping developers, companies, and governments steer AI toward socially beneficial outcomes. Ethical frameworks ensure that AI makes morally acceptable choices. If we use ethical frameworks while building our AI solutions, we can avoid unintended outcomes, even before they take place!

Q5. Mention the key characteristics of sector-based frameworks.

Answer

Sector-based AI frameworks are customized, practical, and context-aware guidelines that bridge general ethical principles and real-world application. They help ensure AI systems are safe, fair, and effective within their specific domains of use.

It addresses issues such as patient privacy, data security, and the ethical use of AI in medical decision-making.

Q6. What do you mean by Bioethics?

Answer

Bioethics is an ethical framework used in healthcare and life sciences. It deals with ethical issues related to health, medicine, and biological sciences, ensuring that AI applications in healthcare adhere to ethical standards and considerations. Bioethics helps society navigate complex ethical challenges in medicine and life sciences by promoting responsible and humane practices in the face of technological and scientific progress.

Q7. What are three categories of Value-based Frameworks?

Answer

i. **Rights-based**: Prioritizes the protection of human rights and dignity, valuing human life over other considerations
ii. **Utility-based:** Evaluates actions based on the principle of maximizing utility or overall good, aiming to achieve outcomes that offer the greatest benefit and minimize harm.
iii. **Virtue-based:** This framework focuses on the character and intentions of the individuals involved in decision-making.

Q8. How do value-based frameworks contribute to ethical decision-making by emphasizing fundamental principles and values?

Answer

Value-based frameworks center around core moral values such as:

- Autonomy – Respecting individuals' rights to make informed choices
- Justice – Ensuring fairness, equality, and non-discrimination
- Beneficence – Promoting well-being and positive outcomes
- Non-maleficence – Avoiding harm
- Accountability – Taking responsibility for decisions and outcomes

- Transparency – Making AI processes understandable and traceable

Value-based frameworks contribute to ethical AI decision-making by:

- Embedding core moral values into design and policy
- Offering a principled approach for navigating complex choices
- Supporting human-centric, fair, and responsible AI development
- They ensure that AI does not just function correctly—but does the right thing.

Q9. What are Fundamental Principles of Ethical Frameworks?

- **Fairness:** Avoiding bias and ensuring equitable treatment
- **Transparency**: Making AI systems understandable and explainable
- **Accountability**: Ensuring someone is responsible for AI outcomes
- **Privacy and Data Protection**
- **Human-Centeredness:** Keeping human welfare and autonomy at the core
- **Safety and Security:** Preventing unintended harm

Q10. How Natural Language Processing is using in Machine Translation?

Answer

NLP is used in machine translation systems like Google Translate and Microsoft Translator to automatically translate text from one language to another. These systems analyze the structure and semantics of sentences in the source language and generate equivalent translations in the target language

Long answer Questions

Q1. A global company deploys an AI system to automate its recruitment process. The system is trained on historical hiring data to screen and rank job applicants. After several months, internal audits reveal that the AI consistently ranks male applicants higher than equally qualified female and minority candidates.

The HR team is now under pressure to either fix the bias or shut down the system. The company wants to use an ethical framework to guide its next steps

Using an ethical AI framework, how should the company evaluate and respond to the bias in its AI recruitment system? Identify the ethical principles involved and propose a suitable course of action

Answer

a. Human Agency and Oversight

Issue: Automated decisions are made without sufficient human review.
Action: Reintroduce human oversight in final hiring decisions, especially for flagged or borderline candidates.

b. Technical Robustness and Safety

Issue: The model lacks fairness and accuracy across demographics.
Action: Audit and retrain the AI with diverse, balanced, and inclusive data, and test for bias using fairness metrics.

c. Privacy and Data Governance

Issue: Personal applicant data is used for algorithmic profiling.
Action: Ensure transparent data use policies and compliance with privacy laws (e.g., GDPR).

d. Transparency

Issue: Candidates and even HR staff are unclear on how decisions are made.
Action: Use explainable AI tools to show how and why the model ranks candidates.

Q2. Akhil wants to learn how to scope the problem for an AI Project. Explain him the following:
(a) 4W Problem Canvas
(b) Problem Statement Template

Answer

The 4Ws Problem canvas helps in identifying the key elements related to the problem. The 4Ws are Who, What, Where and Why

- The "Who" block helps in analysing the people getting affected directly or indirectly due to the problem.
- The "What" block helps us to determine the nature of the problem.
- The "Where" block helps us to look into the situation in which the problem arises, the context of it, and the locations where it is prominent.
- The "Why" block suggests to us the benefits which the stakeholders would get from the solution and how it will benefit them as well as the society

Our	[stakeholders]	Who
Have a problem that	[need]	What
When/while	[context/ location/ situation]	Where
An ideal solution would be	[solution]	Why

Q3. A city government wants to implement a computer vision-based traffic monitoring system to detect traffic violations like running red lights and illegal parking. The system uses real-time video feeds and AI to automatically identify license plates and send violation notices.
What are the key ethical considerations for successfully deploying this computer vision application, and how can these challenges is addressed?

Answer

1. Privacy and Surveillance Concerns

Issue: Constant monitoring may violate citizens' privacy.
Solution: Anonymize individuals in video feeds and encrypt license plate data, limiting access only to authorized personnel.

2. Data Retention and Use

Issue: Misuse or over-retention of surveillance data.
Solution: Set clear data retention policies and delete data once its intended purpose is fulfilled, unless legally required otherwise.

3. Bias and Fairness

Issue: Algorithmic bias may disproportionately flag vehicles in certain areas or with certain license styles.
Solution: Audit training data for representativeness and ensure fair distribution of detection accuracy across demographics and vehicle types.

4. Transparency and Accountability

Issue: Citizens may not understand how or why they were flagged.
Solution: Provide public documentation of how the system works and establish a dispute resolution process for incorrect fines.

Q4. A customer service company wants to implement an NLP-based chatbot to handle client inquiries 24/7. The goal is to reduce human workload, improve response time, and increase customer satisfaction. However, users speak different languages, use slang, and sometimes express frustration or sarcasm.

Answer

1. Transparency

Issue: Customers may feel misled if they think they're talking to a human.
Solution: Clearly disclose at the beginning that they are interacting with an AI system.

2. Bias and Fairness

Issue: The bot may reflect biased training data and respond inappropriately to certain user groups.
Solution: Audit and test the system using diverse inputs to minimize bias, and use inclusive training datasets that represent different cultures, accents, and language use.

3. Data Privacy

Issue: The bot handles sensitive customer information.
Solution: Encrypt conversations, comply with data privacy laws (e.g., GDPR, CCPA), and limit data retention to what's necessary.

4. User Trust and Experience

Issue: Poor or robotic responses may frustrate users.
Solution: Train the bot to use natural, empathetic language and gather feedback through surveys to continuously improve interaction quality.
To successfully implement an NLP-based customer service chatbot, the company should:

- Use robust multilingual and sentiment-aware NLP models
- Ensure ethical practices, including transparency, fairness, and data protection
- Design with the user experience in mind, allowing seamless escalation and empathetic dialogue

Q5. A hospital implements an AI diagnostic tool that analyzes medical images (e.g., X-rays, MRIs) to assist doctors in detecting diseases like cancer. The AI has shown high accuracy in clinical trials, but a recent case revealed that it missed a rare condition, leading to a delayed diagnosis and patient harm.
Using bioethical principles (autonomy, beneficence, non-maleficence, and justice), evaluate the ethical implications of deploying such AI systems in clinical settings. What measures should be taken to ensure that AI in healthcare aligns with bioethical standards?

Answer

Bioethical Principles Applied:

1. Autonomy

Issue: Patients may not be informed that AI is involved in their diagnosis.
Action: Ensure informed consent, where patients are made aware of AI usage and have the right to ask for human-only analysis.

2. Beneficence (Do Good)
Issue: AI is intended to enhance diagnosis and reduce errors.
Action: Continuously improve the model's performance and ensure it's used to support, not replace, clinicians.
3. Non-Maleficence (Do No Harm)
Issue: A missed diagnosis caused real patient harm.

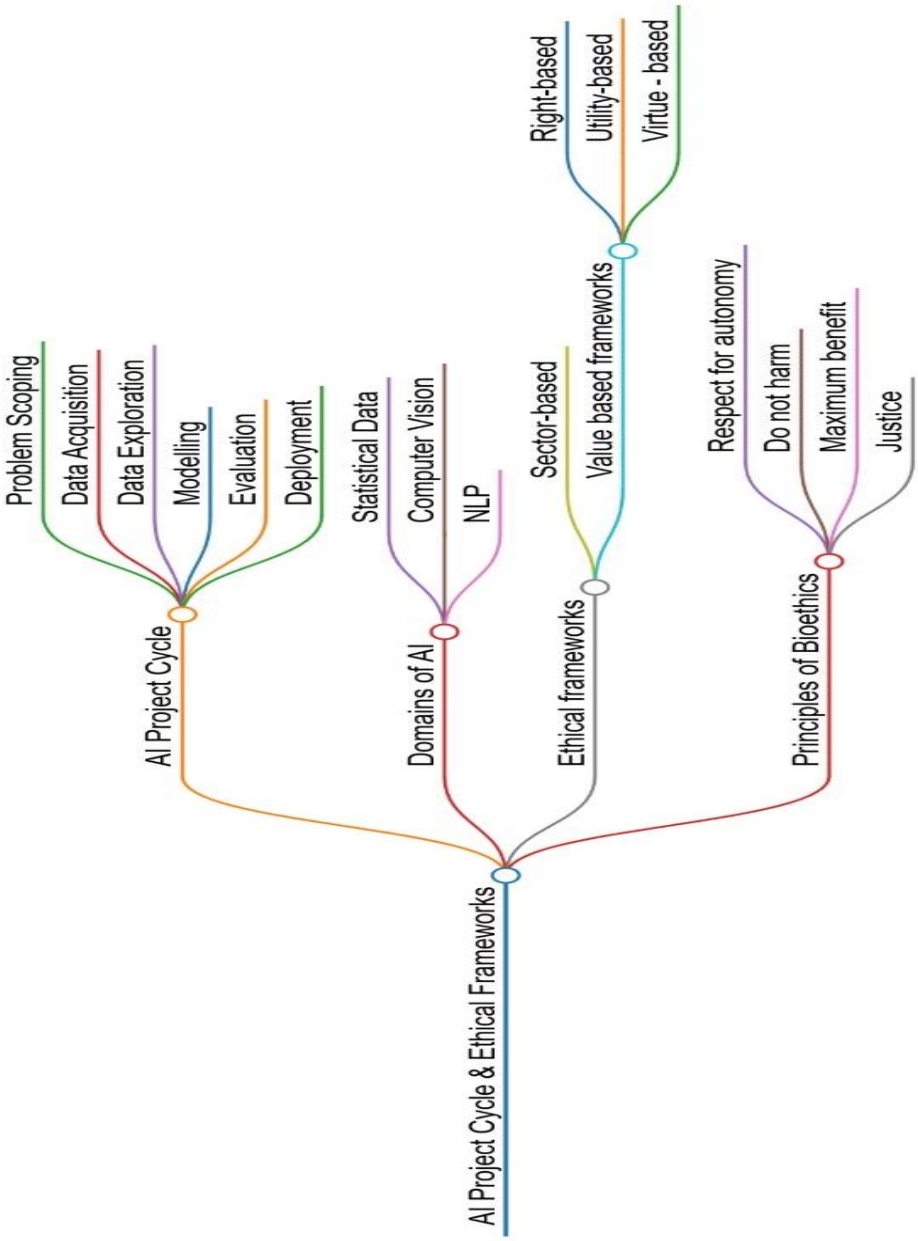
Action: Set clear protocols for human oversight; use AI only as a second opinion, not the sole source of decision-making.
4. Justice
Issue: AI might perform poorly for certain demographics (e.g., rare conditions, underrepresented groups).
Action: Audit the model for bias and equity, and expand training data to include diverse patient populations.
Recommended Measures:

- Implement explain ability tools so doctors can understand AI decisions.
- Require dual validation—AI + physician—before acting on diagnoses.
- Set up ethics review boards to evaluate AI tools before deployment.
- Create a feedback loop to learn from errors and update the system regularly.
- Provide transparency reports to patients and regulators about AI limitations.

This scenario underscores the importance of bioethics in AI applications for healthcare. While AI offers enormous potential, adherence to the principles of autonomy, beneficence, non-maleficence, and justice is essential to ensure safe, ethical, and equitable patient care.

Practical Session on Frameworks, Ethical Framework and need of Ethical Frameworks for AI. Activity: My Goodness https://www.my-goodness.net/

Unit 1 - MIND MAP



Unit-2: Advanced Concepts of Modeling in AI

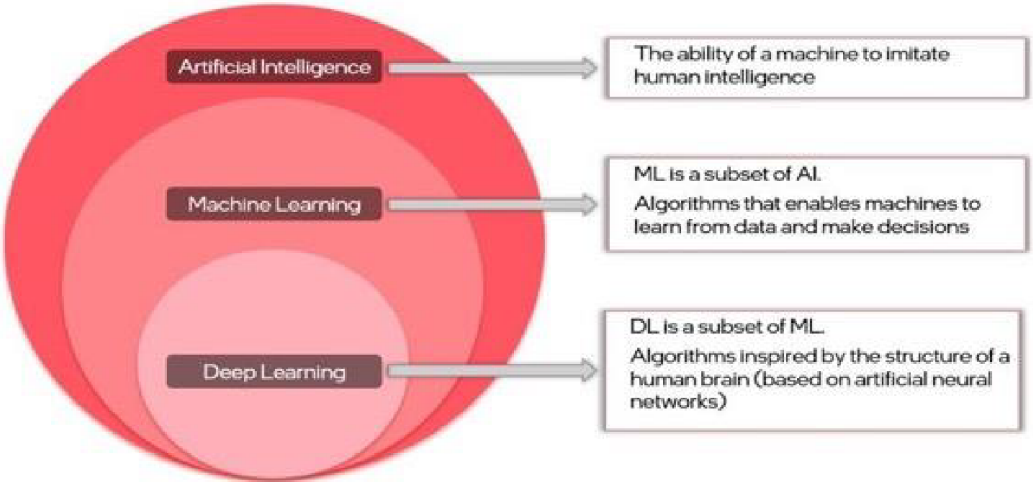
Learning Outcomes

- **Understand AI Modeling Approaches:**
  - Learn the differences between **Rule-based** and **Learning-based** AI models.
- **Learn Categories of Learning-Based Models:**
  - Understand the principles and applications of:
    - **Supervised Learning**
    - **Unsupervised Learning**
    - **Reinforcement Learning**
- **To Learn Machine Learning Concepts:**
  - Understand the roles of **features**, **labels**, **training**, and **testing datasets**.
- **To Familiarize Supervised Learning Models:**
  - Understand **Classification** and **Regression** models with examples.
- **To Familiarize with Unsupervised Learning Models:**
  - Understand **Clustering** and **Association** models.
- **To Understand Deep Learning Concepts:**

Main Important Points:

Introduction to AI, ML, and DL

- **Artificial Intelligence (AI):** When machines behave like humans and make smart decisions.
- **Machine Learning (ML)**: When machines learn from data and improve automatically.
- **Deep Learning (DL)**: A part of ML where machines learn deeply using lots of data and complex networks.



Examples:

AI: A robot that can chat with you.

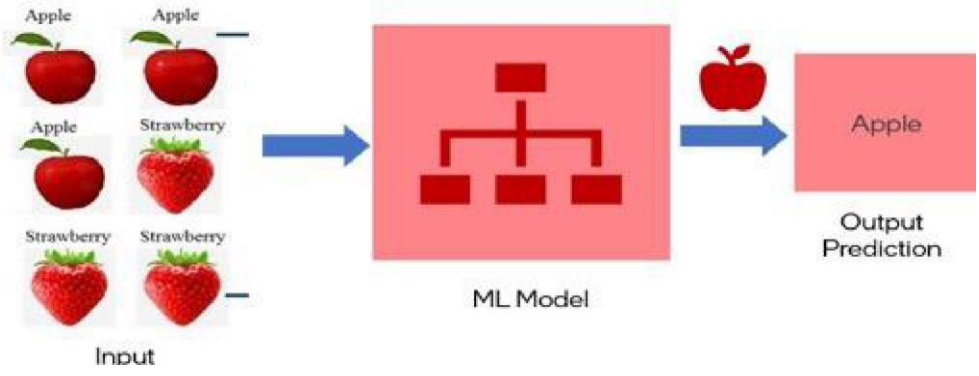
ML: A movie app that suggests your favorite type of films.

DL: Your phone recognizing your face to unlock.

Machine Learning

ML → Learning from Data

- Input = Past data (like pictures of fruits)
- Output = Predictions (like identifying a fruit as an apple or a Strawberry)
- ML improves itself over time using experience.

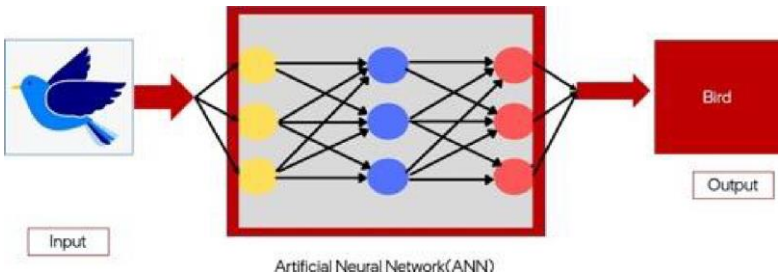


Examples of ML:

- **Object Classification**: Spotting a dog or cat in an image.
- **Anomaly Detection**: Finding something odd, like an unusual heartbeat in health data.

Deep Learning (DL)

- A special kind of ML.
- Uses neural networks to understand complex things.
- Learns from huge datasets (like thousands of images).



Examples:

- You show a bird photo.
- The DL model sees pixel by pixel and says, "That's a bird!"
- Used in face recognition, voice assistants, language translation.

Common Terms Used

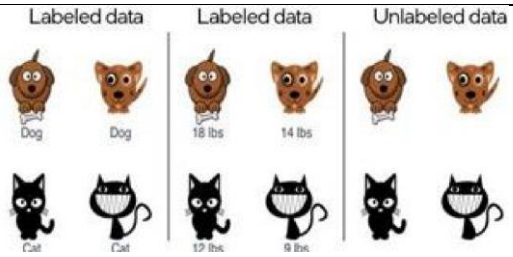
- **Data**: Raw information

Label Feature

Fruit	Color	Price
Apple	Red	$1.8
Orange	Orange	$2
Banana	Yellow	$1
Grape	Purple	$3

- **Features**:
  - Columns of the tables are called features
  - Details about data (color, size, price).
- **Labels**:
  - Data Labelling is the process of attaching meaning to data
  - What you're trying to predict (fruit name).

Types of Data

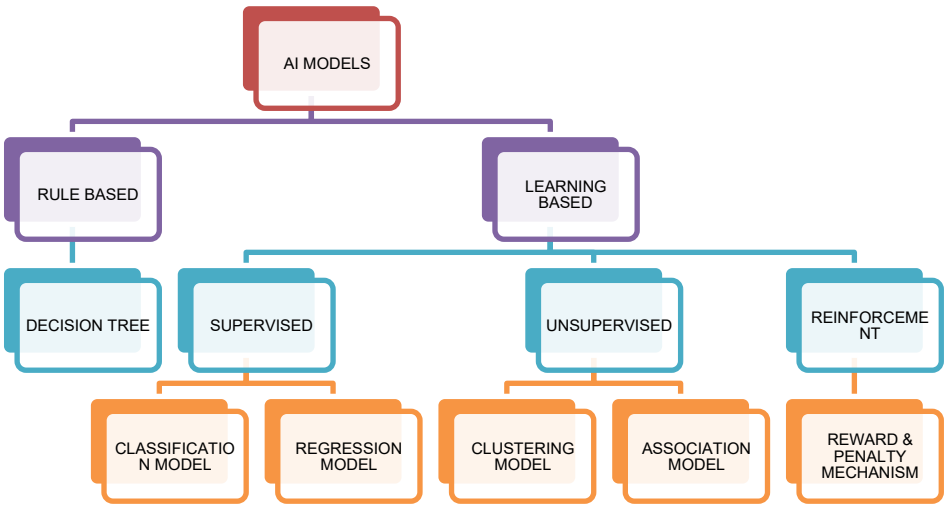


Labelled Data	Unlabelled Data
▪ Data to which a tag/label is attached. ▪ For example: Name, type, number, etc.	▪ The raw form of data ▪ Data to which no tag is attached

Training Data vs Testing Data

Training Data	Testing Data
The training dataset is a collection of samples given to the model to analyse and learn.	The testing dataset is a collection of samples given to the model to test its accuracy.
A set of labelled data is used to train the AI model	The test is performed without labelled data and then verify results with labels.

Two Types of AI Models



1. Rule-Based AI

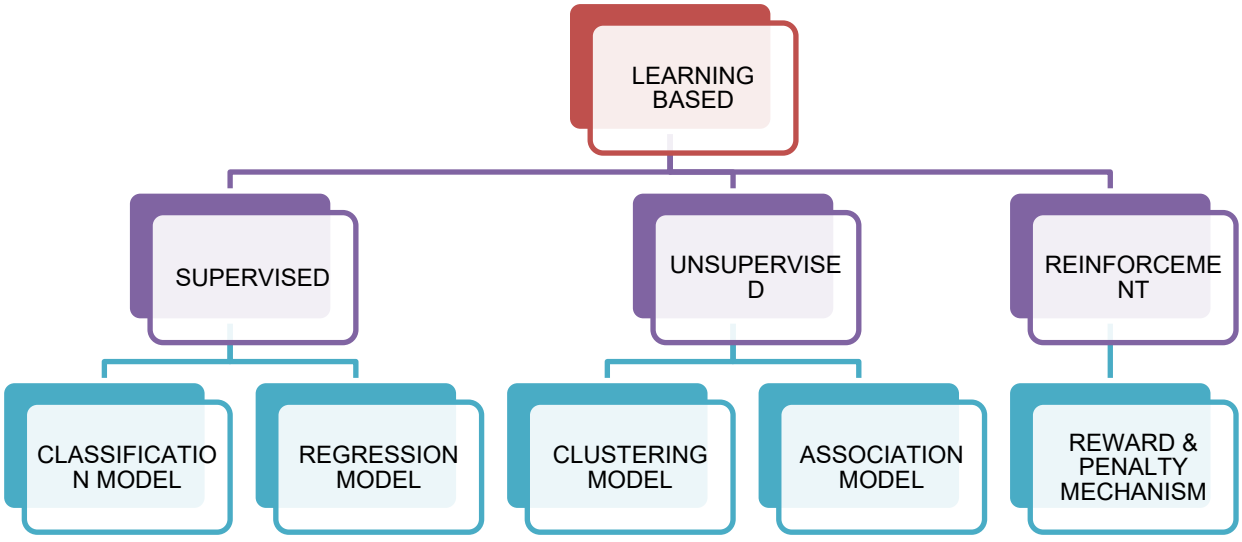
- Follows fixed instructions.
- No learning or improvement.
- Example: A simple chatbot that answers FAQs with fixed replies.

2. Learning-Based AI

- Learns from data.
- Can adapt and improve.
- Example: A spam filter that gets better over time.

Note: Rule-based AI makes Fixed models (cannot adapt to changes),
Learning-based AI makes Flexible models (can adapt to changes)

Types of Learning Models



A. Supervised Learning

Labelled data used for training.

Machine learns from examples and makes predictions.

Example:

You show a coin and its weight.

The model learns: 5g = Euro, 3g = Dollar.

Later, it guesses the coin based on weight.

B. Unsupervised Learning

Unlabelled data is used for training

No labels.

Machine finds patterns or groups.

Example:

1000 photos of dogs with no info.

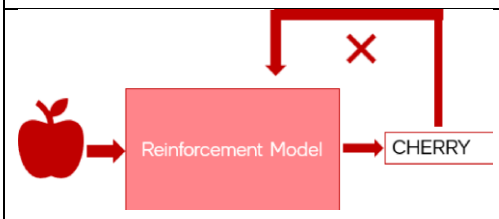
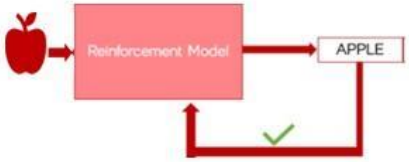
The model groups them by size or color.

C. Reinforcement Learning

Learn by Rewards

The machine tries something.

Gets a reward for right actions, a penalty for wrong ones.

Penalty	Reward
	

Example:

You show a fruit.

Model says cherry → wrong → gets negative point.

Tries again → says apple → right → gets reward.

Used in self-driving cars, games, and robotics.

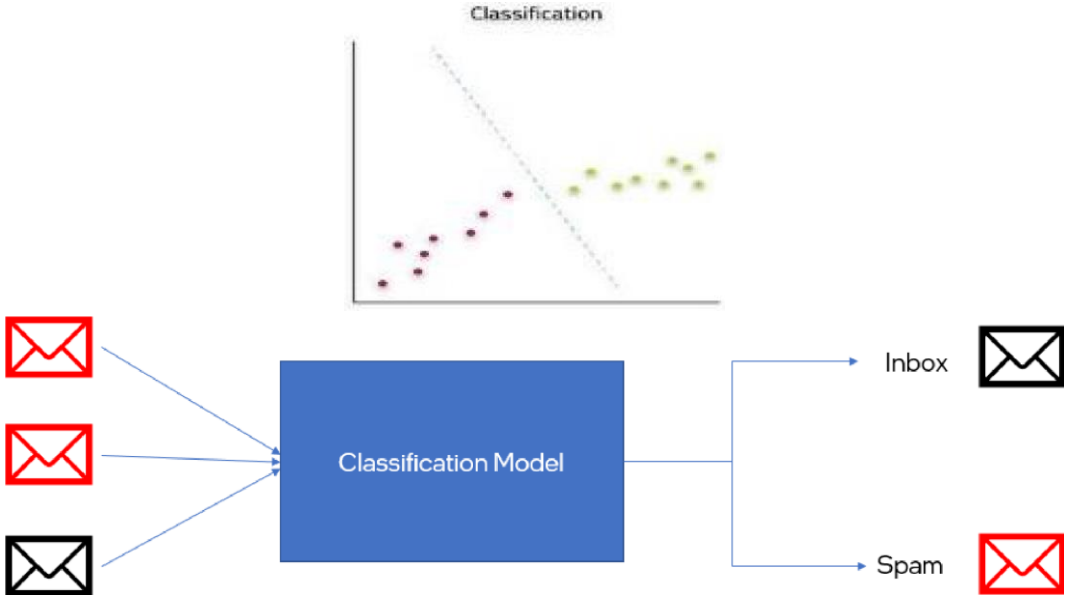
Differences between Supervised and Unsupervised Learning

Supervised Learning	Unsupervised Learning
Learns from labelled data.	Learns from unlabelled data.
Easy to train and use.	Finds hidden patterns.
Need less computing power	Need more computing power

Sub-categories of Supervised Learning Model

A. Classification

- Predicts **categories**.
- Output is discrete (like YES or NO, Cat or Dog, Pass or Fail).
- Classification is "What type?"

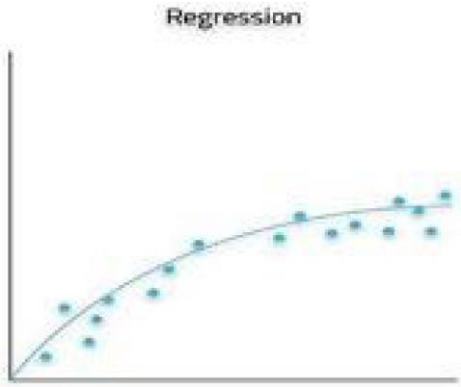


Example:

a. Email → Spam or Not Spam
b. Weather → Hot or Cold

B. Regression

- Predicts numbers or continuous values.
- Regression is "How much?"



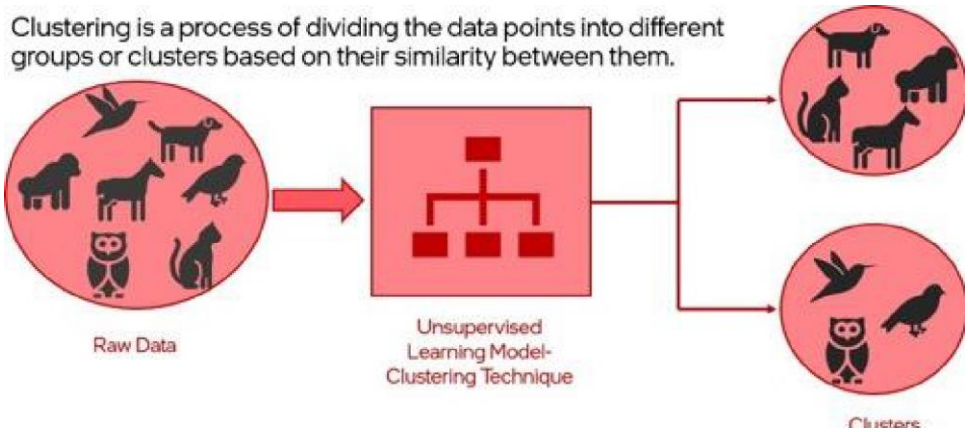
Example:

a. Predicting house price or temperature.

Sub-categories of UnSupervised Learning Model

A. Clustering

- Group similar things together.
- No labels.



Example:

a. Music app groups songs you like based on rhythm, tone and tempo.

B. Association

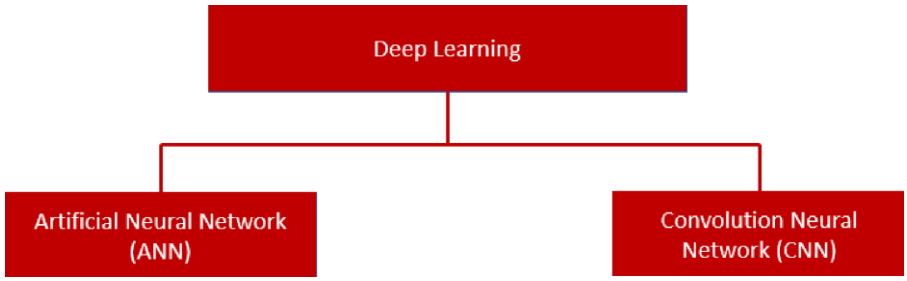
- Finds links between items.

Example:

a. If you buy **bread**, you might also buy **butter**.
b. Useful in shopping apps for product suggestions.

Deep Learning (DL)

- A special kind of ML.
- Uses neural networks to understand complex things.
- Learns from huge datasets (like thousands of images).



Neural Networks

- Mimics how our brain works using "neurons".
- Has **layers** of nodes:
  - **Input Layer**: Takes data, No processing
  - **Hidden Layers**: Do calculations, each node is a machine learning algorithm
  - **Output Layer**: Gives result.

Convolutional Neural Network (CNN)

- Convolutional Neural Network is a Deep Learning algorithm.
- It can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

Summary Points

1. **AI Models are broadly categorized** into:
   - **Rule-based models**: Follow pre-defined rules and do not adapt to new data.
   - **Learning-based models**: Learn from data and adapt over time.
2. **Machine Learning (ML)** is a subset of AI, and **Deep Learning (DL)** is a subset of ML.

3. **Supervised Learning** uses labelled data to train models (e.g., spam detection, coin recognition).
4. **Unsupervised Learning** works on unlabelled data to discover hidden patterns (e.g., customer segmentation, fraud detection).
5. **Reinforcement Learning** is based on feedback from the environment (e.g., AI playing a game, autonomous vehicles).
6. **Classification vs. Regression**:
    - Classification → discrete output (example: spam or not)
    - Regression → continuous output (example: house price prediction)
7. **Clustering and Association** are core unsupervised learning techniques:
    - Clustering → group similar data points
    - Association → discover relationships between variables
8. **Neural Networks** simulate brain-like structure and are used to process complex data like images and texts.
9. **Artificial Neural Networks (ANNs)** are made of input, hidden, and output layers. They use weights, biases, and activation functions.
10. **Practical activity** (Human Neural Network Game) helps students understand the flow and processing of information in a neural network.

Multiple Choice Questions (1 Mark)

1. Which of the following is an example of supervised learning?
   a) Clustering animals into groups b) Spam email classification
   c) Discovering shopping patterns d) Grouping news articles

2. What type of data does supervised learning use?
   a) Unlabelled b) Random
   c) Labelled d) Mixed

3. Which model works on the principle of reward and punishment?
   a) Supervised Learning b) Unsupervised Learning
   c) Classification d) Reinforcement Learning

4. Which sub-field of AI mimics the human brain structure?
   a) Artificial Neural Networks b) Convolutional Networks

c) Decision Trees d) Rule-based Systems

5. What does ANN stand for?
   a) Artificial Nerve Network b) Automated Neural Network
   c) Artificial Neural Network d) Adaptive Node Network

6. Which type of learning is used when we do not know the output?
   a) Supervised b) Unsupervised
   c) Reinforcement d) Logical

7. Which of the following is not an application of machine learning and deep learning?
   a) Digit recognition b) Face detection
   c) Spam email classification d) Rule-based chat

8. What does the input layer in a neural network do?
   a) Feed data into the network b) Connect output nodes
   c) Process information d) Decide final result

9. Which AI model uses fixed rules to make decisions?
   a) Reinforcement model b) Learning-based model
   c) Rule-based model d) Regression model

10. Which of the following is a feature in a dataset?
    a) Labels only b) Column attributes
    c) Output values d) Predefined answers

11. Which learning type is most suitable for anomaly detection?
    a) Unsupervised b) Reinforcement
    c) supervised d) Regression

12. Which of the following is a classification problem?
    a) Predicting stock prices
    b) Grouping books by genre
    c) Estimating house prices
    d) Predicting whether a customer will buy a product or not

13. In reinforcement learning, what happens when the agent performs incorrectly?
a) It is terminated b) It is rewarded
c) It is penalized d) It resets

14. Deep learning is best applied in which scenario?
a) large image datasets b) Structured tabular data
c) small dataset d) Binary classification

15. Which of the following best describes a regression model?
a) Classifies data into clusters b) Predicts continuous values
c) Finds associations d) Uses feedback for learning

16. Which learning model would you choose for a stock price prediction system?
a) Clustering b) Classification
c) Regression d) Association

17. Which of the following is valid according to Neural Networks?
a) Neural Network contain 4 layers (input, processing, hidden and output layers)
b) In Neural Networks every node is essentially a machine learning algorithm.
c) Use the Neural Network if the dataset is small only.
d) The input layers processes the data with algorithms and supply to next layer.

18. What differentiates reinforcement learning from supervised learning?
a) Uses labelled data b) Uses reward-based feedback
c) Works only with images d) Is used for classification

19. Which layer of a neural network performs most of the computation?
a) Input layer b) Output layer
c) Hidden layer d) Bias layer

20. In neural networks, what are weights and biases used for?
a) Visualizing features b) Scaling output
c) Adjusting influence of input nodes d) Measuring data size

21. In association models, what kind of insight is generated?
a) Labels b) Predictions
c) Relations between variables d) Probabilities

22. A smart assistant recommends songs based on listening history. Which type of learning is it using?
a) Supervised b) Unsupervised
c) Reinforcement d) Regression

23. A company wants to forecast next quarter's revenue. Which model should they use?
a) Classification b) Regression
c) Clustering d) Reinforcement

24. An AI robot improves its performance by navigating a maze through repeated tries. What learning type is this?
a) Supervised b) Unsupervised
c) Reinforcement d) Regression

25. A retail store wants to understand which products are frequently bought together. Which model fits?
a) Classification b) Regression
c) Clustering d) Association

26. An app filters spam messages using a pre-trained dataset. What learning approach does it use?
a) Supervised b) Unsupervised
c) Reinforcement d) Association

27. What is the main purpose of the bias in a perceptron model?
a) To increase the number of input features
b) To adjust the learning rate
c) To shift the decision boundary
d) To reduce overfitting

28. Which of the following is a real world application of Neural Networks?
a) Facial Recognition b) Customer support Smart bot
c) Weather forecast analysis d) All the above

29. Which of the following statements best describes a perceptron?
a) A simple neural network that performs linear classification.
b) A non-linear machine learning model used for complex tasks.
c) A complex deep learning network with multiple hidden layers.
d) A type of reinforcement learning algorithm.

30. The perceptron algorithm can only solve which type of problems?
a) Non-linear classification
b) Multi-class regression
c) Linearly separable classification
d) Time-series forecasting

Assertion and Reason based Questions:

31) Assertion (A): Supervised learning uses labelled data to train AI models.
Reason (R): Labels help the model understand the correct output for each input.
a) Both A and R are true and R is the correct explanation of A
b) Both A and R are true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

32)Assertion (A): Unsupervised learning can identify hidden patterns in data.
Reason (R): Unsupervised learning requires data that is already labelled for classification.
a) Both A and R are true and R is the correct explanation of A
b) Both A and R are true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

33) Assertion (A): Neural Networks have multiple layers for processing information.
Reason (R): The hidden layers of a neural network help the machine perform calculations and learn patterns.
a) Both A and R are true and R is the correct explanation of A
b) Both A and R are true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

34)Assertion (A): Reinforcement learning works without labeled data.
Reason (R): The model learns by receiving feedback from its actions.
a) Both A and R are true and R is the correct explanation of A
b) Both A and R are true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

35)Assertion (A): Regression models are used when output is a category like spam or not spam.
Reason (R): Regression works with continuous numerical values, not categories.
a) Both A and R are true and R is the correct explanation of A
b) Both A and R are true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

Multiple choice Answers

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
b	c	d	a	c	b	d	a	c	b
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
a	d	c	a	b	c	b	b	c	c
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
c	b	b	c	d	a	c	d	a	c
31	**32**	**33**	**34**	**35**					
a	c	a	a	d					

Short Answer Questions with Answers

Q1. Define Machine Learning (ML) with examples.
Answer: Machine Learning enables machines to learn from data and improve from experience.
Examples: Object Classification, predicting house prices, predicting temperature, Predicting stock prices, Anomaly detection in emails.

Q2. Write a difference between Training Data and Testing Data.
Answer:

Training Data	Testing Data
Training dataset is a collection of samples given to the model to analyse	Testing data is a collection of samples given to the model to test its

and learn.	accuracy.

Q3. Give two real-life examples of reinforcement learning.

Answer:

a. An AI playing a video game and improving by receiving rewards and penalties.
b. A Self driving car trying to park in empty parking slot.

Q4. What is an Artificial Neural Network (ANN)?

Answer:

ANN is a computing system inspired by the human brain, consisting of layers of interconnected nodes that process data and learn patterns. Each Node in ANN acts as a Machine learning algorithm.

Q5. What are features in a dataset? Identify the Label and feature from the given table.

Company	Model	Engine	CC	Cost
TATA	Harrier	Diesel	2000	27 Lakhs
HONDA	Elevate	Petrol	1500	21 Lakhs
HYUNDAI	Creta	Petrol	1500	21 Lakhs
TOYOTA	Hyryder	Diesel	1500	19Lakhs

Answer:

- Features are individual measurable properties or characteristics of a dataset.
- If we are predicting the company based on the model than Company is Label and Model is Feature.

Q6. A social media app tags your friends in photos using previously tagged data. Identify the learning type and justify.

Answer:

It is Supervised Learning because the model uses labelled (tagged) data to make predictions.

Q7. How is a rule-based AI model different from a learning-based model

Answer:

Rule-based model	Learning-based model
A rule-based model follows predefined rules and does not adapt/change.	A learning-based model learns from data and can adapt to changes
Data and Rules are supplied to Rule based model gives results/answers	Data and Results/answers are supplied to Learning based model gives rules

	(patterns to understand data)

Q8. An autonomous vehicle is learning to navigate through a city and receives rewards for safe driving and penalties for violations.
a) What kind of learning is being implemented?
b) How does this method help the AI system learn to perform the task better over time?
Answer:
a) Reinforcement Learning
b) Reinforcement learning helps the AI agent learn through trial and error. It gets feedback in the form of rewards or penalties. Over time, the system optimizes its actions to maximize positive outcomes, making better decisions in similar situations in the future.

Q9. You are building a model to group customers based on buying habits without prior labels. Which learning type will you use? Why?
Answer:
Unsupervised Learning approach, because it finds hidden patterns, trends in the unlabelled data.

Q10. Differentiate between classification and regression models.
Answer:

Classification	Regression
This model deals with discrete outputs which means the data need not be continuous. (e.g., spam or not spam)	This model works on continuous data. (e.g., temperature).
Example: Classifying the house to a particular category i.e., Luxury, Midrange, affordable	Example: Predicting the Price of a house. i.e., in numbers
Example: Predict weather condition to particular category i.e., Sunny, Cloudy, Rainy.	Example: Predicting the temperature in degree Celsius.

Q11. A healthcare provider wants to identify patterns in patient data to personalize treatment plans. They have a dataset with various patient attributes but no predefined labels indicating specific treatment plans.
a) What type of learning approach is being used here?

b) Explain how this approach helps in deriving insights from the dataset.
Answer:
a) Unsupervised Learning
b) In unsupervised learning, the system works with unlabelled data. It identifies patterns, similarities, and differences on its own. In this case, the machine clusters patients based on shared characteristics, which can lead to grouped treatment plans for patients with similar profiles.

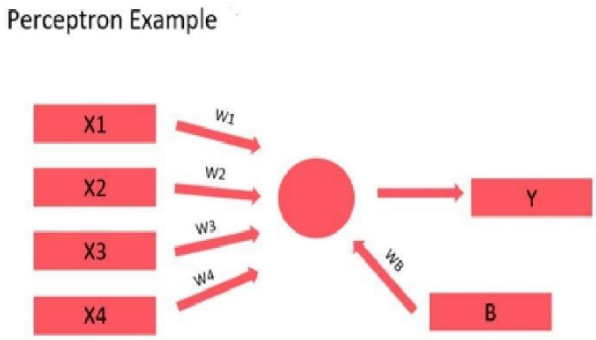
Q12. How can a regression model help predict real estate prices?
Answer: Regression model works on continuous data. (numeric data)
It uses features like size, location, and number of bedrooms to estimate a house's price as a continuous output.

Q13. What are the differences between Clustering and Classification
Answer:

Clustering	Classification
Clustering finds similarities between objects and places them in one cluster and objects with other similarities in another cluster.	Classification uses predefined classes in which objects are assigned.
Example: Recommendation systems in OTT Platforms.	Example: Email is Spam or not, Weather Forecast.

Q14. If a machine identifies similar songs based on listening habits, which model and method is being used? Identify the Learning approach and Model.
Answer:
Unsupervised learning approach.
Clustering model.

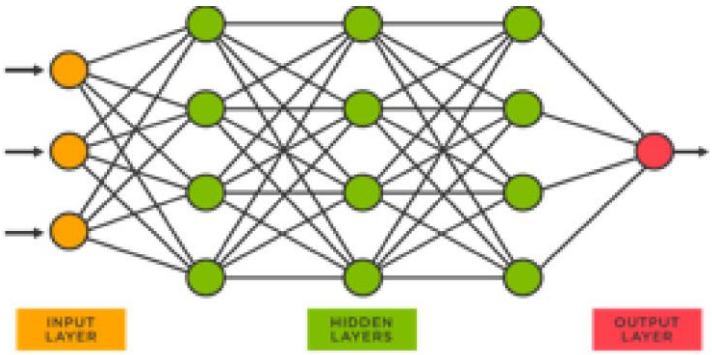
Q15. You are asked to represent the decision-making process of going out to a park based on four conditions: having a jacket, having an umbrella, current weather, and weather forecast.
a) Explain how a Perceptron model works in this context.
b) Illustrate the concept of weights, bias, and threshold in making the decision.
Answer:



a)
A perceptron takes inputs (example: jacket = 1, umbrella = 0), multiplies them by weights (importance), adds a bias, and calculates a weighted sum.
b) If the weighted sum exceeds a value >=0 (go out); otherwise, <0 (stay in).
For example:
Output = w1*x1 + w2*x2 + w3*x3 + w4*x4 - b
If Output >=0
→ Go to park
Else
→ Stay at home

Long Answer Questions with Answers

Q1. Explain neural networks. Describe the three layers of neural networks.
Answer:
An Artificial Neural Network (ANN) is a model inspired by the human brain. It consists of layers of interconnected nodes ("neurons") that process information. A neural network is essentially a system of organizing machine learning algorithms to perform certain tasks. It is a fast and efficient way to solve problems for which the dataset is very large, such as in images.



Layer 1: Input Layer

- The job of an input layer is to acquire data and feed it to the Neural Network. No processing occurs at the input layer.

Layer 2: Processing/Hidden Layer

- Each node of these hidden layers has its own machine learning algorithm which it executes on the data received from the input layer.
- Each node Learns patterns, relationships in the input received.
- Why "Hidden"? Not directly visible; it processes internal computations.
- There can be multiple hidden layers in a neural network that depends upon the complexity of the function.

Layer 3: Output Layer

- Produces final prediction/output.
- The last hidden layer passes the final processed data to the output layer which then gives it to the user as the final output.
- Similar to the input layer, output layer too does not process the data which it acquires.

Q2. Identify the type of learning (supervised, unsupervised, reinforcement learning) and justify the following case studies most likely based on?

Case Study 1: A company wants to predict customer churn based on past purchasing behaviour, demographics, and customer interactions. They have a dataset with labelled examples of customers who churned and those who did not.

Case Study 2: A social media platform wants to group users based on their interests and behaviour to recommend relevant content. They have a large dataset of user interactions but no predefined categories.

Case Study 3: An autonomous vehicle is learning to navigate through a city environment. It receives feedback in the form of rewards for reaching its destination safely and penalties for traffic violations.

Case Study 4: A healthcare provider wants to identify patterns in patient data to personalize treatment plans. They have a dataset with various patient attributes but no predefined labels indicating specific treatment plans.

Answer:

Case Study 1: Predicting customer churn

- Type of Learning: Supervised Learning
- Justification: The company has a labelled dataset with examples of customers who churned and those who did not. Since the goal is to predict a labelled outcome (churn or not) based on input features purchasing behaviour, this is a supervised learning scenario.

Case Study 2: Grouping users for content recommendation

- Type of Learning: Unsupervised Learning
- Justification: The goal is to group users based on their behaviour and interests without predefined categories or labels. This task involves finding patterns or clusters in the data, which is characteristic of unsupervised learning.

Case Study 3: Autonomous vehicle learning to navigate

- Type of Learning: Reinforcement Learning
- Justification: The autonomous vehicle learns by interacting with the environment, receiving rewards for good behaviour (reaching the destination safely) and penalties for bad behaviour (traffic violations). This feedback-based trial-and-error approach is typical of reinforcement learning.

Case Study 4: Identifying patterns in patient data

- Type of Learning: Unsupervised Learning
- Justification: The healthcare provider aims to find hidden patterns in patient data without predefined labels or outcomes. This suggests clustering or dimensionality reduction to support treatment personalization, which falls under unsupervised learning.

Q3. Identify the type of learning (supervised, unsupervised, reinforcement learning) and justify the following case studies most likely based on?

Case Study 1: An online learning platform wants to predict student performance in upcoming tests based on their previous quiz scores, course engagement data, and demographic information. The platform has labelled data indicating whether students passed or failed in past tests.

Case Study 2: A factory installs sensors on machines to collect data such as temperature, vibration, and noise levels. They want to detect abnormal machine behaviour that could indicate a malfunction. They do not have labelled examples of failures but want to monitor anomalies in real-time.

Case Study 3: A farming organization wants to optimize irrigation by using a drone that learns to adjust water levels based on crop health, weather conditions, and soil moisture. The drone receives a reward when crop yield improves and a penalty when overwatering occurs.

Case Study 4: A retail chain wants to segment its customers based on their purchasing habits to tailor marketing campaigns. They have large amounts of transaction data but no predefined customer segments.

Answer:

Case Study 1: Predicting student performance

- Type of Learning: Supervised Learning
- Justification: The dataset includes labelled outcomes (e.g., passed or failed), and the goal is to predict a specific outcome based on input features. This clearly fits the supervised learning model, where the model is trained on known inputs and outputs to make future predictions.

Case Study 2: Detecting abnormal machine behaviour

- Type of Learning: Unsupervised Learning
- Justification: Since there are no labelled outcomes (i.e., no specific examples of what constitutes a failure), the goal is to identify anomalies or patterns in sensor data. This is a typical application of unsupervised learning, especially using techniques like anomaly detection or clustering.

Case Study 3: A drone learning irrigation optimization

- Type of Learning: Reinforcement Learning
- Justification: The drone receives feedback in the form of rewards (high yield) or penalties (overwatering) and adjusts its actions accordingly. This trial-and-error learning with a focus on maximizing cumulative rewards is a characteristic of reinforcement learning.

Case Study 4: Segmenting customers based on purchase behaviour

- Type of Learning: Unsupervised Learning
- Justification: The objective is to group customers based on similarities in purchasing habits without existing labels or segments. This is a classic

clustering problem in unsupervised learning, often used for customer segmentation in marketing.

Q4. Explain the Perceptron Model with the given context. (Illustrative Model)

Context: Decide whether to go outside, based on weather-related inputs.

Factors:

- Do I have a jacket?
- Do I have an umbrella?
- Is it sunny now?
- What is the weather forecast later?

Answer:

Goal: Decide whether to go outside or prepare for the weather

Step-by-Step Conversion to Perceptron

Step 1: Define the Inputs

Question	**Variable**	**Case 1 Sample Answer**	**Case 2 Sample Answer**
Do I have a jacket?	X1	1 (Yes)	0 (No)
Do I have an umbrella?	X2	0 (No)	1(Yes)
Is it Sunny now?	X3	1(Yes)	0 (No)
What is the weather forecast for later? (Good(No rain)- Yes, Not Good(rain) - No)	X4	0 (No)	1(Yes)

Step 2: Assign Weights and Bias

Weights Importances	**Sample Example Weights**
W1 (having a jacket helps)	1.5
W2 (umbrella more important in rain)	1.0
W3 (it is Sunny now is most important)	3.0
W4 (weather to be ok is next most important)	2.5
Bias (B) (Note: Bias value can be higher or lower value, Higher bias value Favors to be cautious about weather,	4.0

lower bias value Favors going outside) Here we have taken +4.0	

Step 3: Apply the Perceptron Formula

Case 1:

Result = X1*W1 + X2*W2 + X3*W3 + X4*W4 - B

Result= 1*1.5 + 0*1.0 + 1*3.0 + 0*2.5 - 4.0

Result= 1.5+0.0+3.0+0.0 – 4.0 = +0.5

Case 2:

Result = X1*W1 + X2*W2 + X3*W3 + X4*W4 - B

Result= 0*1.5 + 1*1.0 + 0*3.0 + 1*2.5 - 4.0

Result= 0.0 + 1.0 + 0.0 + 2.5 – 4.0 = –0.5

Step 4: Apply Activation Function (Step Function)

Output= if Result >= 0 Go Outside

if Result < 0 Don't Go Outside

Case 1:

As Result = 0.5 > =0 → Go outside

Case 2:

As Result = − 0.5 < 0 → Don't go outside

Q5. Identify the type of model (classification, regression, clustering, association model) and justify the following case studies most likely based on?

Case Study 1: A bank wants to predict whether a loan applicant will "default" or "non-default" on their loan payments. They have a dataset containing information such as income, credit score, loan amount, and employment status.

Case Study 2: A real estate agency wants to predict the selling price of houses based on various features such as size, location, number of bedrooms, and bathrooms. They have a dataset containing historical sales data.

Case Study 3: A marketing company wants to segment its customer base into distinct groups based on purchasing behaviour for targeted marketing

campaigns. They have a dataset containing information such as purchase history, frequency of purchases, and amount spent.

Case Study 4: A grocery store wants to identify associations between different products purchased by customers to understand which products are commonly bought together. They have a transaction dataset containing records of items purchased together during each transaction.

Answer:

Case Study 1: Predicting Loan Default

- Type of Model: Classification
- Justification: The goal is to predict a categorical outcome — whether a customer will "default" or "non-default" on a loan. Since the outcome is binary (two classes), this is a classification problem.

Case Study 2: Predicting House Prices

- Type of Model: Regression
- Justification: The objective is to predict a continuous numeric value — the selling price of a house based on various features such as size, location, number of bedrooms, and bathrooms This falls under regression model.

Case Study 3: Customer Segmentation

- Type of Model: Clustering
- Justification: The goal is to group customers into segments based on behaviour, without predefined labels. This is a clustering task, a type of unsupervised learning.

Case Study 4: Product Association Analysis

- Type of Model: Association Model
- Justification: The task is to identify relationships between items purchased together, such as "customers who buy bread also buy butter." This is best addressed with association rule, making it an association model.

Q6. Identify the type of model (classification, regression, clustering, association model) and justify the following case studies most likely based

on?

Case Study 1: An investment firm wants to predict the future stock price of a company based on historical stock data, trading volume, market indicators, and financial reports.

Case Study 2: A social media platform wants to identify communities of users with similar interests and interactions for better content personalization. They have data on likes, comments, shares, and followed pages.

Case Study 3: A school wants to determine whether students will pass or fail a standardized exam based on features such as attendance, homework completion rate, quiz scores, and participation.

Case Study 4: An agricultural analytics company wants to find combinations of fertilizers and crop types that are frequently used together across different farms, to optimize supply chain and product bundling.

Answer:

Case Study 1: Predict the future stock price

- Type of Model: Regression
- Justification: The goal is to predict a continuous numerical value, the future stock price, based on past and present data. This clearly represents a regression problem.

Case Study 2: Identify communities of users

- Type of Model: Clustering
- Justification: The task is to group users based on patterns in their behaviour without predefined labels. This is a clustering problem used to uncover structure in user interaction data.

Case Study 3: Whether students will pass or fail.

- Type of Model: Classification
- Justification: The goal is to predict a categorical outcome (pass or fail), making this a classification problem.

Case Study 4: Find combinations of fertilizers and crop type

- Type of Model: Association Model
- Justification: The objective is to discover associations or frequent patterns among items (fertilizers and crops) used together, which is a typical use case for an association model.

Q7. Explain the Perceptron Model with the given context. (Illustrative Model)

Context: A manager is deciding whether to approve a work-from-home request from an employee.

Factors:

Does the employee perform well when working remotely?
Are there any upcoming team meetings or collaborative projects?
Does the company's policy support remote work?
Is it beneficial for both the employee and the company?

Answer:

Goal: whether to approve a work-from-home request or not

Step-by-Step Conversion to Perceptron

Step 1: Define the Inputs

We'll define each factor as a binary input (1 for Yes/True, 0 for No/False)

Question	Variable	Case 1 Sample Answer	Case 2 Sample Answer
Does the employee perform well when working remotely?	X1	0 (No)	1 (Yes)
Are there any upcoming team meetings or collaborative projects?	X2	0 (No)	0 (No)
Does the company's policy support remote work?	X3	1(Yes)	1(Yes)
Is it beneficial for both the employee and the company?	X4	0(No)	0(No)

Step 2: Assign Weights and Bias

Assign sample weights (w1 to w4) to reflect the importance of each factor. For example:

Weights Importances	Sample Example Weights
W1 (performance remotely is important)	0.6
W2 (collaboration can affect approval, but less critically)	0.4
W3 (policy compliance matters)	0.5
W4 (mutual benefit is most important)	0.7
Bias (B) (Note: Bias value can be higher or lower value, Higher bias value Favors to be Strict in permitting work from	1.0

home, lower bias value Favors to allow work from home) Here we have taken +4.0	

Step 3: Apply the Perceptron Formula

Case 1:

Result = X1*W1 + X2*W2 + X3*W3 + X4*W4 − B

Result= 0*0.6 + 0*0.4 + 1*0.5 + 0*0.7 – 1.0

Result= 0.0+0.0+0.5+0.0 – 1.0 = − 0.5

Case 2:

Result = X1*W1 + X2*W2 + X3*W3 + X4*W4 - B

Result= 1*0.6 + 0*0.4 + 1*0.5 + 0*0.7 – 1.0

Result= 0.6+0.0+0.5+0.0 – 1.0 = + 0.1

Step 4: Apply Activation Function (Step Function)

Output= if Result >= 0 Allow to work from home

If Result < 0 Don't allow to work from home

Case 1:

As Result = − 0.5 (i.e < 0)

Hence, Employee request to work from home is Not Approved.

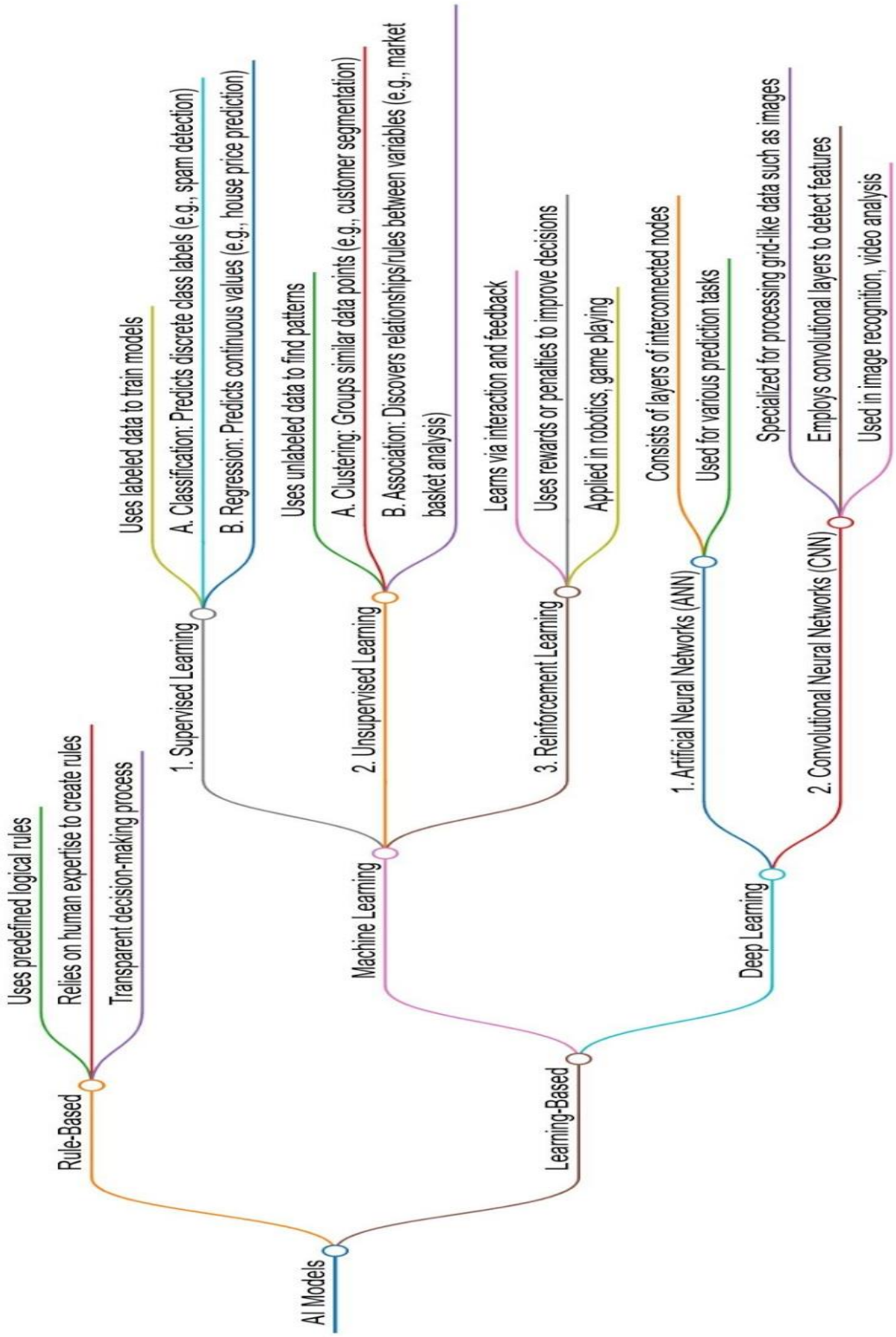
Case 2:

As Result = + 0.1 (i.e >= 0)

Hence, Employee request to work from home is Approved.

Unit-2: Advanced Concepts of Modelling in AI

MIND MAP



Unit 3: Evaluation Models

Learning Outcomes:

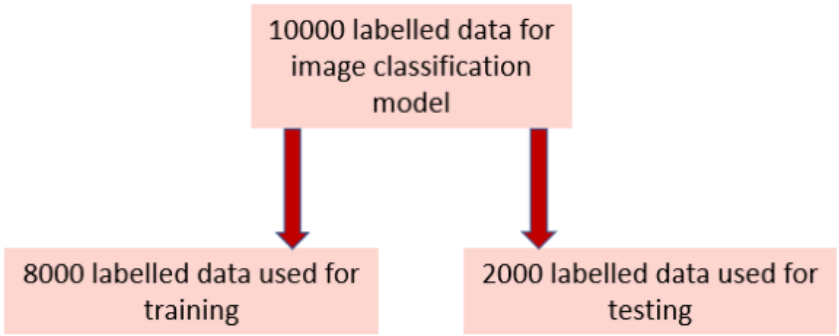
- Recognise common metrics used to evaluate AI models
- Derive and calculate the evaluation metrics
- Recognize the most suitable evaluation metric for a given application.

Main points

Evaluation

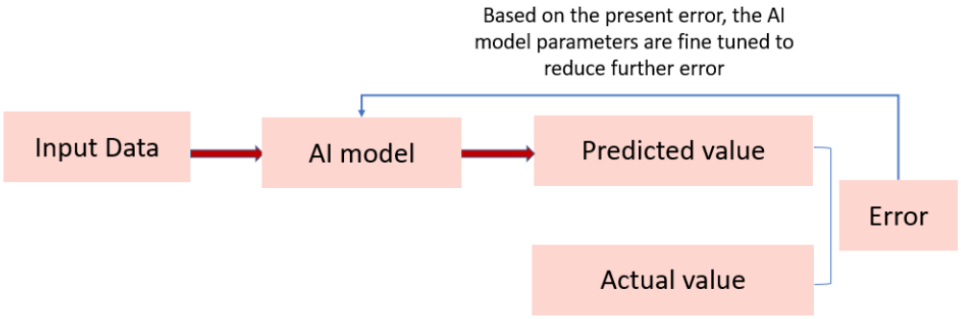
- Process of using different evaluation metrics to understand a machine learning model's performance.
  - Need of model evaluation
    - Helps you understand its strengths, weaknesses, and suitability for the task at hand.

- **Splitting the training set data for Evaluation**
  - Train-test split
    - Technique for evaluating the performance of a machine learning algorithm.
    - It can be used for any supervised learning algorithm.
    - The procedure involves taking a dataset and dividing it into two subsets:
      - The training dataset
      - The testing dataset
    - The train-test procedure is appropriate when there is a sufficiently large dataset available.



  - Need of Train-test split
    - 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.
    - **Accuracy and Error**
        - Accuracy
            - metric that allows you to measure the total number of predictions a model gets right.
        - Error
            - The difference between a model's prediction and the actual outcome. It quantifies how often the model makes mistakes.



- **Evaluation metrics for classification**
    - What is Classification?
        - Classification usually refers to a problem where a specific type of class label is the result to be predicted from the given input field of data
            - For example, A classifier model which identifies the fungal infections in paddy crops.
    - Classification metrics
        - Confusion matrix
            - The confusion matrix is a tabular presentation of the accuracy of a model with two or more classes.
            - The table presents the actual values on the y-axis and predicted values on the x-axis.
            - The numbers in each cell represents the number of predictions made by a machine learning algorithm that falls into that particular category

Confusion Matrix	Predicted Values		
Actual Values		1	0
	1	**12**	**06**
	0	**04**	**21**

True Positive (TP) is the outcome of the model correctly predicting the positive class
True Negative (TN) is the outcome of the model correctly predicting the negative class
False Positive (FP) is the outcome of the model wrongly predicting the negative class as positive class
False Negative (FN) is the outcome of the model wrongly predicting the positive class as the negative class
Example:Consider that a model has been developed to test specimens of paddy plants to diagnose fungal infections. The confusion matrix is shown below.

Confusion Matrix	Predicted Values		
Actual Values		1	0
	1	**12**	**06**
	0	**04**	**21**

From the **total 43 observations** conducted

- 12 observations **correctly** identified the fungal infection**(True positives)**.
- 04 observations **incorrectly** identified the fungal infection.(**False positives**)
- 21 observations **correctly** identified the absence of fungal infection**(True negatives)**.
- 06 observations **failed to** identify the fungal infection. (**False negatives**)

Classification accuracy

- Accuracy from Confusion matrix
- Classification accuracy is the number of correct predictions made as a ratio of all predictions made.

Confusion Matrix	Predicted Values		
Actual Values		1	0
	1	TP=12	FN=06
	0	FP=04	TN=21

Correct predictions=TP+TN

Total predictions=TP+TN+FP+FN

$$\text{Classification accuracy} = \frac{\text{Correct predictions}}{\text{Total predictions}}$$

$$= \frac{TP+TN}{TP+TN+FP+FN}$$

$$= \frac{12+21}{12+21+04+06} = 0.767$$

It is only suitable when there is an equal number of observations in each class, i.e., a balanced dataset (which is rarely the case), and that all predictions and prediction errors are equally important. In cases of unbalanced data, we should use other metrics such as Precision, Recall or F1 Score.

- Precision

  Precision is the ratio of the total number of correctly classified positive examples and the total number of predicted positive examples.

Confusion Matrix	Predicted Values		
Actual Values		1	0
	1	TP=12	FN=06
	0	FP=04	TN=21

$$\text{Precision} = \frac{\text{Correct positive predictions}}{\text{Total positive predictions}}$$

$$= \frac{TP}{TP+FP}$$

When to use?

Used for unbalanced datasets when dealing with the False Positives become important, and the model needs to reduce the FPs as much as possible.

- Recall
  - measure of our model correctly identifying True Positives

$$\text{Recall} = \frac{\text{Correct positive predictions}}{\text{Total actual positive values}}$$

$$= \frac{TP}{TP+FN}$$

When to use?

used for unbalanced dataset when dealing with the False Negatives become important and the model needs to reduce the FNs as much as possible.

- F1 score

  provides a way to combine both precisions and recall into a single measure that captures both properties where the dataset is unbalanced, and we are unable to decide whether FP is more important or FN, we should use the F1 score as the suitable metric.

$$\text{F1 Score} = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

- **Ethical concerns around model evaluation**
  - Bias
    - The evaluation metrics chosen should not result in any kind of bias
  - Transparency
    - Clarity in the explanation of the evaluation of model without any hidden information
  - Accountability
    - Taking the responsibility of the choice of evaluation metrics

Multiple Choice questions with answers

1. A _____ is a table that lists the predicted values of an AI model and the actual/correct outcome values.
   a) Classification Matrix b) Regression Matrix
   c) Confusion Matrix d) Deep learning Matrix

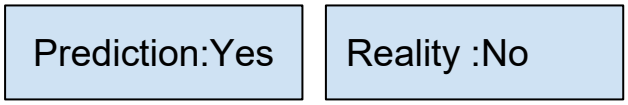
2. When both predicted value of the AI model and actual value are positive, it is called _____
   a) True Positive b) True Negative
   c) False Positive d) False Negative

3. Statement1: The output given by the AI model is known as reality.
   Statement2:The real scenario is known as Prediction.
   (a)Both Statement1 and Statement2 are correct
   (b)Both Statement1 and Statement2 are incorrect
   (c) Statement1 is correct but Statement2 is incorrect
   (d) Statement2 is correct but Statement1 is incorrect

4. Anjali has made a model which predicts the performance of students in the various examinations in India. She collected the data of students' performance with respect to state, age, school and curriculum. Her model works with good accuracy and precision value. Which of the statements given below is incorrect?
   (a) Data gathered with respect to state, age, school and curriculum is known as Testing Data.
   (b) Data given to an AI model to check accuracy and precision is Testing Data.
   (c) Training data and testing data are acquired in the Data Acquisition stage.
   (d) Training data is always larger as compared to testing data.

5. Amaira made a Forest Fire detector system for which she had collected the dataset and used all the dataset to train the model. Then, she used the same data to evaluate the model which resulted in the correct answer all the time but was not able to perform with unknown dataset. Name the concept.
   a)Best fit b) Overfitting c) underfitting d) Regression

6. Which condition of the evaluation does the following diagram indicate?



a) True Positiveb) True Negative c) False Positive d) False Negative

7. Which evaluation parameter takes into consideration all the correct predictions?

a)Precision b) Recall c) Accuracy d) F1 score

8. **Statement** 1: Overfitting is not recommended for evaluation of a model.
Statement 2: This is because the model will simply remember the whole training set, and will therefore always predict the correct label for any point in the training set.

(a) Both Statement 1 and Statement 2 are correct.

(b) Both Statement 1 and Statement 2 are incorrect.

(c) Statement 1 is correct but Statement 2 is incorrect.

(d) Statement 2 is correct but Statement 1 is incorrect.

9. It is one of the parameters for evaluating a model's performance which is defined as the percentage of true positive cases versus all the cases where the prediction is true. Which of the following evaluation parameters is this?

(a) Precision (b)Recall (c) F1 score (d) accuracy

10. With respect to evaluation, for which of the following does the prediction and reality match?

(a) True positive and False positive

(b) True positive and True negative

(c) False positive and False negative

(d) True positive and False negative

11. Which of these reflect the correct decisions by an AI model?

a) True Positive b) True Negative c) False Positive d) False Negative

12. ____ is the percentage of times the predictions out of all the observations are correct.

a) Precision Rate b) Recallc) Accuracy Rate d) F1 score

13. ____ is the rate at which desirable predictions turn out to be correct.
a) Precision Rate b) Recall c) Accuracy Rate d) F1 score

14. A high F1 score generally suggests:
a) A significant imbalance between precision and recall
b) A good balance between precision and recall
c) A model that only performs well on specific data points
d) The need for more training data

15. When the predicted value of the AI model is positive but actual value is negative, it is called _____
a) True Positive b) True Negative
c) False Positive d) False Negative

16. The goal of evaluating an AI model is to:
a) Maximize error and minimize accuracy
b) Minimize error and maximize accuracy
c) Focus solely on the number of data points used
d) Prioritize the complexity of the model

17. In a binary classification problem, a model predicts 70 instances as positive out of which 50 are actually positive. What is the recall of the model?
a) 50% b) 70% c) 80% d) 100%

18. A teacher's marks prediction system predicts the marks of a student as 75, but the actual mark obtained by the student is 80. What is the absolute error in the prediction?
a) 5 b) 10 c) 15 d) 20

19. Which of the following ethical concerns is related to taking the responsibility for the choice of evaluation metrics.
a) Bias b) Accountability c) Transparency d) Translucency

20. How is the relationship between model performance and accuracy described?
a) Inversely proportional b) Not related

c) Directly proportional d) Randomly fluctuating

Answer key

1.c	2.a	3.b	4.a	5.b
6.c	7.c	8.a	9.a	10.b
11.a,b	12.c	13.a	14.b	15.c
16.b	17.b	18.a	19.b	20.c

Short Answer questions with answers(2 marks)

Q1. Define Evaluation.

Ans: Evaluation is a process of understanding the reliability of any AI model, based on outputs by feeding the test dataset into the model and comparing it with actual answers.

Q2. **Which two parameters are considered for Evaluation of a model?**

Ans: Prediction and Reality are the two parameters considered for Evaluation of a model.The "Prediction" is the output which is given by the machine. "Reality" is the real scenario, when the prediction has been made.

Q3. **What is TruePositive?**

Ans: True positive is the outcome of the model correctly predicting the positive class . The predicted value matches the actual value.

Q4. **What is TrueNegative?**

Ans: True negative is the outcome of the model correctly predicting the negative class. Thee predicted value matches the actual value.

Q5. **What is FalsePositive?**

Ans: False positive is the outcome of the model wrongly predicting the negative class as positive class.

Q6. **What is FalseNegative?**

Ans: False Negative (FN) is the outcome of the model wrongly predicting the positive class as the negative class.

Q7. What is meant by Overfitting of Data?

Ans: Overfitting is the scenario where the model remembers the data in the training set , and always predicts the data in the training set with the correct label, for any point in the training set and may fail to predict future observations in any unseen data set.

Q8. What is a confusion matrix? What is it used for?

Ans: A Confusion Matrix is a table that is often used to describe the performance of a classification model on a set of test data for which the true values are known. It stores the results of comparison between the prediction and reality. From the confusion matrix, we can calculate parameters like recall, precision, F1 score which are used to evaluate the performance of an AI model.

Q9. Draw the Confusion matrix with following data

the number of true positive = 100

the number of true negative 47

the number of false positive = 62

the number of false negative = 290

Ans:

Confusion matrix	Reality	
Prediction	yes	no
yes	100	62
no	290	47

10. **Explain the need for a train-test split with an example.**

There is a need for a train test split since overfitting may occur. Overfitting is the scenario where the model remembers the data in the training set , and always predicts the data in the training set with the correct label, for any point in the training set and may fail to predict future observations in any unseen data set. So The performance of the model is estimated with the test data set, the data that is not used to train the model.

Example : If there is a model to classify the images of flowers and

vegetables,it will correctly label the images given in the training data set but may fail to label a new image which is not in the training set.

Long Answer questions(4 marks)

Q1. What is Accuracy? Mention its formula.

Ans: Accuracy is an evaluation metric that allows you to measure the total number of Predictions a model gets right.The accuracy of the model and performance of the model is directly proportional, and hence better the performance of the model, the more accurate are the predictions.

Correct prediction =TP+TN

Total Predictions=TP+TN+FP+FN

Accuracy =Correct Predictions /Total Predictions

=(TP+TN)/(TP+TN+FP+FN)

Q2. What is Precision? Mention its formula.

Ans: Precision is the ratio of the total number of correctly classified positive examples and the total number of predicted positive examples.

Precision =Correct Positive Predictions /Total Positive Predictions

=(TP)/(TP+FP)

It is used for unbalanced datasets when dealing with the False Positives becomes important, and the model needs to reduce the FPs as much as possible.

Q3. What is Recall? Mention its formula.

Ans: Recall is the measure of the model correctly identifying True Positives. It is also called Sensitivity or True Positive Rate. It is generally used for unbalanced dataset when dealing with the False Negatives becomes important and the model needs to reduce the FNs as much as possible.

Recall =Correct Positive Predictions /Total Actual Positive Values

=(TP)/(TP+FN)

Q4. Identify which metric (Precision or Recall) is to be used in the following cases and why?

a. MailSpamming

b. GoldMining

c. ViralOutbreak

Ans:

a) Precision has to be used since False Positives (legitimate emails marked as spam) have to be reduced as much as possible.
b) Precision has to be used since False Positives((incorrectly identifying a non-gold area as containing gold) have to be reduced as much as possible.
c) Recall is important in this case since False negatives have to be reduced as much as possible. False negatives in viral outbreak means failing to identify a person with disease, which may have life threatening consequences.

Q5. **An AI model made the following digital payment usage prediction in a state where government has recently launched the facility of digital payments:**

Confusion Matrix		Reality	
		Yes	No
Prediction	Yes	50	40
	No	12	10

(i) Identify the total number of wrong predictions made by the model.
(ii) Calculate precision, recall and F1 Score.

Ans:

(i)The total number of wrong predictions made by the model is the sum of false positive and false negative.= FP+FN

=40+12

= 52

(ii) Precision=TP/(TP+FP)

= 50/(50+40)

= 50/90

=0.55

Recall=TP/(TP+FN)

=50/(50+12)

=50/62

=0.81

F1 Score = 2*Precision*Recall/(Precision+Recall)

=2*0.55*.81/(.55+.81)

=.891/1.36

=0.65

Q6. **An Al model has been developed to test specimens of paddy plants to diagnose fungal,bacterial and viral infections. The model was tested on a data-set of about 630 tests and the resulting confusion matrix is as follows:**

- True Positives(TP): 110 tests correctly predicted the disease.
- False Positives(FP): 60 tests incorrectly predicted the disease
- True Negatives(TN): 410 tests correctly predicted the absence of disease
- False Negatives (FN): 50 tests incorrectly predicted the absence of disease

Calculate metrics such as accuracy, precision, recall, and F1-score.

Ans:

Accuracy= (TP+TN)/(FP+FN+TP+TN)
= (110+410)/(60+50+110+410)
= 520/630
= 0.825

Accuracy : 82.5%

Precision=TP/(TP+FP)
= 110/(110+60)
= 110/170
= 0.647

Recall=TP/(TP+FN)
=110/(110+50)
=110/160
=0.688

F1 Score = 2*Precision*Recall/(Precision+Recall)
=2*0.647*0.688/(0.647+0.688)
=0.890/1.335
= 0.667

Q7. In a sentiment analysis task, a model correctly predicts 120 positive sentiments out of 200 positive instances. However, it also incorrectly predicts 40 negative sentiments as positive. What is the F1 score of the

model?

Ans:

Given,

TP = 120

FP = 40

Total Actual Positive Values= 200

TP+FN =200

So, FN =200-TP

= 200- 120

=80

Recall = Correct Positive Predictions /Total Actual Positive Values

= (TP)/(TP+FN)

= 120/ 200

= 0.6

Precision = Correct Positive Predictions /Total Positive Predictions

=(TP)/(TP+FP)

=120/ (120+40)

= 120/180

= 0.75

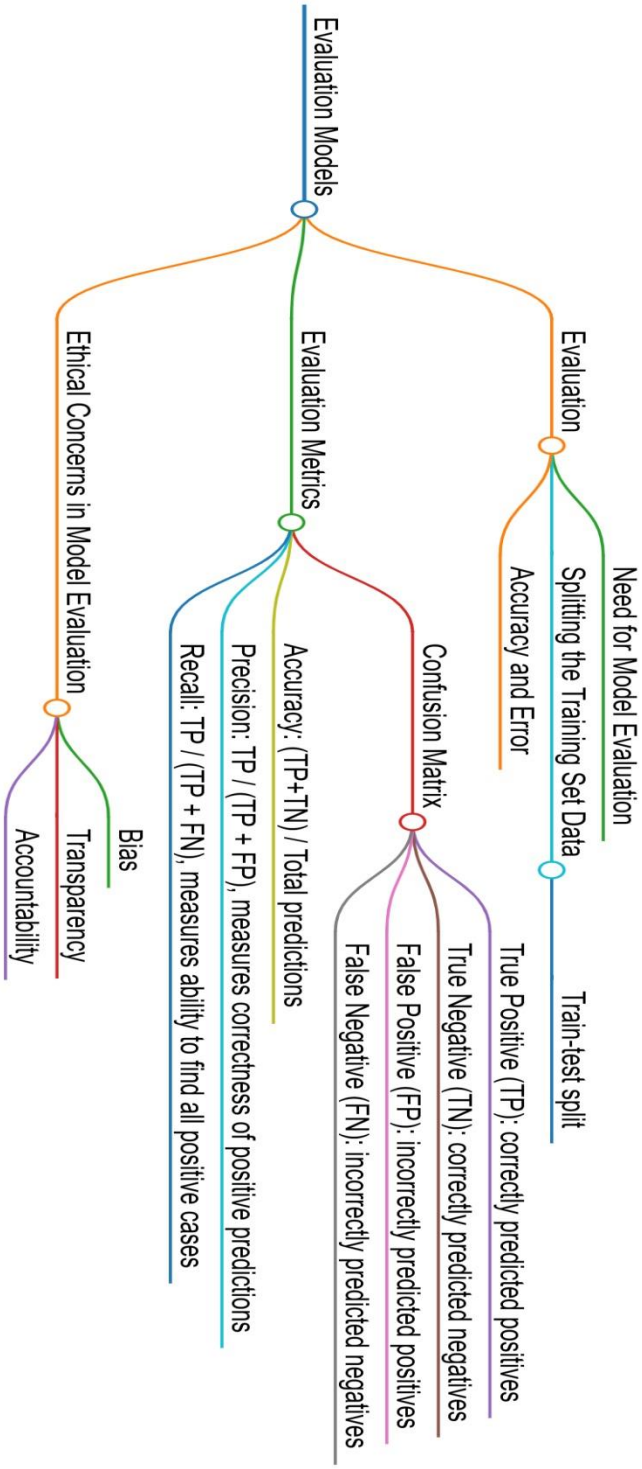
F1 Score = 2*Precision*Recall/(Precision+Recall)

=2*0.75*0.6/(0.75+0.6)

= 2 * 0.45/1.35

=0.66

MINDMAP


Evaluation Models
Evaluation
Need for Model Evaluation
Splitting the Training Set Data
Train-test split
Accuracy and Error
Evaluation Metrics
Confusion Matrix
True Positive (TP): correctly predicted positives
True Negative (TN): correctly predicted negatives
False Positive (FP): incorrectly predicted positives
False Negative (FN): incorrectly predicted negatives
Accuracy: (TP+TN) / Total predictions
Precision: TP / (TP + FP), measures correctness of positive predictions
Recall: TP / (TP + FN), measures ability to find all positive cases
Ethical Concerns in Model Evaluation
Bias
Transparency
Accountability

Unit 4: Computer Vision

Learning Outcomes

- Define the concept of Computer Vision and understand its applications in various fields.
- Understand the basic concepts of image representation, feature extraction, object detection, and segmentation.
- To demonstrate proficiency in using no-code AI tools for computer vision projects. To deploy models, fine-tune parameters, and interpret results. Skills acquired include data preprocessing, model selection, and project deployment.
- Apply the convolution operator to process images and extract useful features.
- Understand the basic architecture of a CNN and its applications in computer vision and image recognition.

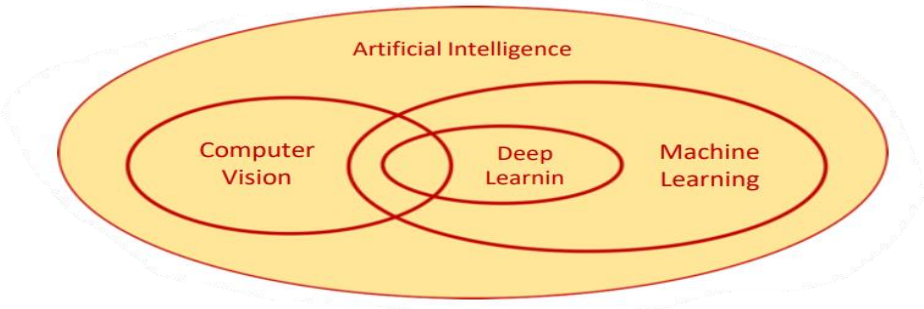
1. Computer Vision:

Computer Vision (CV) is a field of **Artificial Intelligence (AI)** that helps machines **"see" and understand images or videos** just like humans do.

- It teaches computers to **analyze, recognize, and make decisions** based on visuals.
- CV uses **Machine Learning (ML)** and **Deep Learning (DL)** to understand visual data.

Computer Vision and Artificial Intelligence

- Computer Vision is a part of Artificial Intelligence (AI).
- It helps machines understand images and videos.
- AI makes machines think, while Computer Vision helps them see and interpret visuals.



Why is it important?

- Automates tasks that need **human eyes** (e.g., identifying faces or objects).
- Helps in areas like **self-driving cars, facial recognition, healthcare**, and **security systems**.

Difference Between Computer Vision and Image Processing

Computer Vision	Image Processing
Focuses on interpreting images or videos to extract meaningful data and make predictions.	Focuses on enhancing or transforming images for further analysis.
Encompasses image processing as part of its workflow.	A component of computer vision tasks.
Examples: Object detection, face recognition, handwriting reading.	Examples: Resizing, adjusting brightness, filtering colors.

2. Applications of Computer Vision

Here are real-life uses of Computer Vision:

1. **Facial Recognition**
   Used in **phones and security systems** to recognize faces.
   Example: Face ID in iPhones.
2. **Self-Driving Cars**
   Detects roads, people, and signs to drive safely.
   Example: Tesla's Autopilot.
3. **Medical Imaging**
   Analyzes scans like X-rays and MRIs to detect diseases.
   Example: AI finds tumors faster than doctors.
4. **Retail Industry**
   Tracks customers and stock using cameras.
   Example: Amazon Go stores with no cashier.
5. **Google Translate Camera**
   Translates text from photos using OCR (Optical Character Recognition).
   Example: Translating a menu from Chinese to English.

3. Key Tasks in Computer Vision

Here are the main things **Computer Vision** can do with images:

- **Image Classification** – Tells what the object in the image is (e.g., cat or dog).
- **Localization** – Tells where the object is inside the image.

- **Object Detection** – Finds **multiple objects** in one image.
- **Instance Segmentation** – Separates and labels **every part** of an object in the image.

Example: A self-driving car detects people, vehicles, and traffic signs around it.

4. Understanding Images & Pixels

- **Pixel (Picture Element)** is the **smallest unit** of an image.
- Each pixel holds **color and brightness**.
- More pixels = **higher resolution** and better image clarity.

Types of Images:

- **Grayscale Images** – Only **black, white, and gray** (0 to 255).
- **RGB Images** – Uses **Red, Green, and Blue** colors.

Examples:

- Black = (0, 0, 0)
- White = (255, 255, 255)
- Red = (255, 0, 0)

5. Image Features

AI looks for special visual patterns:

- **Edges** – Sharp color changes (useful for object shapes).
- **Corners** – Meeting points of edges (used in 3D detection).
- **Blobs** – Similar color areas (used in medical scans).

Example: Detecting edges of car number plates using CV.

6. Introduction to OpenCV

OpenCV stands for **Open-Source Computer Vision**. It's a **Python library** that helps in:

- Reading and changing images.
- Doing tasks like face detection and noise removal.

Installing OpenCV:

pip install opencv-python

Common OpenCV functions:

- cv2.imread() – Load an image.
- cv2.imshow() – Show the image.
- cv2.cvtColor() – Change image colors (e.g., to grayscale).

7. No-Code AI Tools – Computer Vision

1. Lobe.ai (AutoML Tool)

- **No-code tool** that helps you create AI models **without programming**.
- Mainly used for **image classification**.

- You just **upload labeled images**, and it builds the **best model** to classify them.

2. Teachable Machine (by Google)

- Developed in **2017** by **Google**.
- Based on **TensorFlow.js** (a machine learning library).
- A **web-based tool** that trains models using:
  - **Images**
  - **Sounds**
  - **Poses** (from webcam/pictures)
- Easy to use for students and beginners.

Activity: Build a Smart Sorter (Using Computer Vision)

Goal: Automate sorting of items using image classification.

Steps:

1. Make a group of 4 students.
2. Collect images of **Bottles, Cans, and Paper**.
3. Use a **No-Code AI tool** (like Lobe or Teachable Machine).
4. Create 3 classes – **Bottles**, **Cans**, and **Paper**.
5. Train your model.
6. **Test the model** to see if it works correctly!

Orange Data Mining Tool – Coral Bleaching Project

Real-world Use Case: Build a **classification model** to detect **coral bleaching**.

What are Coral Reefs?

- Found in **tropical oceans**.
- Made from **skeletons of marine animals** called corals.
- **Important** for marine life and ecosystems.

What is Coral Bleaching?

- Coral loses color due to **temperature rise**, **pollution**, or **other environmental changes**.
- Early detection helps **protect marine life**.

Use Case Walkthrough:

- Create a model using **Orange Data Mining Tool**.
- Dataset and project steps are available via this link: bit.ly/orange_computer_vision

8. What is Convolution?

Convolution is a method to change an image by using a small matrix called a **kernel**.

A **kernel** moves over the image and changes pixel values to:

- Detect **edges**
- **Blur** or **sharpen** the image
- Remove **noise**

Example: In CCTV, convolution helps sharpen blurry images.

9. What are CNNs (Convolutional Neural Networks)?

CNNs are **deep learning models** specially made for analyzing images.

Layers in CNN:

1. **Convolution Layer** – Finds patterns like edges and textures.
2. **ReLU((Rectified Linear Unit) Layer** – Adds non-linearity to make learning better.
3. **Pooling Layer** – Shrinks the image while keeping the main parts.
4. **Fully Connected Layer** – Makes the final prediction.

Example: Instagram uses CNNs to detect your face for filters.

10. Pooling Layer

Reduces the image size to:

- Make processing **faster**
- Use **less memory**

Types:

- **Max Pooling** – Takes the largest value (best for feature selection).
- **Average Pooling** – Takes the average value.

Example: Compressing satellite images but keeping key features.

11. Fully Connected Layer

This is the **final step** in CNN.

- Uses all features from the image to **predict the result**.
- Outputs a **class label** (e.g., Cat or Dog).

Example: AI detects whether an X-ray shows a healthy or diseased lung.

Objective Questions on Computer Vision

1. What is the full form of CNN in the context of Computer Vision?

a) Convolutional Neural Network b) Computer Network Node
c) Central Neural Network d) Convoluted Network Node

2. Which of these is a key function of Computer Vision?

a) Text-to-speech conversion b) Image recognition
c) Data compression d) Speech processing

3. What is a pixel in an image?

a) Brightness tool b) A unit of image storage c) The smallest unit of an image d) An image filter

4. Which model is commonly used for color representation in digital images?

a) CMYK b) RGB c) HSV d) RYB

5. What is the main use of the pooling layer in a CNN?

a) To enlarge the image b) To reduce processing complexity c) To convert image format d) To sharpen image

6. Which of these is an application area of Computer Vision?

a) Facial recognition b) Audio mixing c) Sound detection d) Text translation

7. What does edge detection help achieve in image processing?

a) Blur the background b) Find object outlines c) Add shadow effects d) Remove image noise

8. What does resolution in an image typically indicate?

a) Number of bits b) Number of colors c) Width × Height in pixels d) Color range of pixels

9. Which range represents grayscale image pixel values?

a) 1 to 128 b) 0 to 255 c) 0 to 1000 d) 1 to 256

10. What is object detection in the context of CV?

a) Changing image colors b) Compressing images c) Finding objects within an image d) Saving an image

11. Which layer in a CNN is responsible for learning key features?

a) Output layer b) Pooling layer c) Convolutional layer d) Input layer

12. Which of the following is not a Computer Vision task?

a) Object detection b) Image segmentation c) Voice modulation d) Image classification

13. What is the core idea behind image classification?

a) Locate object boundaries b) Assign category to image c) Convert to grayscale d) Measure image resolution

14. What is the role of the ReLU layer in CNN?

a) Adds shadows b) Removes negative values

c) Enlarges feature map d) Rotates images

15. Object detection and handwriting recognition are examples of:

a) Sound processing b) Image compression

c) Computer Vision tasks d) Data entry

16. What does the pixel value indicate in a grayscale image?

a) The pixel size b) Color depth c) Brightness level d) Image height

17. In an RGB image, what does a pixel with all values 0 represent?

a) Maximum brightness b) Complete darkness c) Full saturation d) Grayscale tone

18. Assertion: Object detection is more complex than image classification.

Reason: It involves identifying the object's type and its position in the image.

a) Both A and R are true; R explains A b) Both A and R are true; R doesn't explain A

c) A is true; R is false d) A is false; R is true

19. Assertion: Grayscale images consist of varying shades of gray and use one byte per pixel.

Reason: Each pixel in grayscale has three intensity values ranging from 0 to 255.

a) Both A and R are true; R explains A b) Both A and R are true; R doesn't explain A

c) A is true; R is false d) A is false; R is true

20. What is the main goal of using CNNs in Computer Vision?

a) Text formatting b) Image encryption c) Pattern detection in visuals d) File conversion

Answer Key

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
a	b	c	b	b	a	b	c	b	c
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
c	c	b	b	c	c	b	a	c	c

Short Answer Questions on Computer Vision

1. Define Computer Vision and provide one real-life application.

Answer: Computer Vision is a field of Artificial Intelligence that enables machines to interpret and process visual information from the world, such as images and videos. A real-life application is facial recognition used in smartphone security systems.

2. What is the role of pixels in digital images?

Answer: Pixels, short for "picture elements," are the smallest units of a digital image. Each pixel represents a single point in the image and has its own color and intensity value, contributing to the overall picture.

3. Explain the difference between grayscale and RGB images.

Answer: Grayscale images consist of shades of gray, with pixel values ranging from 0 (black) to 255 (white). RGB images use three color channels—Red, Green, and Blue—each ranging from 0 to 255, to create a full spectrum of colors.

4. What is the purpose of the pooling layer in Convolutional Neural Networks (CNNs)?

Answer: The pooling layer reduces the spatial dimensions of the feature maps, which decreases computational load and helps in extracting dominant features that are rotational and positional invariant.

5. Name two Python functions from the OpenCV library used in image processing.

Answer: Two commonly used OpenCV functions are cv2.imread() for reading images and cv2.imshow() for displaying images.

6. Describe one application of Computer Vision in the healthcare industry.

Answer: In healthcare, Computer Vision is used in medical imaging to detect anomalies such as tumors in X-rays or MRI scans, aiding in early diagnosis and treatment planning.

7. What is edge detection in image processing, and why is it important?

Answer: Edge detection is a technique used to identify the boundaries within images. It is crucial for object detection and recognition, as it highlights significant transitions in pixel intensity.

8. How does Computer Vision contribute to autonomous vehicles?

Answer: Computer Vision enables autonomous vehicles to interpret visual data from their surroundings, such as recognizing traffic signs, detecting pedestrians, and identifying other vehicles, which is essential for safe navigation.

9. What is the function of the cv2.cvtColor() method in OpenCV?

Answer: The cv2.cvtColor() function is used to convert images from one color space to another, such as converting a color image to grayscale.

10. Explain the term 'object detection' in the context of Computer Vision.

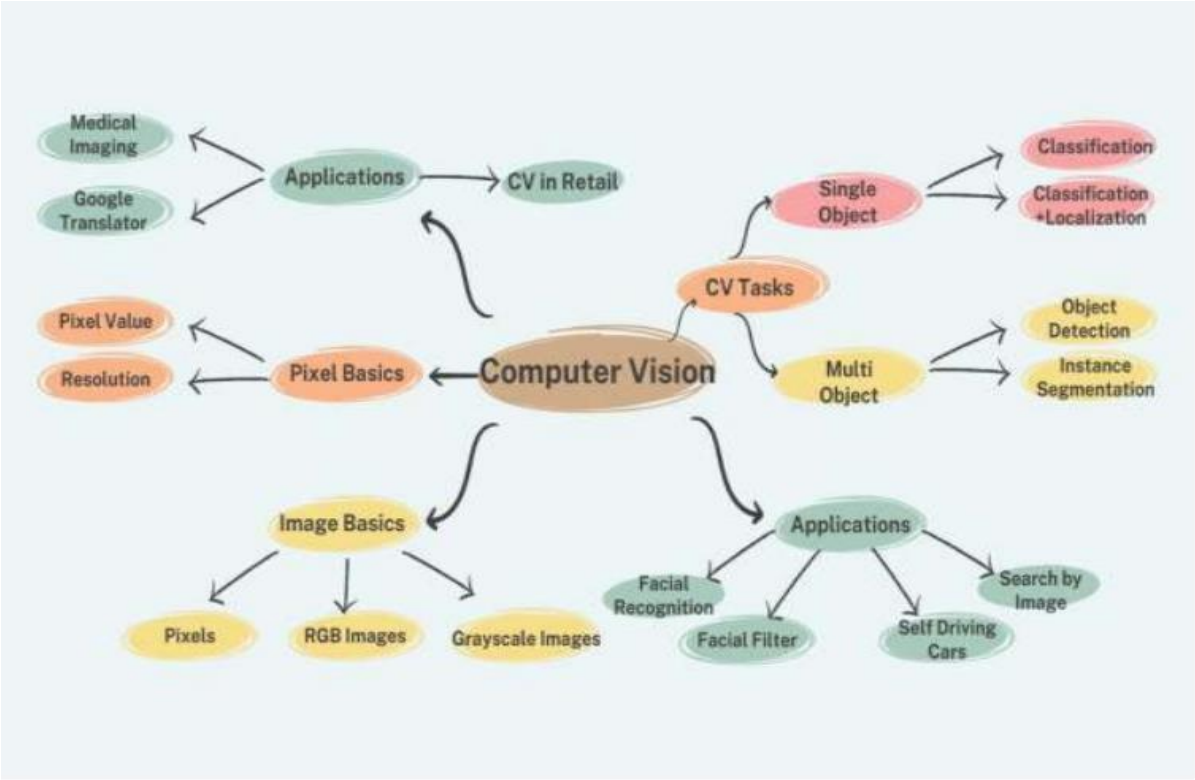
Answer: Object detection refers to the process of identifying and locating objects within an image or video. It involves classifying objects and determining their positions, often using bounding boxes.

11. Describe how image classification, classification with localization, object detection, and instance segmentation differ in computer vision. Support your explanation with suitable examples for each.

Answer.

Task	Description	Example
Image Classification	Predicts the main object or scene in the entire image.	A photo is classified as "cat".
Classification with Localization	Predicts the object class and its location (bounding box).	Identifying a "dog" and drawing a box around it.
Object Detection	Detects multiple objects with their classes and bounding boxes.	Detecting cars, people, and bikes in a street image.
Instance Segmentation	Detects, classifies, and precisely outlines each object at the pixel level.	Separating and labeling each person in a crowd.

COMPUTER VISION MIND MAP



UNIT 5 – NATURAL LANGUAGE PROCESSING

Learning outcomes:

- Comprehend the complexities of natural languages and elaborate on the need for NLP techniques for machines to understand various natural languages effectively.
- Explore the various applications of NLP in everyday life, such as , voice assistants, auto generated captions, language translation, sentiment analysis, text classification and keyword extraction.
- Understand the concepts like lexicon, syntax, semantics, and logical analysis of input text.
- Understand the concept of chatbot and the differences between smartbots and script bots.
- Learn about the Text Normalization technique used in NLP and the popular NLP model - Bag-of-Words.

Main points:

1. Features of Natural languages.
    - Natural language, like English, is a human language unlike artificial or machine languages.
    - Natural languages follow rules but are also flexible, changing over time and with use. Natural languages show creativity and efficiency, helping us communicate in new ways.
2. Introduction to Natural Language Processing.
    - Natural Language Processing (NLP) is a field that combines computer science, artificial intelligence and language studies.
    - It helps computers understand, process and create human language in a way that makes sense and is useful.
3. Various real-life applications of NLP
    - Sentiment analysis, chatbots, machine translation, and text summarization.
4. Explore the various stages of NLP that involve in understanding and processing human language.
    - Lexical Analysis
    - Syntactic Analysis

- Semantics Analysis
- Discourse Integration
- Pragmatic Analysis

5. Text Normalization
   - Tokenization
   - Lowercasing
   - Stop word removal
   - Stemming and lemmatization
6. Bag of Words
   - A fundamental technique used to represent text data as numerical vectors.
   - It essentially treats a document as a collection (or "bag") of words, ignoring word order and grammar, and focuses on the frequency of each word.
   - This allows machine learning algorithms to process text data more easily.

Multiple Choice Questions (MCQs)

1. Which feature of NLP helps in understanding the emotions of the people mentioned with the feedback?
   (a) Virtual assistants (b) Sentiment analysis
   (c) Text classification (d) Automatic summarization

2. Which of the following is used for finding the frequency of words in some given text sample?
   (a) Stemming (b) Lemmatisation
   (c) Bag of words (d) None of the above

3. Machine translation feature converts _____.
   (a) One language to another
   (b) Human language to machine language
   (c) Any human language to Programming
   (d) Machine language to human language

4. Which of the following comes under NLP?
   (a) Chatbots (b) Price comparison websites
   (c) Facial recognition (d) All of the above

5. Chatbots are AI systems which
   (a) Interact with humans through text or speech
   (b) Are able to offer round the clock responses and handle multiple queries simultaneously
   (c) Both (a) and (b) (d) Neither (a) nor (b)

6. What do we call the process of dividing a string into component words?
   (a) Regression (b) Word Tokenisation
   (c) Classification (d) Clustering

7. Sentence segment is the _____ step for building the NLP model.
   (a) First (b) Second
   (c) Third (d) Fourth

8. Which of these is not a stopword?
   (a) This (b) Things
   (c) Is (d) Do

9. What is the stem of the word “Making”?
   (a) Mak (b) Make
   (c) Making (d) Maker

10. What is the lemma of the word “Making”?
   (a) Mak (b) Make
   (c) Making (d) Maker

11. Which algorithms result in two things, a vocabulary of words and frequency of the words in the corpus?
   (a) Sentence segmentation (b) Tokenisation
   (c) Bag of words (d) Text normalisation

12. Which of the following is the type of data used by NLP applications?
   (a) Images (b) Numerical data
   (c) Graphical data (d) Text and Speech

13. A corpus contains 12 documents. How many document vectors will be there for that corpus?
(a) 12 (b) 1 (c) 24 (d)1 / 12

14. This real life application of NLP is used to provide an overview of a news item or blog post, while avoiding redundancy from multiple sources and maximising the diversity of content obtained. Which is this application?
(a) Chatbot (b) Virtual Assistant
(c) Sentiment Analysis (d) Automatic Summarisation

15. Which of the following words represent an example of a lemma resulting from lemmatisation for "caring" in context to Natural Language Processing (NLP)?
(a) Care (b) Cared
(c) Cares (d) Car

16. Bag of Words is a _____ model which helps in extracting features out of the text which can be helpful in machine learning algorithms.
(a) Data Science (DS) (b) Virtual Reality (VR)
(c) Natural Language Processing (NLP) (d) Computer Vision (CV)

17. Select the correct features of Smart Bot
(a) Smart-bots are flexible and powerful
(b) Coding is required to take this up on board
(c) Smart bots work on bigger databases and other resources directly
(d) All of the above

18. For _____ the whole corpus is divided into sentences. Each sentence is taken as a different data so now the whole corpus gets reduced to sentences.
(a) Text Regulation (b) Sentence Segmentation
(c) Tokenization (d) Stemming

19. Assertion (A): Stemming is a technique used to reduce an inflected word down to its word stem.
Reason (R): For example, the words “programming,” “programmer,” and “programs” can all be reduced down to the common word stem “program”.
(a) Both A and R are correct and R is the correct explanation of A
(b) Both A and R are correct but R is not the correct explanation of A
(c) A is correct but R is not correct
(d) A is not correct but R is correct

20. Assertion (A): TF-IDF is a natural language processing (NLP) technique that’s used to evaluate the importance of different words in a sentence.
Reason (R): It’s useful in text classification and for helping a machine learning model read words.
(a) Both A and R are correct and R is the correct explanation of A
(b) Both A and R are correct but R is not the correct explanation of A
(c) A is correct but R is not correct
(d) A is not correct but R is correct

Multiple Choice Questions (MCQs) - Answers:

1. b	2. c	3. a	4. a	5. c
6. b	7. a	8. b	9. a	10. b
11. c	12. d	13. a	14. d	15. a
16. c	17. d	18. b	19. a	20. a

Short answer type questions:

1. What is the meaning of syntax and semantics in NLP?

Answer:

Syntax refers to the grammatical structure of a sentence. Semanticss refers to the meaning of the sentence.

2. What is the difference between stemming and lemmatization?
Answer:
Stemming is a technique used to extract the base form of the words by removing affixes from them. It is just like cutting down the branches of a tree to its stems. For example, the stem of the words eating, eats, eaten is eat. Lemmatization is the grouping together of different forms of the same word. In search queries, lemmatization allows end users to query any version of a base word and get relevant results.
3. What is a document vector table?
Answer:
Document Vector Table is used while implementing Bag of Words algorithm. In a document vector table, the header row contains the vocabulary of the corpus and other rows correspond to different documents. If the document contains a particular word it is represented by 1 and absence of word is represented by 0 value.
4. What do you mean by corpus?
Answer:
In Text Normalization, we undergo several steps to normalize the text to a lower level. That is, we will be working on text from multiple documents and the term used for the whole textual data from all the documents altogether is known as corpus.
5. Differentiate between a script-bot and a smart-bot. (Any 2 differences)
Answer:
Script-bot
· A scripted chatbot doesn't carry even a glimpse of A.I
· Script bots are easy to make
Smart-bot
· Smart bots are built on NLP and ML.
· Smart –bots are comparatively difficult to make.
6. What is inverse document frequency?
Answer:
Document Frequency is the number of documents in which the word occurs irrespective of how many times it has occurred in those documents. In case of inverse document frequency, we need to put the document frequency in the denominator while the total number of documents is the numerator. For example, if the document frequency of a word "AMAN" is 2 in a particular document then its inverse document frequency will be 3/2. (Here no. of documents is 3).

7. What is the significance of converting the text into a common case?
Answer:
In Text Normalization, we undergo several steps to normalize the text to a lower level. After the removal of stop words, we convert the whole text into a similar case, preferably lower case. This ensures that the case-sensitivity of the machine does not consider same words as different just because of different cases.
8. Mention some applications of Natural Language Processing.
Answer:
Natural Language Processing Applications-
- Sentiment Analysis.
- Chatbots & Virtual Assistants.
- Text Classification.
- Text Extraction.
- Machine Translation
- Text Summarization
- Market Intelligence
- Auto-Correct

9. What are stop words? Explain with the help of examples.
Answer:
"Stop words" are the most common words in a language like "the", "a", "on", "is", "all". These words do not carry important meaning and are usually removed from texts. It is possible to remove stop words using Natural Language Toolkit (NLTK), a suite of libraries and programs for symbolic and statistical natural language processing.
10. Explain the concept of Bag of Words.
Answer:
Bag of Words is a Natural Language Processing model which helps in extracting features out of the text which can be helpful in machine learning algorithms. In bag of words, we get the occurrences of each word and construct the vocabulary for the corpus. Bag of Words just creates a set of vectors containing the count of word occurrences in the document (reviews). Bag of Words vectors are easy to interpret. The bag of words gives us two things:

i) A vocabulary of words for the corpus

ii) The frequency of these words (number of times it has occurred in the whole corpus).

Long answer type questions:

1. Why are human languages complicated for a computer to understand? Explain.
Answer:
The communications made by the machines are very basic and simple. Human communication is complex. There are multiple characteristics of the human language that might be easy for a human to understand but extremely difficult for a computer to understand. For machines it is difficult to understand our language. Arrangement of the words and meaning - There are rules in human language. There are nouns, verbs, adverbs, adjectives. A word can be a noun at one time and an adjective some other time. This can create difficulty while processing by computers. Multiple Meanings of a word - In natural language, it is important to understand that a word can have multiple meanings, and the meanings fit into the statement according to the context of it.
Perfect Syntax, no Meaning - Sometimes, a statement can have a perfectly correct syntax but it does not mean anything. In Human language, a perfect balance of syntax and semantics is important for better understanding. These are some of the challenges we might have to face if we try to teach computers how to understand and interact in human language
2. What are the steps of Text Normalization? Explain them briefly.
Answer:
Text Normalization: In Text Normalization, we undergo following steps to normalize the text to a lower level.
i) Sentence Segmentation - Under sentence segmentation, the whole corpus is divided into sentences. Each sentence is taken as a different data so now the whole corpus gets reduced to sentences.
ii) Tokenisation - After segmenting the sentences, each sentence is then further divided into tokens. Tokens is a term used for any word or number or special character occurring in a sentence. Under tokenisation, every word, number and special character is considered separately and each of them is now a separate token.
iii) Removing Stop words, Special Characters and Numbers - In this step, the tokens which are not necessary are removed from the token list.
iv) Converting text to a common case -After the stop words removal, we convert the whole text into a similar case, preferably lower case. This ensures that the case-sensitivity of the machine does not consider same words as different just because of different cases.
v) Stemming - In this step, the remaining words are reduced to their root words.

In other words, stemming is the process in which the affixes of words are removed and the words are converted to their base form.

vi) Lemmatization - In lemmatization, the word we get after affix removal (also known as lemma) is a meaningful one. With this we have normalized our text to tokens which are the simplest form of words present in the corpus. Now it is time to convert the tokens into numbers. For this, we would use the Bag of Words algorithm.

3. Through a step-by-step process, calculate TFIDF for the given corpus and mention the word(s) having highest value.

Document 1: We are going to Mumbai

Document 2: Mumbai is a famous place.

Document 3: We are going to a famous place.

Document 4: I am famous in Mumbai.

Answer:

Term frequency is the frequency of a word in one document. Term frequency can easily be found from the document vector table as in that table we mention the frequency of each word of vocabulary in each document.

We	are	going	to	Mumbai	is	a	famous	place	I	am	in
1	1	1	1	1	0	0	0	0	0	0	0
0	0	0	0	1	1	1	1	1	0	0	0
1	1	1	1	0	0	1	1	1	0	0	0
0	0	0	0	1	0	0	1	0	1	1	1

Document Frequency is the number of documents in which the word occurs irrespective of how many times it has occurred in those documents. The document frequency would be:

We	are	going	to	Mumbai	is	a	famous	place	I	am	in
2	2	2	2	3	1	2	3	2	1	1	1

Here, the total number of documents are 4, hence inverse document frequency becomes:

We	are	going	to	Mumbai	is	a	famous	place	I	am	in
4/2	4/2	4/2	4/2	4/3	4/1	4/2	4/3	4/2	4/1	4/1	4/1

The formula of TFIDF for any word W becomes:

$$TFIDF(W) = TF(W) * \log(IDF(W))$$

4. Explain how AI can play a role in sentiment analysis of human beings?

Answer:

The goal of sentiment analysis is to identify sentiment among several posts or

even in the same post where emotion is not always explicitly expressed. Companies use Natural Language Processing applications, such as sentiment analysis, to identify opinions and sentiment online to help them understand what customers think about their products and services. Sentiment analysis understands sentiment in context to help better understand what's behind an expressed opinion, which can be extremely relevant in understanding and driving purchasing decisions.

5. Through a step-by-step process, perform text normalization for the given Corpus:

Raj and Vijay are best friends. They play together with other friends. Raj likes to play football but Vijay prefers to play online games. Raj wants to be a footballer. Vijay wants to become an online gamer.

Answer:

Sentence segmentation:

1. Raj and Vijay are best friends.
2. They play together with other friends.
3. Raj likes to play football but Vijay prefers to play online games.
4. Raj wants to be a footballer.
5. Vijay wants to become an online gamer.

Tokenization:

Raj	and	Vijay	are	Best	friends.						
They	play	together	with	Other	friends.						
Raj	likes	to	play	football	but	Vijay	prefers	to	play	online	games.
Raj	wants	to	be	A	footballer.						
Vijay	wants	to	become	An	online	gamer.					

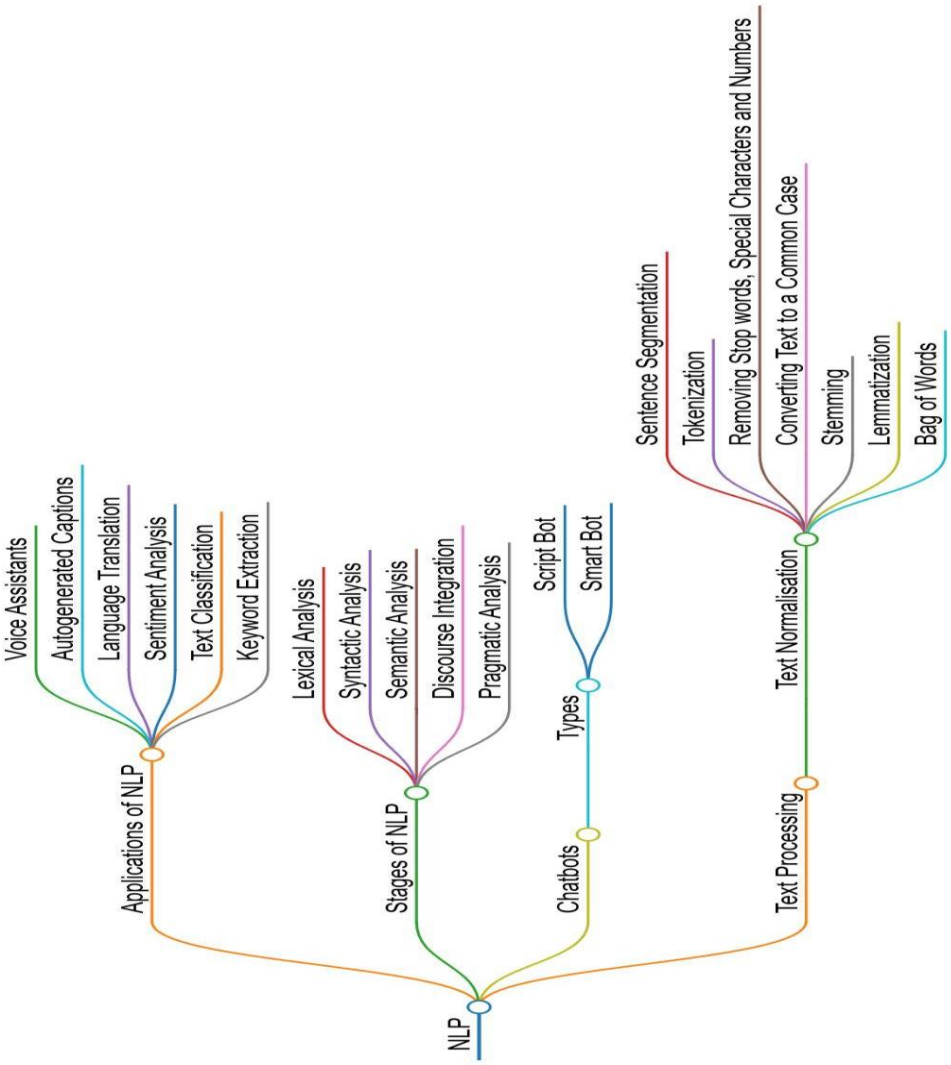
Removing punctuation and stop words and converting to common case:

Raj	and	Vijay		Best	friends.						
They	play	together	with	Other	friends.						
Raj	likes		play	football	but	Vijay	prefers	to	play	online	games.
Raj	wants				footballer.						
Vijay	wants		become		online	gamer.					

Stemming and lemmatization:

Word	Stem	Word	Stem
play	play	likes	like
wants	want	friends	friend
games	Game	gamer	game

Unit 6-MIND MAP



PRACTICAL

Unit 4 Statistical Data

Introduction & No code AI tool

Activity 1

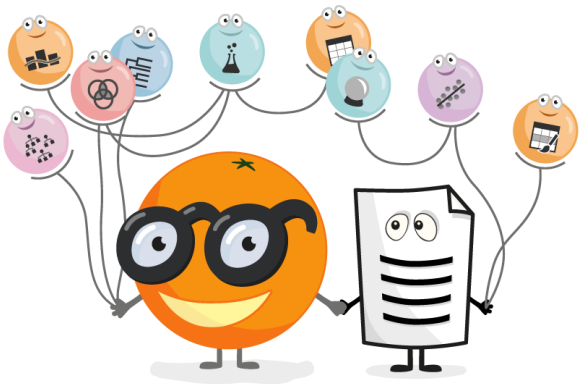
Familiarization of any two No code AI tools.:

Two No Code AI tools are :

- Orange Data mining tool
- Google Cloud AutoML

Orange Data Mining

Orange enables you to visualize data and perform data mining and machine learning. This platform can be used for analysis, is relatively easy, and has beautiful visuals.



Google Cloud AutoML

- Users with limited ML knowledge can train high-quality models specific to their business needs with minimal effort.
- Users can build their own custom machine learning model in minutes and then use the models in their applications and web sites.

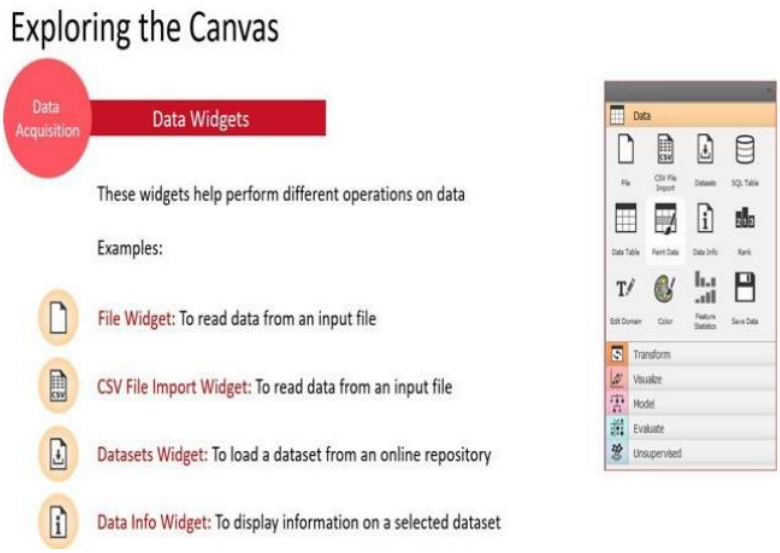
Link : [Introducing Cloud AutoML]

Activity 2

Familiarization of commonly used Orange data mining widgets.

1. **Data Loading Widgets:** These widgets help you bring your data into Orange from files or online sources.

File: Allows you to load data from files in various formats such as CSV, Excel, and SQL.
URL: Loads data from a URL.
Data Table: Displays loaded data in a tabular format.

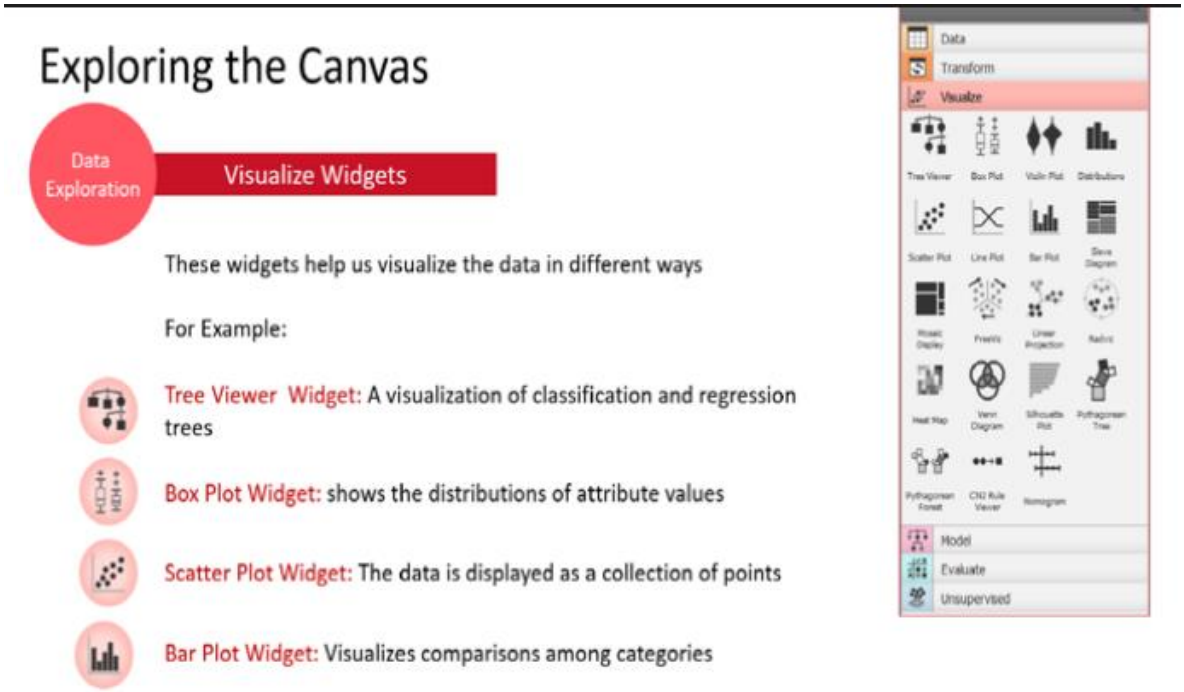


2.**Data Exploration Widgets:** These widgets allow you to look at your data in different ways, like scatter plots or histograms, to see patterns or trends.

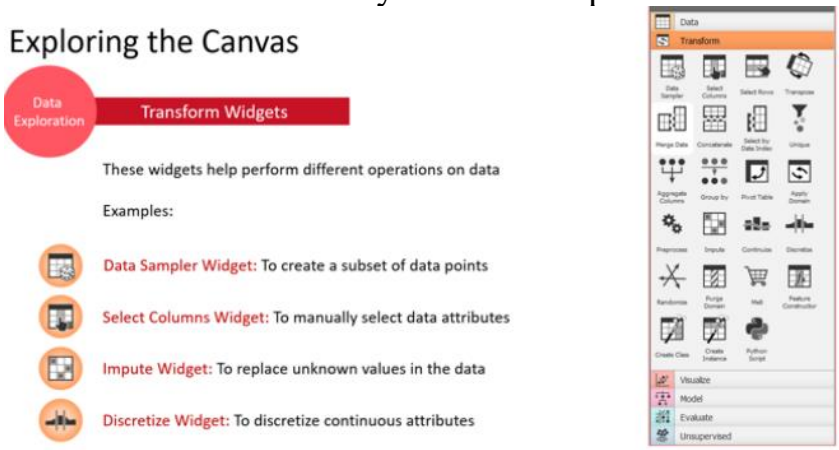
Scatter Plot: Visualizes the relationship between two variables in the data.

Data Table: Allows for manual inspection and exploration of data.

Distributions: Displays histograms and other statistical distributions of variables.



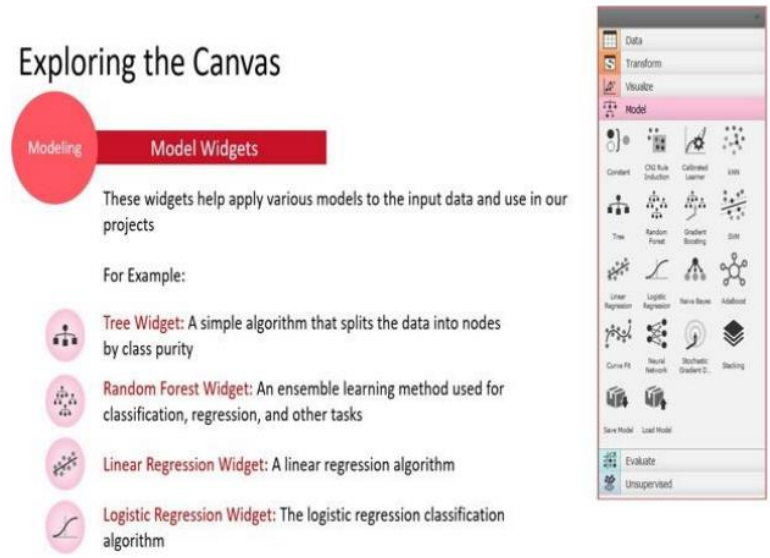
3. **Preprocessing Widgets**: These widgets help you clean up your data, like filling in missing values or making sure all your data is on the same scale.
Impute: Handles missing values in the dataset. Normalize: Normalizes the data to a common scale.
Select Columns: Allows you to select specific columns from the dataset.



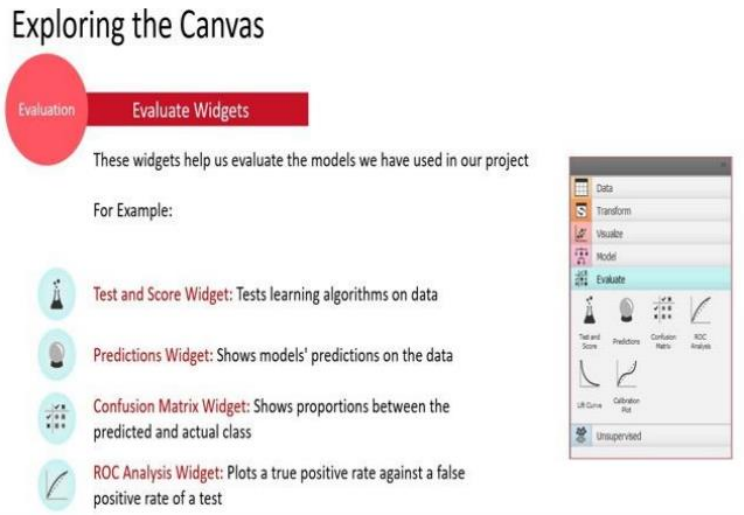
4. **Feature Selection Widgets:** These widgets help you choose which parts of your data are most important for your analysis.
Select Columns: Allows you to choose relevant columns/features from the dataset.
Select Best Features: Automatically selects the best features based on certain criteria like mutual information or correlation.

5. Modelling Widgets: These widgets build models from your data, like decision trees or clustering algorithms, to help you understand it better.
Classification Tree: Constructs a decision tree classifier.

k-Means: Performs k-means clustering on the data.
Support Vector Machine: Trains a support vector machine classifier.
Logistic Regression: Constructs a logistic regression model.



6. **Evaluation Widgets:** These widgets help you see how well your models are performing, so you can make adjustments if needed.
Test & Score: Evaluates the performance of a predictive model on a test dataset.
Cross Validation: Performs cross-validation to assess model performance.



7. Visualization Widgets: These widgets help you turn your data into visual representations, like charts or graphs, to make it easier to understand.
Bar Chart: Displays data in a bar chart format.
Heat Map: Visualizes data using a heatmap.
Scatter Plot: Visualizes the relationship between two variables.

Statistical Data: Use Case Walkthrough

AI model Creation and Evaluation using No code AI tool, Orange Data Mining

Scenario: Kayla is a wildlife animal's dietitian manager at the zoo. She takes care of the cost of buying meat and vegetables for animals. With the prices of food increasing rapidly, it will become more expensive for the zoo to buy healthy and nutritious foods for its animals. Therefore, the zoo's accounts team wants to know the increase in the price of food so that they can ask the government or sponsors to fund for the food. Thus, Kayla requires the help of AI to predict the price.We are helping her build a price prediction model to predict the prices of meat and vegetables without any code, using a No code AI tool Orange Data Mining.

Dataset: https://www.fao.org/worldfoodsituation/foodpricesindex/en/

Activity 1:

Upload and View the dataset in orange data mining tool

Steps for uploading

- Click on the File widget under Data Menu
- File widget will appear on the canvas
- Click on it and browse to the folder to upload the dataset
- Select the target variable as Food Price Index, as we are trying to predict the price index.

Steps for viewing

- Click on the Data Table widget under Data Menu
- Data Table widget will appear on the canvas
- Connect File to Data Table
- Click on Data Table to view the dataset using the tool.

Activity 2

Select the model for prediction

Steps for Selecting the Model for Prediction

- Click on the Linear Regression widget under Model Menu
- Linear Regression widget will appear on the canvas

- Connect File to Linear Regression
- Linear Regression is an algorithm used for Regression Model

Activity 3

Evaluate the Model

Steps for Evaluating the Model

- Click on the Test and Score widget under Evaluate Menu
- Test and Score widget will appear on the canvas
- Connect File and Linear Regression to Test and Score to check the performance parameters.
- Click on Test and Score to view the parameters.

Activity 4

Model Prediction

Steps for Model Prediction

- Click on the Prediction widget under Evaluate Menu
- Prediction widget will appear on the canvas
- Connect the Test and Score to the Prediction to check the prediction made by the Logistic Regression Model.
- Click on Prediction to view the price prediction.

Suggested Datasets for extra activities

1. https://www.kaggle.com/datasets/teamincribo/cyber-security-attacks
2. https://www.kaggle.com/datasets/willianoliveiragibin/games-and-students
3. https://www.data.gov.in/catalog/all-india-seasonal-and-annual-temperature-series

UNIT-5 COMPUTER VISION

Pre-requisite:

Notes for Teachers and Students:

- Ensure you have OpenCV installed: pip install opencv-python
- Use sample images like 'sample_image.jpg' placed in the same folder as the Python file
- These programs demonstrate core CV concepts like image loading, color transformation, and feature detection.

Program 1: Read and Display an Image

Objective: To read an image using OpenCV and display it in a window.

Program:

```
import cv2

# Load an image from file

image = cv2.imread('sample_image.jpg')

# Display the image in a window

cv2.imshow('Displayed Image', image)

# Wait until a key is pressed

cv2.waitKey(0)

# Close all OpenCV windows

cv2.destroyAllWindows()
```

Concept Covered:

- cv2.imread() – Reads image
- cv2.imshow() – Displays image
- cv2.waitKey() – Waits for a key press
- cv2.destroyAllWindows() – Closes image window

Program 2: Convert an Image to Grayscale
Objective: Convert a colored image into grayscale using OpenCV.
Program:

```
import cv2

# Read the original image

image = cv2.imread('sample_image.jpg')

# Convert the image to grayscale

gray_image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

# Display the grayscale image

cv2.imshow('Grayscale Image', gray_image)

cv2.waitKey(0)

cv2.destroyAllWindows()
```

Concept Covered:

- cv2.cvtColor() – Used for color conversion
- cv2.COLOR_BGR2GRAY – Converts BGR (color) to grayscale

Program 3: Detect Edges in an Image Using Canny Edge Detection
Objective: Use the Canny method to detect edges in an image.
Program:

```
import cv2

# Read the image

image = cv2.imread('sample_image.jpg')

# Convert to grayscale for edge detection

gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

# Apply Canny edge detection

edges = cv2.Canny(gray, 100, 200)

# Show the edge-detected image
```

```
cv2.imshow('Edge Detection', edges)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

Concept Covered:

- cv2.Canny() – Detects edges using threshold values
- Helps in identifying outlines and object shapes

UNIT-6 NATURAL LANGUAGE PROCESSING

Program 1. Sentiment Analysis, This program uses the NLTK library to determine the sentiment of a given text.

Program:

```
import nltk
from nltk.sentiment import SentimentIntensityAnalyzer
nltk.download('vader_lexicon')
text = "I love natural language processing! It's so interesting and useful."
analyzer = SentimentIntensityAnalyzer()
sentiment_scores = analyzer.polarity_scores(text)
print(sentiment_scores)
```

Output:

{'neg': 0.0, 'neu': 0.456, 'pos': 0.544, 'compound': 0.7003}

Program 2. Stop Words Removal, This program removes common English stop words from a given list of words.

Program:

```
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
nltk.download('stopwords')
nltk.download('punkt')
text = "This is an example sentence, showing off stop words filtration."
stop_words = set(stopwords.words('english'))
word_tokens = word_tokenize(text)
```

```
filtered_list = [word for word in word_tokens if
word.casefold() not in stop_words]
print(filtered_list)
```

Output:

['example', 'sentence', ',', 'showing', 'stop', 'words', 'filtration', '.']

Program 3. Bag of Words, This program demonstrates how to create a bag of words matrix using scikit-learn.

Program:

```
from sklearn.feature_extraction.text import CountVectorizer
headlines = [
    "Dog bites man.",
    "Man bites dog.",
    "Dog eats food.",
    "Man eats food."
]
vectorizer = CountVectorizer(lowercase=True,
stop_words="english")
matrix = vectorizer.fit_transform(headlines)
print(matrix.todense())
```

Output:

```
[[0 0 1 0 0 0]
 [1 0 0 0 1 0]
 [0 1 0 1 0 0]
 [0 0 0 0 0 1]]
```

Unit 7 (Advanced Python) Programs

Program 1. Write a program to add the elements of the two lists.

Program:

```
# Define two lists

list1 = [1, 2, 3, 4]
list2 = [10, 20, 30, 40]
```

```
# Check if lists are the same length
if len(list1) != len(list2):
    print("Error: Lists are not the same length.")
else:
    # Add elements element-wise
    result = [a + b for a, b in zip(list1, list2)]
    print("Result:", result)
```

OUTPUT

Result: [11, 22, 33, 44]

Program 2: Write a program to calculate mean, median and mode using Numpy

Program:

```
import numpy as np
from scipy import stats
# Sample data
data = [10, 20, 20, 30, 40, 50, 50, 50, 60]
# Convert to NumPy array (optional but common)
array = np.array(data)
# Calculate mean
mean = np.mean(array)
# Calculate median
median = np.median(array)
# Calculate mode (returns an object with mode and count)
mode_result = stats.mode(array, keepdims=True)
mode = mode_result.mode[0]
# Display results
print(f"Mean: {mean}")
print(f"Median: {median}")
print(f"Mode: {mode}")
```

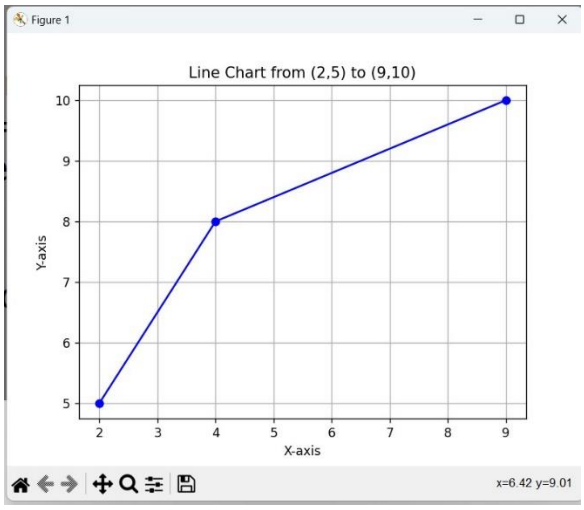
Output:

Mean: 36.666666666666664
Median: 40.0
Mode: 50

Program 3. Write a program to display line chart from (2,5) to (9,10).

```
import matplotlib.pyplot as plt
# Define the x and y coordinates
x = [2,4, 9]
y = [5, 8, 10]
# Create the line chart
plt.plot(x, y, marker='o', linestyle='-', color='blue')
# Add labels and title
plt.xlabel('X-axis')
plt.ylabel('Y-axis')
plt.title('Line Chart from (2,5) to (9,10)')
# Show the chart
plt.grid(True)
plt.show()
```

Output:



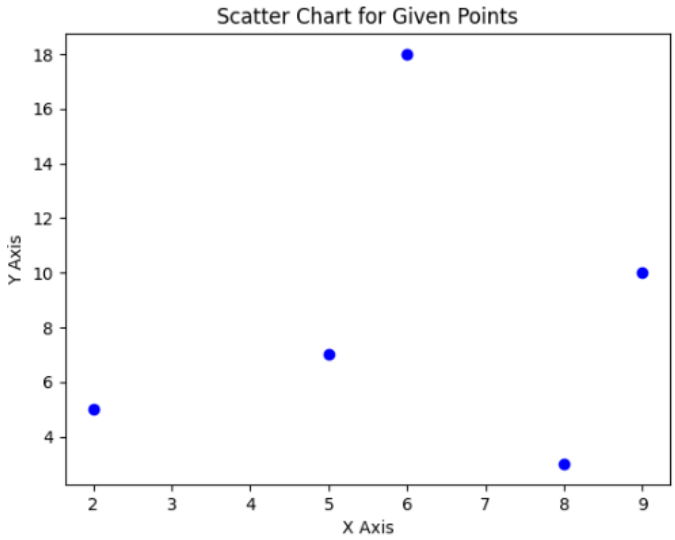
Program 4. Write a program to display a scatter chart for the following points (2,5), (9,10),(8,3),(5,7),(6,18).

Program

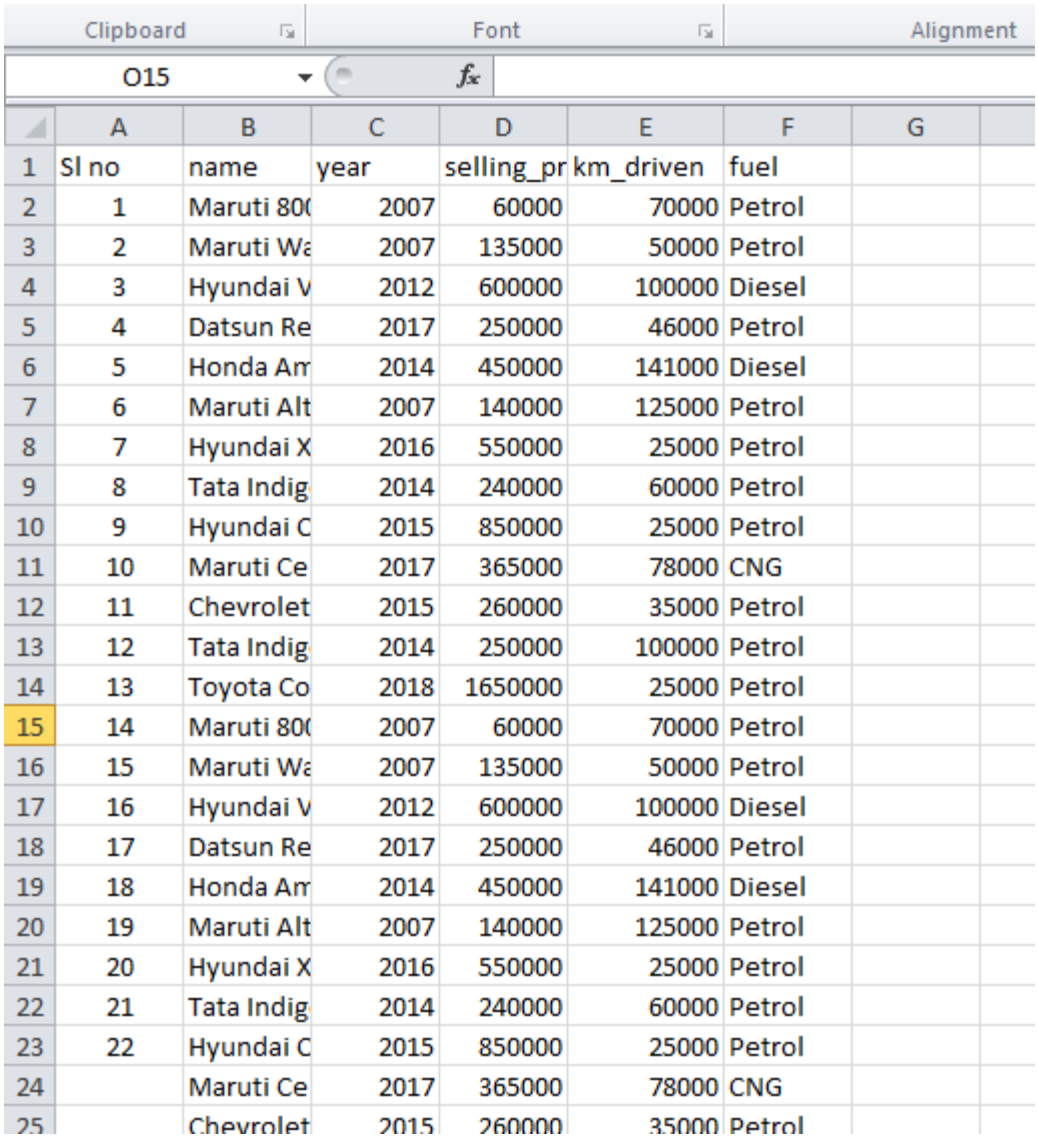
```
import matplotlib.pyplot as plt
# Data points
x = [2, 9, 8, 5, 6]
y = [5, 10, 3, 7, 18]
# Create scatter plot
plt.scatter(x, y, color='blue', marker='o')
# Add title and labels
plt.title("Scatter Chart for Given Points")
```

```
plt.xlabel("X Axis")
plt.ylabel("Y Axis")
# Show plot
plt.show()
```

Output



Program 5. Read the csv file saved in your system and display 10 rows.
data.csv



Clipboard | Font | Alignment

O15 f_x

	A	B	C	D	E	F	G
1	Sl no	name	year	selling_pr	km_driven	fuel	
2	1	Maruti 80(	2007	60000	70000	Petrol	
3	2	Maruti Wa	2007	135000	50000	Petrol	
4	3	Hyundai V	2012	600000	100000	Diesel	
5	4	Datsun Re	2017	250000	46000	Petrol	
6	5	Honda Am	2014	450000	141000	Diesel	
7	6	Maruti Alt	2007	140000	125000	Petrol	
8	7	Hyundai X	2016	550000	25000	Petrol	
9	8	Tata Indig	2014	240000	60000	Petrol	
10	9	Hyundai C	2015	850000	25000	Petrol	
11	10	Maruti Ce	2017	365000	78000	CNG	
12	11	Chevrolet	2015	260000	35000	Petrol	
13	12	Tata Indig	2014	250000	100000	Petrol	
14	13	Toyota Co	2018	1650000	25000	Petrol	
15	14	Maruti 80(	2007	60000	70000	Petrol	
16	15	Maruti Wa	2007	135000	50000	Petrol	
17	16	Hyundai V	2012	600000	100000	Diesel	
18	17	Datsun Re	2017	250000	46000	Petrol	
19	18	Honda Am	2014	450000	141000	Diesel	
20	19	Maruti Alt	2007	140000	125000	Petrol	
21	20	Hyundai X	2016	550000	25000	Petrol	
22	21	Tata Indig	2014	240000	60000	Petrol	
23	22	Hyundai C	2015	850000	25000	Petrol	
24		Maruti Ce	2017	365000	78000	CNG	
25		Chevrolet	2015	260000	35000	Petrol	

Program

```
import pandas as pd
# Replace 'data.csv' with the path to your CSV file
file_path = 'data.csv'
# Read the CSV file into a DataFrame
df = pd.read_csv(file_path)
# Display the first 10 rows
print(df.head(10))
```

Output

	Sl no	name	year	selling_price	km_driven	fuel
0	1.0	Maruti 800 AC	2007	60000	70000	Petrol
1	2.0	Maruti Wagon R LXI Minor	2007	135000	50000	Petrol
2	3.0	Hyundai Verna 1.6 SX	2012	600000	100000	Diesel
3	4.0	Datsun RediGO T Option	2017	250000	46000	Petrol
4	5.0	Honda Amaze VX i-DTEC	2014	450000	141000	Diesel
5	6.0	Maruti Alto LX BSIII	2007	140000	125000	Petrol
6	7.0	Hyundai Xcent 1.2 Kappa S	2016	550000	25000	Petrol
7	8.0	Tata Indigo Grand Petrol	2014	240000	60000	Petrol
8	9.0	Hyundai Creta 1.6 VTVT S	2015	850000	25000	Petrol
9	10.0	Maruti Celerio Green VXI	2017	365000	78000	CNG

Program 6. Read csv file saved in your system and display its information

Program

```
import pandas as pd
# Replace 'data.csv' with the path to your CSV file
file_path = 'data.csv'
# Read the CSV file into a DataFrame
df = pd.read_csv(file_path)
# Display the whole contents
print(df)
```

Output

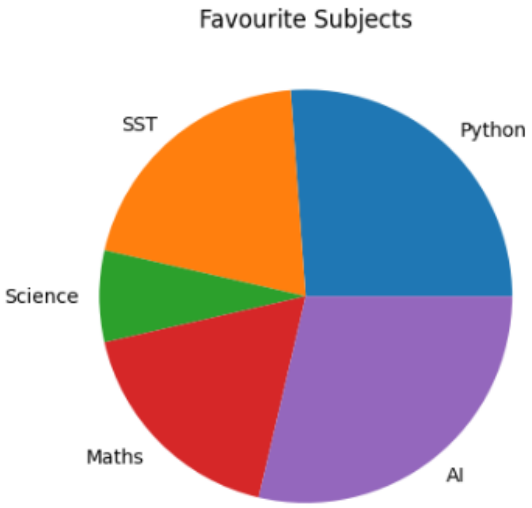
```
      Sl no                                name  year  selling_price
0       1.0                       Maruti 800 AC  2007          60000
1       2.0             Maruti Wagon R LXI Minor  2007         135000
2       3.0                 Hyundai Verna 1.6 SX  2012         600000
3       4.0               Datsun RediGO T Option  2017         250000
4       5.0                Honda Amaze VX i-DTEC  2014         450000
...     ...                                  ...   ...            ...
4335    NaN  Hyundai i20 Magna 1.4 CRDi (Diesel)  2014         409999
4336    NaN           Hyundai i20 Magna 1.4 CRDi  2014         409999
4337    NaN                 Maruti 800 AC BSIII  2009         110000
4338    NaN     Hyundai Creta 1.6 CRDi SX Option  2016         865000
4339    NaN                   Renault KWID RXT  2016         225000

      km_driven    fuel
0         70000  Petrol
1         50000  Petrol
2        100000  Diesel
3         46000  Petrol
4        141000  Diesel
...         ...     ...
4335      80000  Diesel
4336      80000  Diesel
4337      83000  Petrol
4338      90000  Diesel
4339      40000  Petrol

[4340 rows x 6 columns]
```

Program 7. Write a python program to draw pie chart using the following data .
language=['Python','SST','Science','Maths','AI']
students=[84,65,23,57,92]

Program

```
import matplotlib.pyplot as plt
language=['Python','SST','Science','Maths','AI']
students=[84,65,23,57,92]
plt.title("Favourite Subjects")
plt.pie(students, labels=language)
plt.show()
```

Output

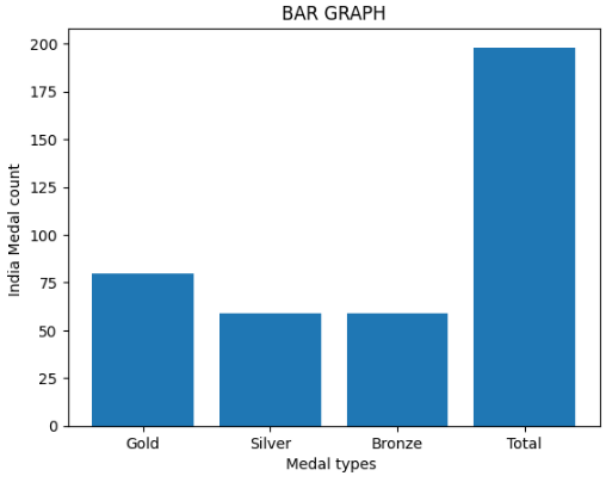


Program 8. Write a python program to create a bar graph for the given data.
Info=['Gold','Silver','Bronze','Total']
India =[80,59,59,198]

Program

```
import matplotlib.pyplot as plt
Info=['Gold','Silver','Bronze','Total']
India =[80,59,59,198]
plt.bar(Info,India)
plt.title("BAR GRAPH")
plt.xlabel("Medal types ")
plt.ylabel("India Medal count ")
plt.show()
```

Output


BAR GRAPH
India Medal count
200
175
150
125
100
75
50
25
0
Gold
Silver
Bronze
Total
Medal types

INTERACTIVE ASSESSMENT LINKS

Sr. No	Unit Name	Link
1	Part A - Unit 1 - Communication Skills - II	https://forms.gle/ScuvmS67CwbotVQu5
2	Part A - Unit 2 - Self Management Skills - II	https://forms.gle/meGC41eTzfew63Bi8
3	Part A - Unit 3 - ICT Skills - II	https://forms.gle/1g1UYMgrApt3fpSk8
4	Part A - Unit 4: Entrepreneurial Skills - II	https://forms.gle/siKrAgZuUaDu9paWA
5	Part A - Unit 5: Green Skills - II	https://forms.gle/Amk8caMpq9913N116
6	Part B - Unit 1: Revisiting AI Project Cycle & Ethical Frameworks for AI	https://forms.gle/qG3gqzTcdogWs3Zf7 https://forms.gle/XwfBZJD6pCCFDyyw7
7	Part B - Unit 2: Advanced Concepts of Modeling in AI	https://forms.gle/Wn2hTUc6B2jFeUMs8
8	Part B - Unit 3: Evaluating Models	https://forms.gle/9YniWor9Mv7uRVVs9
9	Part B - Unit 5: Computer Vision	https://forms.gle/H4ByzDvZNcNiypB39
10	Part B - Unit 6: Natural Language Processing	https://forms.gle/GPoZDLYXT6TtMcSdA
11	Sample Question Paper and Previous year Question paper	AI SSE 2025 Class X AI SQP-3 Class X AI SQP-2 with Ans Key Class X AI SQP-1 with Ans Key Class X

References

1) https://cbseacademic.nic.in/web_material/Curriculum26/publication/secondary/AI_Facilitators_Handbook_X.pdf (Class X text book CBSE)
2) https://www.geeksforgeeks.org/metrics-for-machine-learning-model/
3) https://www.shiksha.com/online-courses/articles/evaluating-a-machine-learning-algorithm/
4) CBSE Sample Question Papers: https://cbseacademic.nic.in/skill-education-sqp_archive.html
5) CBSE Skill Education books: https://cbseacademic.nic.in/skill-education-books_archive.html
6) https://www.youtube.com/watch?v=qWfzIYCvBqo
7) https://www.youtube.com/watch?v=lt1YxJ_8Jzs
8) **Intel® AI for Youth Program (CBSE Partner for AI Curriculum)**
    a. Offers hands-on modules, videos, and projects for CBSE students
    b. https://www.intel.com/content/www/us/en/education/intel-education.html
9) **GeeksforGeeks – Introduction to Computer Vision**
    a. Detailed article on basic concepts, features, and OpenCV
    b. https://www.geeksforgeeks.org/computer-vision/
10) **W3Schools – Python OpenCV Tutorial**
    a. Step-by-step explanation of OpenCV functions used in Computer Vision
    b. https://www.w3schools.com/training/aws/computer-vision-with-gluoncv.php