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CLASS: X
ARTIFICIAL INTELLIGENCE (417)
PART-A & B
(EMPLOYABILITY & SUBJECTIVE SKILLS NOTES)

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Unit 1

Communication Skills-II

SESSION 1: METHODS OF COMMUNICATION

The word 'communication' comes from the Latin word **commūnicāre**, meaning 'to share'.

There are three types of communication. They are: 1. Verbal Communication

2. Non-verbal communication and 3. Visual communication.

Communication has three important parts:

1. **Transmitting** — The sender transmits the message through one medium or another.
2. **Listening** — The receiver listens or understands the message.
3. **Feedback** — The receiver conveys their understanding of the message to the sender in the form of feedback to complete the communication cycle.

Elements of a communication cycle:

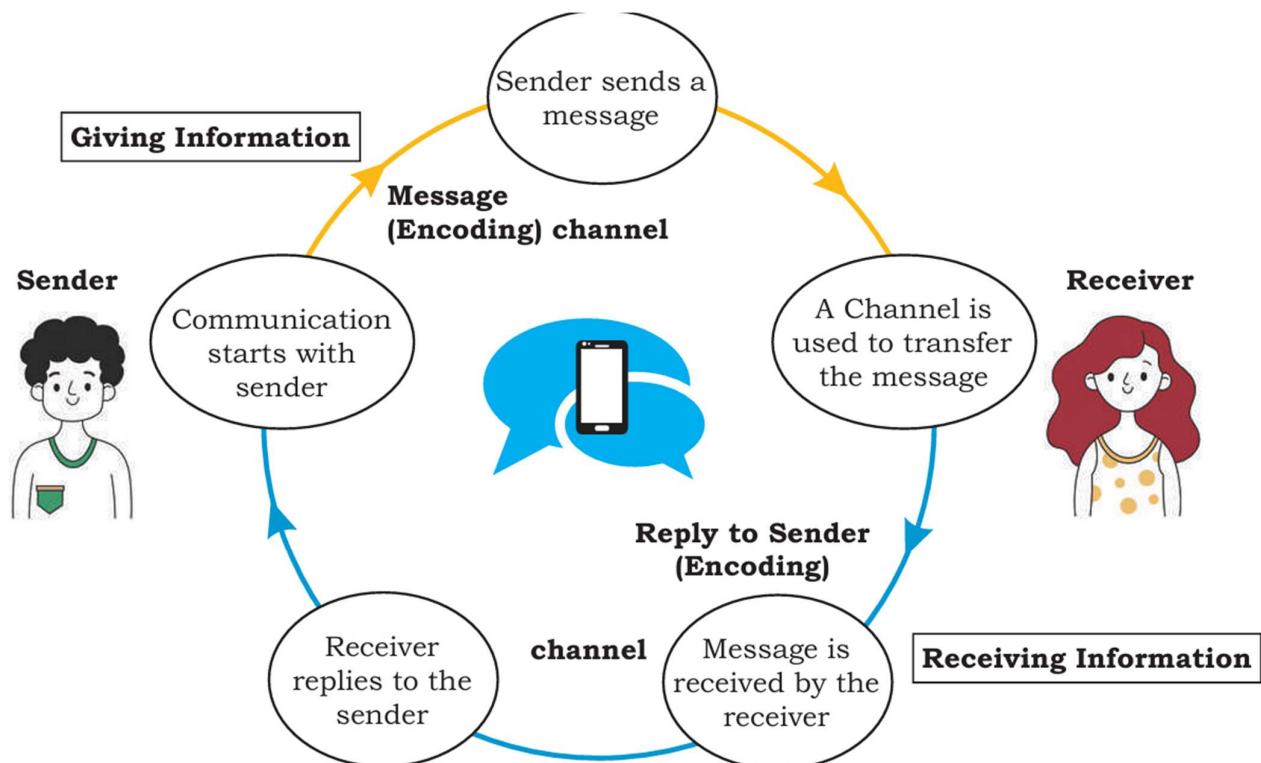


Figure 1.2: Elements of Communication

The various elements of a communication cycle are:

- **Sender:** the person beginning the communication.
- **Message:** the information that the sender wants to convey.
- **Channel:** the means by which the information is sent.
- **Receiver:** the person to whom the message is sent.
- **Feedback:** the receiver's acknowledgement and response to the message.

Methods of Communication:

Face-to-face informal communication:

There is nothing better than face-to-face communication. It helps the message to be understood clearly and quickly.

e-mail :

It can be used to communicate quickly with one or many individuals in various locations

Notices/Posters:

It is effective when the same message has to go out to a large group of people.

Business Meetings:

Communication during business meetings at an organisation are generally addressed to a group of people

Other Methods:

There can be various other methods like social networks, message, phone call for communication, newsletter, blog, etc.

Choosing the right method of communication depends on

- target audience
- costs
- kind/type of information
- urgency/priority

SESSION 2: VERBAL COMMUNICATION

Verbal communication includes sounds, words, language, and speech.

Types of Verbal Communication:

Interpersonal Communication:

This form of communication takes place between two individuals and is thus a one-on-one conversation. It can be formal or informal.

Written Communication:

This form of communication involves writing words. It can be letters, circulars, reports, manuals, SMS, social media chats, etc. It can be between two or more people

Small Group Communication:

This type of communication takes place when there are more than two people involved. Each participant can interact and converse with the rest.

Examples 1. Press conferences 2. Board meetings 3. Team meetings

Public Communication:

This type of communication takes place when one individual addresses a large gathering.

Examples 1. Election campaigns 2. Public speeches by dignitaries

Advantages of Verbal Communication:

It is an easy mode of communication in which you can exchange ideas by saying what you want and get a quick response.

Verbal communication also enables you to keep changing your interaction as per the other person's response.

Disadvantages of Verbal Communication:

Since verbal communication depends on written or spoken words, sometimes the meanings can be confusing and difficult to understand if the right words are not used.

Mastering Verbal Communication:

Think Before You Speak	• Think about your topic. • Think about the most effective ways to make your listeners understand the topic. • Write or note down whatever you plan to say.
Concise and Clear	• Speak clearly, loudly and at moderate speed. • Be sure the information you want to share is to the point. • Do not repeat the same sentences.
Confidence and Body Language	• Be confident. • Maintain eye contact, stand straight and be attentive. • Be friendly.

SESSION 3: NON-VERBAL COMMUNICATION

Non-verbal communication is the expression or exchange of information or messages without using any spoken or written word.

In other words, we send signals and messages to others, through expressions, gestures, postures, touch, space, eye contact and para language.

Importance of Non-verbal Communication:

In our day-to-day communication

- 55% communication is done using body movements, face, arms, etc.
- 38% communication is done using voice, tone, pauses, etc.
- only 7% communication is done using words.

Types of Non-verbal Communication:

- Facial Expressions
- Posture
- Gestures or Body Language
- Touch
- Space
- Eye Contact
- Paralanguage

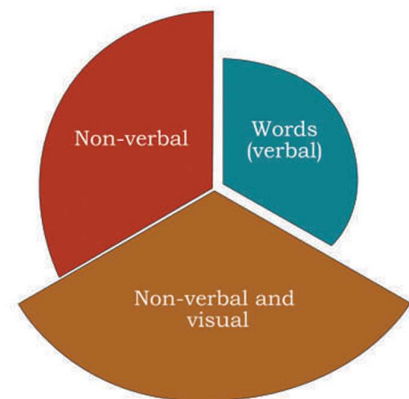


Figure 1.4: Methods of Communication

VISUAL COMMUNICATION

Visual communication proves to be effective since it involves interchanging messages only through images or pictures and therefore, you do not need to know any particular language for understanding it.

It is simple and remains consistent across different places.

Visual Communication: Exchanging Information through Images:

Example:

No parking zone		No entry	
Danger warning		Radiation/biohazard warning	
Under CCTV surveillance		No mobile phone	

SESSION 4: COMMUNICATION CYCLE AND IMPORTANCE OF FEEDBACK

Feedback is an important part of the communication cycle.

For effective communication, it is important that the sender receives an acknowledgement from the receiver about getting the message across.

While a sender sends information, the receiver provides feedback on the received message.

A good feedback is always • specific • helpful • kind

A good feedback is one that is:

- **Specific:** Avoid general comments. Try to include examples to clarify your statement.
- **Timely:** Being prompt is the key, since feedback loses its impact if delayed for too long.

- **Polite:** While it is important to share feedback, the recipient should not feel offended by the language of the feedback.

- **Offering continuing support:** Feedback sharing should be a continuous process. After offering feedback, let recipients know you are available for support.

Importance of Feedback:

Feedback is the final component and one of the most important factors in the process of communication since it is defined as the response given by the receiver to the sender. Let us look at certain reasons why feedback is important.

- It validates effective listening
- It motivates
- It is always there
- It boosts learning
- It improves performance

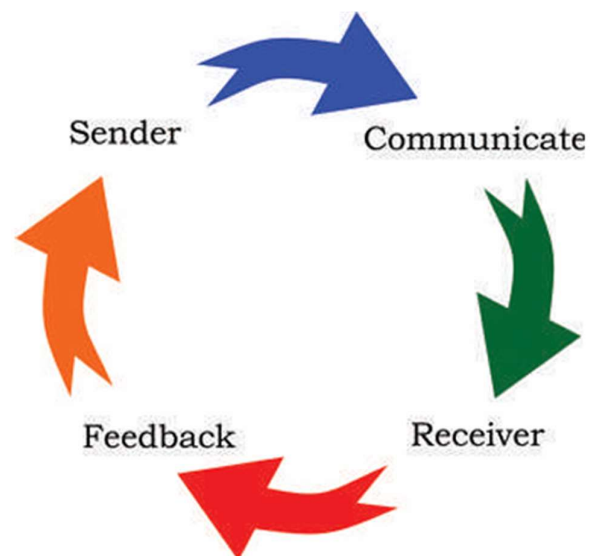


Figure 1.5: Communication Cycle

Type of Feedback	Examples	
Positive Feedback	- I noticed you finished the work perfectly. Great job! - I really appreciate you taking that call. Can you please also share the details?	 POSITIVE FEEDBACK
Negative Feedback	- You keep forgetting to smile at the hotel guests when you talk to them. - You take really long to reply to e-mails! Are you always so busy?	 NEGATIVE FEEDBACK
No Feedback	It is also a feedback in itself which indicates disagreement of ideas.	

SESSION 5: BARRIERS TO EFFECTIVE COMMUNICATION

Effective Communication:

Communication can be effective when you follow the below mentioned **7C's principle**

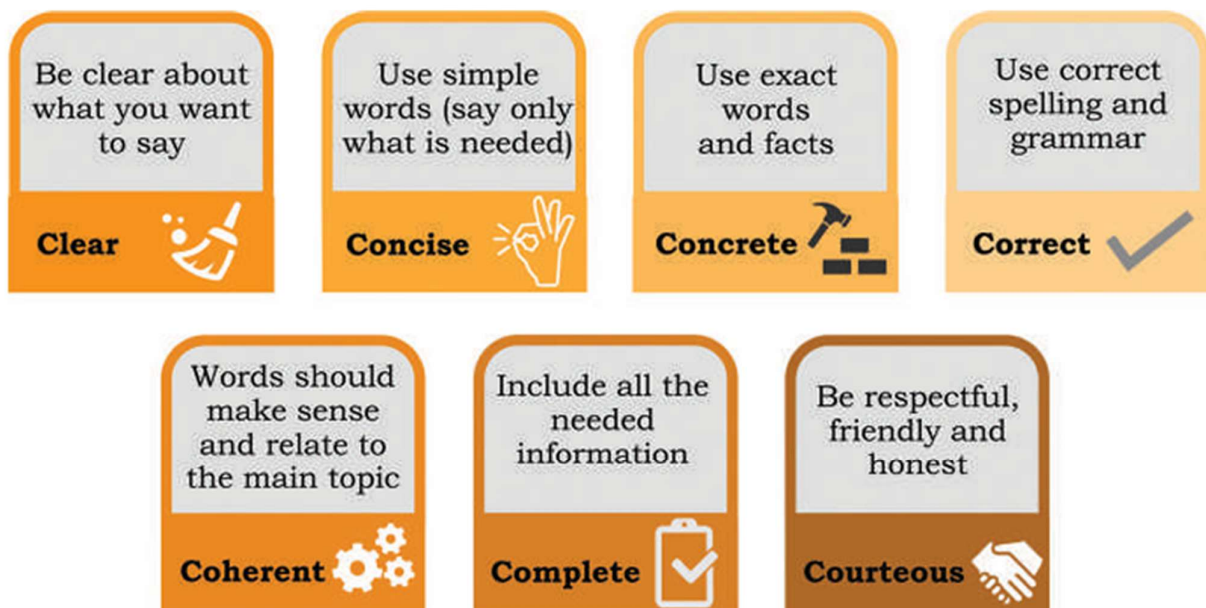


Figure 1.6: 7Cs of Effective Communication

Barriers to Effective Communication

Physical Barriers:

Physical barrier is the environmental and natural condition that act as a barrier in communication in sending message from sender to receiver. Not being able to see gestures, posture and general body language can make communication less effective.

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.

Organisational Barriers:

Organisations are designed on the basis of formal hierarchical structures that follow performance standards, rules and regulations, procedures, policies, behavioural norms, etc. All these affect the free flow of communication in organisations and therefore, need to be suitably managed

Cultural Barriers:

Cultural barriers is when people of different cultures are unable to understand each other's customs, resulting in inconveniences and difficulties.

Ways to Overcome Barriers to Effective Communication:

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



Figure 1.7: Barriers to Effective Communication

SESSION 6: WRITING SKILLS — PARTS OF SPEECH

Capitalisation:

Here's in a sentence where we should use capital letters. ‘

Table 1.7: Capitalisation Rules

Alphabet	T	I	N	S
What it shows:	Titles	word 'I'	Names	Starting letter of sentences

Punctuation

Certain set of marks, such as full stop, comma, question mark, exclamation mark and apostrophe are used in communication to separate parts of a sentence for better clarity of message.

The parts of speech:

It indicates how a particular word functions in meaning as well as grammatically within the sentence.

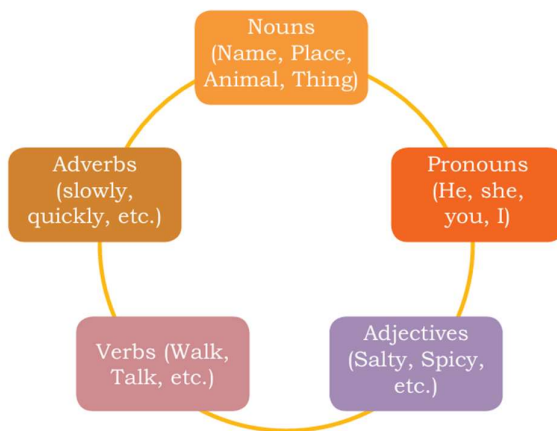


Figure 1.8: Parts of Speech

Supporting Parts of Speech Types

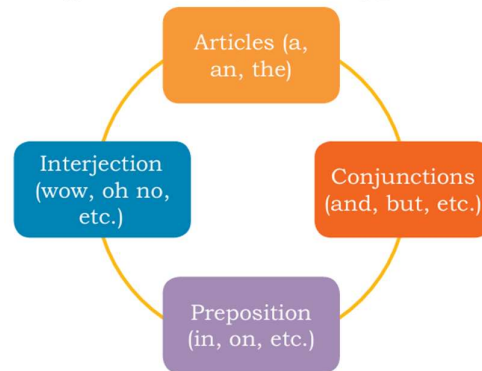


Figure 1.9: Supporting Parts of Speech

SESSION 7: WRITING SKILLS — SENTENCES

Parts of a Sentence:

Subject: Person or thing that performs an action.

Verb: Describes the action.

Object: Person or thing that receives the action.

Types of Sentences:

Active and Passive Sentences

Active: 1. Radha is reading a book.

Passive: 2. A book is being read by Radha.

Table 1.12: Active and Passive Sentences

Active Voice	Passive Voice
Ali changed the flat tire.	The flat tire was changed by Ali.
I will clean the house every Saturday.	The house will be cleaned by me every Saturday.
Ravi painted the entire house.	The entire house was painted by Ravi.

Paragraph:

A group of words form a sentence, a group of sentences forms a paragraph. However, to qualify as a paragraph, all the sentences within it must have a common idea or theme.

Unit 2

Self-Management Skills-II

Session 1: Stress Management

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.

Stress Management

Stress is a part of everyday life. There are many instances when stress can be helpful. Managing stress is about making a plan to be able to cope effectively with daily pressures.

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

Step 2: Identify what is causing you stress

Step 3: Apply stress management methods

Stress Management Techniques

- Time management
- Physical exercise and fresh air
- Healthy diet
- Positivity
- Organising academic life; no delaying
- Sleep
- Holidays with family and friends
- Ability to Work Independently

Emotional Intelligence

Emotional intelligence is the ability to identify and manage one's own emotions, as well as the emotions of others.

Emotional awareness, harnessing emotions, managing emotions

Some steps to manage emotional intelligence are:

Understand your emotions, Rationalise, Practise.

Session 2: Self-Awareness — Strength And Weakness Analysis

Techniques for Identifying your Strengths and Weaknesses:

Finding Strengths (or abilities) :

- Think of anything that you are always successful at.

Finding Weaknesses:

- Point out the areas where you struggle and the things you find difficult to do.

Table 2.1: Difference between Interests and Abilities

S.No	Interests	Abilities
1.	Things that you like to do in your free time that make you happy.	An acquired or natural capacity
2.	Things you are curious about or would do even if no one asked you to do it.	Enable you to perform a particular job or task with considerable proficiency.
3.	Things you want to learn or would like to do in the future.	

Session 3: 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. In other words, it is our ability to do the things that need to be done without someone or something influencing us.

Types of Motivation



Internal Motivation: LOVE

We do things because they make us happy, healthy and feel good. For example, when you perform on your annual day function and you learn something new, such as dancing, singing, etc., you feel good.



External Motivation: REWARD

We do things because they give us respect, recognition and appreciation. For example, Suresh participated in a 100m race and won a prize. This motivated him to go for practice every morning.

Qualities of Self-motivated People

Know what they want from life, Are focussed, Know what is important, Are dedicated to fulfil their dreams.

Building Self-motivation:

There are four steps for building self-motivation, which are as given below.

- Find out your strengths
- Set and focus on your goals
- Develop a plan to achieve your goals
- Stay loyal to your goals

Session 4: Self-Regulation — Goal Setting

Goals and Setting SMART Goals:

Goals : They are a set of dreams with a deadline to get them.

Goal setting : It is all about finding and listing your goals and then planning on how to achieve them.

SMART method to set goals.

SMART stands for:

- Specific • Measureable • Achievable • Realistic • Time bound

Session 5: Self-Regulation — Time Management

Four Steps for Effective Time Management

Organise:

We plan our day to-day activities.

Prioritise:

We make a to-do list that has all our activities and we rank them in the order of importance.

Control:

We have a control over our activities and time.

Track:

We identify and note where we have spent our time.

Unit 3

Information and Communication Technology Skills-II

Session 1: Basic Computer Operations

ICT stands for Information and Communication Technology. ICT refers to all the methods, tools, concepts related to storing, recording and sending digital information.

Computer Hardware and Software:

A computer system consists of two main parts— the hardware and the software.

The physical parts that we can see and touch are called hardware. It is the machinery of a computer. These are the keyboard, monitor, CPU, etc.

There is another important part i.e., the software. Though we cannot see it, it makes the hardware work the way we want. The most important software in any computer is the Operating System (OS).

Session 2: Performing Basic File Operations Basic File Operations

Files and Folders All information stored in a computer is kept in files.

A folder is a location where a group of files can be stored.

Commonly used shortcut keys:

To paste a file- Ctrl +V

To copy a file Ctrl+C

To cut a file Ctrl+X

To create a new file Ctrl+N

Session 3: Computer Care And Maintenance

Importance Of Care And Maintenance Of Computers

Computers and mobiles are very expensive. When we take good care of them on a regular basis, we can use them for a longer time. This will help us save money as we do not need to buy new devices too often.

Basic Tips for Taking Care of Devices

Keeping a Device Clean

Cleaning a device, such as a computer or mobile means to keep the screen, keyboard and mouse clean.

Be careful with food and drinks

Handle devices carefully

Keep the computer cool

Do not overcharge your battery

Always plug in devices carefully

Do not run too many programs at a time

Prepare a Maintenance Schedule

Backup your Data: Backing up data means to save the information present on your computer on another device, such as CD/DVD drives

Scanning and Cleaning Viruses

Increasing Computer Performance

Removing SPAM from your Computer

Session 4: Computer Security And Privacy

Computer Security Deals with Protecting Computers, Computer security and privacy deals with the measures used to prevent loss of data.

Personal information can be lost or leaked in two ways:

- We are not careful in giving out personal information over the Internet.
- A person gets unauthorised access to our computer.

1) Threats to Computer: Threats are the ways in which personal information can be leaked from a computer without our knowing.

Eg: Physical, Identity, and Software Piracy

2) Virus: Viruses are computer programs that can damage the data and software programs or steal the information stored on a computer. Major types of viruses are Worms and Trojan horse.

a) Worms: These are viruses that replicate themselves and spread to all files once they attack a computer. This makes it very difficult to remove them.

b) Trojan Horse: A Trojan Horse disguises itself i.e., it appears to be a useful software program but once it reaches a computer it starts behaving like a virus and destroying data
Online Predator: Online predators are people who trap you into inappropriate relationships. They may be older people posing to be your age, bullying you into doing illegal activities online and sometimes face to face.

3) Internet Scams: Sometimes you may receive very attractive offers saying you have won a huge money in a lottery and that you can claim the prize by depositing a certain amount of money.

Protecting your Data:

To protect our data from theft and viruses we can take the following measures:

- Use passwords to login to your computer (strong passwords)
- Install Anti-virus and Firewall
- Encrypt Data
- Visit Secure sites

If the site address starts with https:// and a lock symbol, then it is safe to give your credit card and bank details.

Unit 4

Entrepreneurial Skills-II

Session 1: Entrepreneurship and Society

Entrepreneurship is the type of self-employment where one is running a business to satisfy the needs of people and looking for ways to make the business better to make profits.

Successful entrepreneurs have the following qualities.

- They are confident. They believe in themselves and their abilities.
- They keep trying new ideas in their business.
- They are patient.
- They are creative and think differently about business ideas.
- They take responsibility for their actions.
- They take decisions after thinking about them.
- They work hard.
- They do not give up when they face a difficulty.

What do entrepreneurs do when they run their business?

Fulfil Customer Needs

Use Local Materials

Help Society

Create Jobs

Sharing of Wealth

Lower Price of Products

Session 2: Qualities and functions of an entrepreneur

Qualities of an Entrepreneur:

Be confident and take business decision

Keep trying new ideas

Patient

Creative

Take responsibility for the mistakes made

Take decisions after thinking about whether they are good or bad for my business.

Work hard

Do not give up

Functions of an Entrepreneur:



Session 3: Myths about Entrepreneurship

- 1: The misconception is that every business idea needs to be unique or special.
- 2 The misconception we have is that a person needs a lot of money to start a business.
- 3 A misconception we have is that only a person having a big business is an entrepreneur

Session 4: Entrepreneurship as A Career Option

A career is a line of work that a person takes for life. There are two ways a person can earn a living. They are

1. Self-employment
2. Wage employment

For example, a doctor who works for a hospital is a **wage employed** person.

If the same doctor has their own clinic, he or she is a **self-employed** person.

A self-employed person running a business to satisfy a need by trying new ideas is an entrepreneur.

A person who becomes an entrepreneur goes through a career process. This process is as follows:

ENTER	SURVIVE	GROW
		
When an entrepreneur is starting, they are just entering the market to do business.	There are many entrepreneurs in the market. The entrepreneur has to remain in a competitive market.	Once the business is stable, an entrepreneur thinks about expanding his or her business.
For example, Sanjana is starting a small grocery store in a locality.	For example, there are many other grocery stores in the area. Yet, Sanjana's store survives the competition and does well. She also expands the store to two more floors.	For example, after five years, Sanjana has opened a chain of four more grocery stores in the same city. In the next two years, she plans to expand to two other cities.

Unit 5

Green Skills-II

Session 1: Sustainable Development

Sustainable development is the development that satisfies the needs of the present without compromising the capacity of future generations, guaranteeing the balance between economic growth, care for the environment and social well-being.

Importance of Sustainable Development

Sustainable development is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987)

Problems Related to Sustainable Development

Three major problems related to sustainable development are:

(a) Food: The amount of rich, fertile land needed to grow crops, such as wheat, rice, etc., is becoming less as we are using up more and more land for other purposes. Soil nutrients are also getting depleted and lots of chemicals are spoiling the soil due to use of chemical fertilisers.

(b) Water: We use fresh water from rivers and ponds for drinking and cleaning but dump garbage into them. The rivers and ponds are getting polluted. This way after several years, we will have no clean water for our use.

(c) Fuel: We are using a lot of wood from trees as fuels and for construction of homes and furniture. As more and more trees are being cut, it is affecting the climate of the place. Extreme weather conditions, such as floods, extreme cold or heat, are seen in many places, which affect the people living there.

Sustainable development includes:

- Reducing excessive use of resources and enhancing resource conservation;
- Recycling and reuse of waste materials;
- Scientific management of renewable resources, especially bio-resources;
- Planting more trees;
- Green grassy patches and trees to be interspersed between concrete buildings;
- Using more environment friendly material or biodegradable material and
- Use of technologies, which are environmental friendly and based on efficient use of resources.

Sustainable Development Goals:

The Sustainable Development Goals (SDGs) were launched at the United Nations Sustainable Development Summit in New York in September 2015, forming the 2030 Agenda for Sustainable Development. It has set targets that the countries have to should work towards and achieve by 2030. The 17 SDGs have been made with the aim to take care of important issues facing businesses, governments and society.



Fig. 5.1 Sustainable Development Goals

Session 2: Our Role in Sustainable Development

Our Role towards Sustainable Development United Nations has formed 17 Sustainable Development Goals (SDGs) so that countries and nations can work towards finding a solution to the growing problems in the world

Quality Education

Education is the most important factors for sustainable development. Children who have gone to school will be able to do jobs so that they can take care of themselves and their families. Education helps us become aware of our role as a responsible citizen. We should

1. Use the facilities present in our areas.
2. Take our friends to school.
3. Help friends study.
4. Stop friends from dropping out of school

Clean Water and Sanitation

We must make efforts to make India free of open defecation by building toilets and creating awareness towards Industrial is sanitation.

Pollution: polluting our water resources, which in near future will cause scarcity of clean drinking and usable water.

Affordable and Clean Energy

Using solar power i.e., power generated using the sun does not cause pollution as it does not require burning of non-renewable fuels, such as coal

Decent Work and Economic Growth

- (a) Study and find good jobs to take care of ourselves and our families.

(b) Work hard and contribute to society.

(c) Learn and develop skills so that we get add value in our community

Reduced Inequalities

To reduce inequalities we can

1. Be helpful to one another.
2. Be friendly with everyone.
3. Include everyone while working or playing.
4. Help others by including everyone whether they are small or big, girl or boy, belong to any class or caste

Sustainable Cities and Communities

Creating Sustainable Cities

1. Save energy by switching off lights and fans when not in use.
2. Use natural light as much as possible.
3. Use energy efficient lights (LED bulbs) and appliances

Responsible Consumers and Producers

1. Reusing paper, glass, plastic, water, etc.
2. Taking cloth bags to market carrying fruits and vegetables.
3. Donate things we do not use such as clothes, books, furniture, food, etc.
4. Buy and eat seasonal fruits and vegetables from local growers.
5. Repair leaking taps and pipes to avoid wasting water.
6. Sort and treat garbage before disposing.

Protect Life below Water

Tons of plastic is found in the seas, which is killing marine life. Protecting marine life, saving our oceans from pollution is necessary to preserve the marine life.

Protect Life on Land

Cutting of trees is leading to soil erosion and making land dry and unusable for cultivation. Planting more tree to replace the ones that we have cut is an important step towards sustainable development.

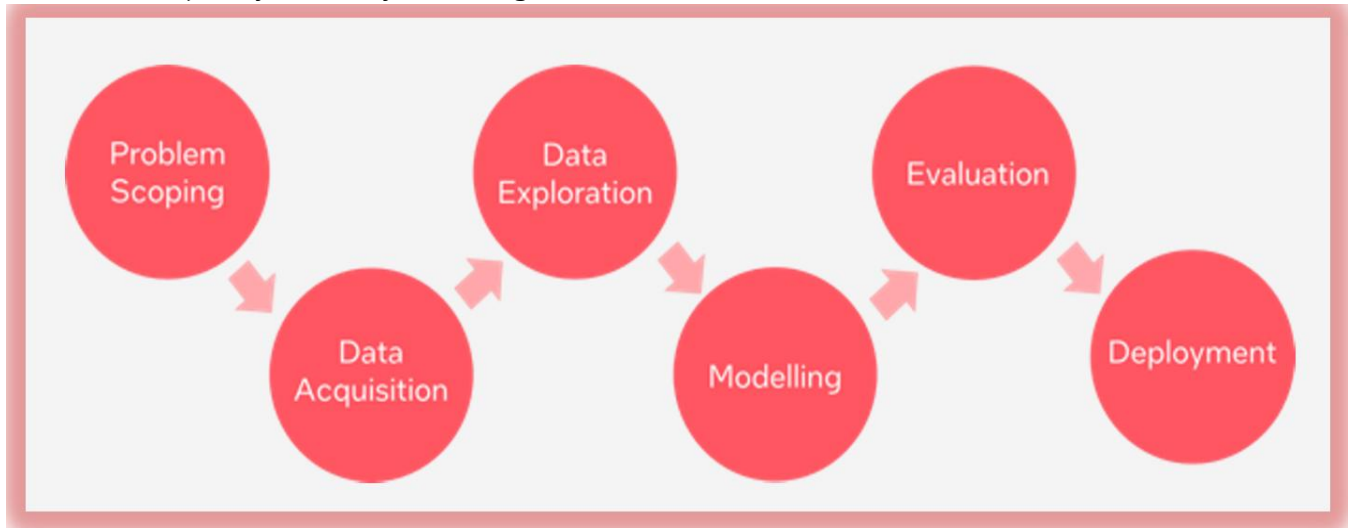
Unit -1

Revisiting AI Project Cycle & Ethical Frameworks for AI

1.1 AI Project Cycle:

The AI Project Cycle provides us with an appropriate framework which can lead us towards the goal. The AI project cycle is the cyclical process followed to complete an AI project.

The AI Project Cycle mainly has 6 stages:



Stage 1: Problem Scoping:

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.

A lot of times we are unable to observe any problem in our surroundings. In that case, we can take a look at the Sustainable Development Goals. 17 goals have been announced by the United Nations which are termed as the Sustainable Development Goals. The aim is to achieve these goals by the end of 2030. A pledge to do so has been taken by all the member nations of the UN.

The 4Ws Problem canvas helps in identifying the key elements related to the problem.



- The “Who” block helps in analysing the people getting affected directly or indirectly due to it. Under this, we find out who the ‘Stakeholders’ to this problem
- Under the “What” block, you need to look into what you have on hand. At this stage, you need to determine the nature of the problem.
- Under the “Where” block will help you look into the situation in which the problem arises, the context of it, and the locations where it is prominent.
- Thus, in the “Why” canvas, think about the benefits which the stakeholders would get from the solution and how it will benefit them as well as the society.

Stage: 2. Data Acquisition:

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.

There can be various ways in which you can collect data. Some of them are:



Stage 3: Data Exploration:

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, maps, Histograms, scatterplots, line graphs, and flowcharts etc. This makes it easier for you to interpret the patterns which your acquired data follows.

Stage 4: Modelling:

- 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.

Stage 5: Evaluation:

- Once the modelling 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.
- the efficiency of the model is calculated on the basis of the parameters mentioned below:



Stage 6: Deployment:

- 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.

1.2: Introduction to AI Domains

Artificial Intelligence becomes intelligent according to the training it gets. For training, the machine is fed with datasets. According to the applications for which the AI algorithm is being developed, the data fed into it changes. With respect to the type of data fed in the AI model,

AI models can be broadly categorized into three domains:



1. Statistical Data/ Data Science:

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.

The information extracted through statistical data can be used to make a decision about it.

Example of Statistical Data

a. Price Comparison Websites:

These websites are being driven by lots and lots of data.

The convenience of comparing the price of a product from multiple vendors in one place.

Eg: PriceGrabber, PriceRunner, Junglee, Shopzilla, DealTime are some examples of price comparison websites

b. Fraud and Risk Detection*:

The earliest applications of data science were in Finance. Companies were fed up of bad debts and losses every year.

c. Genetics & Genomics*:

Data Science applications also enable an advanced level of treatment personalization through research in genetics and genomics. The goal is to understand the impact of the DNA on our health and find individual biological connections between genetics, diseases, and drug response.

d. Internet Search*:

All these search engines (including Google) make use of data science algorithms to deliver the best result for our searched query in the fraction of a second.

e. Targeted Advertising*:

If you thought Search would have been the biggest of all data science applications, here is a challenger – the entire digital marketing spectrum.

f. Website Recommendations*:

They not only help us find relevant products from billions of products available with them but also add a lot to the user experience.

Eg: amazon, Netflix

g. Airline Route Planning*:

Data Science to identify the strategic areas of improvements. Now, while using Data Science, the airline companies can: Predict flight delay, Decide which class of airplanes to buy

2. Computer Vision:

Computer Vision, abbreviated as CV, is a domain of AI that depicts the capability of a machine to get and analyse visual information and afterwards predict some decisions about it.

The entire process involves image acquiring, screening, analysing, identifying and extracting information.

This extensive processing helps computers to understand any visual content and act on it accordingly.

In computer vision, Input to machines can be photographs, videos and pictures from thermal or infrared sensors, indicators and different sources.

Computer vision-related projects translate digital visual data into descriptions.

This data is then turned into computer-readable language to aid the decision-making process. The main objective of this domain of AI is to teach machines to collect information from pixels.

Examples of Computer Vision

a.Agricultural Monitoring

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.

b.Surveillance Systems

Computer vision is used in surveillance systems to monitor public spaces, buildings, and borders. It can detect suspicious activities, track individuals or vehicles, and provide real-time alerts to security personnel

c.Facial Recognition*:

With the advent of smart cities and smart homes, Computer Vision plays a vital role in making the home smarter. Security being the most important application involves use of Computer Vision for facial recognition.

d.Face Filters*:

The modern-day apps like Instagram and snapchat have a lot of features based on the usage of computer vision.

Through the camera the machine or the algorithm is able to identify the facial dynamics of the person and applies the facial filter selected.

e.Google's Search by Image*:

The maximum amount of searching for data on Google's search engine comes from textual data, but at the same time it has an interesting feature of getting search results through an image.

f.Computer Vision in Retail*:

The retail field has been one of the fastest growing field and at the same time is using Computer Vision for making the user experience more fruitful.

g.Self-Driving Cars:

Computer Vision is the fundamental technology behind developing autonomous vehicles.

h.Medical Imaging*:

For the last decades, computer supported medical imaging application has been a trustworthy help for physicians.

The application is used to read and convert 2D scan images into interactive 3D models that enable medical professionals to gain a detailed understanding of a patient's health condition.

i.Google Translate App*:

All you need to do to read signs in a foreign language is to point your phone's camera at the words and let the Google Translate app tell you what it means in your preferred language almost instantly.

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. Natural language refers to language that is spoken and written by people, and natural language processing (NLP) attempts to extract information from the spoken and written word using algorithms. The ultimate objective of NLP is to read, decipher, understand, and make sense of human languages in a valuable manner.

Examples of Natural Language Processing

a.Email filters:

Email filters are one of the most basic and initial applications of NLP online. It started with spam filters, uncovering certain words or phrases that signal a spam message.

b.Machine Translation

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.

cAutomatic Summarization:

Information overload is a real problem when we need to access a specific, important piece of information from a huge knowledge base. Automatic summarization is relevant not only for summarizing the meaning of documents and information, but also to understand the emotional meanings within the information, such as in collecting data from social media.

d.Sentiment Analysis:

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

e.Text classification:

Text classification makes it possible to assign predefined categories to a document and organize it to help you find the information you need or simplify some activities. For example, an application of text categorization is spam filtering in email.

g.Virtual Assistants:

Nowadays Google Assistant, Cortana, Siri, Alexa, etc have become an integral part of our lives. Not only can we talk to them but they also have the abilities to make our lives easier

1.3. Ethical Frameworks for AI

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. Ethical frameworks provide a systematic approach to navigating complex moral dilemmas by considering various ethical principles and perspectives.

By utilizing ethical frameworks, individuals and organizations can make well- informed decisions that align with their values and promote positive outcomes for all stakeholders involved.

Why do we need Ethical Frameworks for AI?

AI bias could result in unwanted outcomes in AI solutions.

AI is essentially being used as a decision-making/ influencing tool. As such we need to ensure that AI makes morally acceptable recommendations

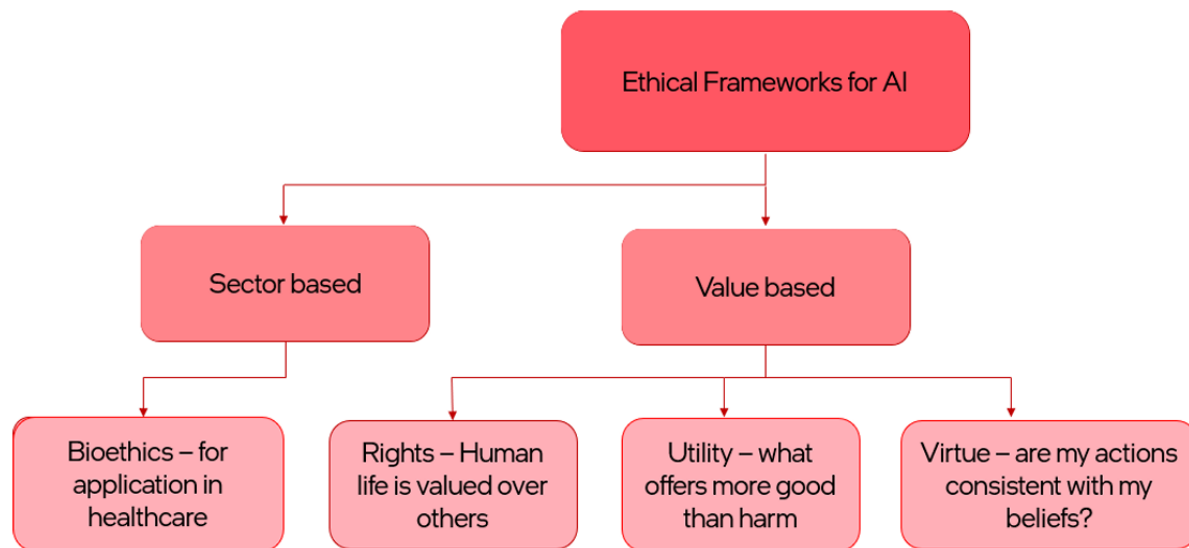
Ethical frameworks ensure that AI makes morally acceptable choices. If we use ethical frameworks while building our AI solutions, we can avoid unintended outcomes, even before they take place.

Types of Ethical Framework:

The various types of ethical frameworks are classified as follows:

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

Sector-based and Value- based frameworks.



1. Sector-based Frameworks:

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

Sector-based ethical frameworks may also apply to domains such as finance, education, transportation, agriculture, governance, and law enforcement.

Bioethics

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.

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.

Value-based frameworks are concerned with assessing the moral worth of actions and guiding ethical behaviour.

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. It emphasizes the importance of respecting individual autonomy, dignity, and freedoms.

In the context of AI, this could involve ensuring that AI systems do not violate human rights or discriminate against certain groups.

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. It seeks to maximize overall utility or benefit for the greatest number of people.

In AI, this might involve weighing the potential benefits of AI applications against the risks they pose to society, such as job displacement or privacy concerns.

iii. Virtue-based:

This framework focuses on the character and intentions of the individuals involved in decision-making. It asks whether the actions of individuals or organizations align with virtuous principles such as honesty, compassion, and integrity.

In the context of AI, virtue ethics could involve considering whether developers, users, and regulators uphold ethical values throughout the AI lifecycle.

These classifications provide a structured approach for addressing ethical concerns in AI development and deployment, ensuring that considerations relevant to specific sectors and fundamental ethical values are adequately addressed.

ETHICAL PRINCIPLES

- **“Non-maleficence”** refers to the ethical principle of avoiding causing harm or negative consequences. It emphasizes the obligation to minimize harm as much as possible and prioritize actions that prevent harm to individuals, communities, or the environment.
- **“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. It emphasizes taking actions that produce positive outcomes and contribute to the overall good, ensuring that the greatest benefit is achieved for all stakeholders involved.

PRACTICE BITS

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

A) To understand the aim and objective of the project

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

A) Three domains

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

A) Analyzing data to extract insights

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

A) Converting digital visual data into computer-readable language

5. What is the primary focus of NLP?

A) Dealing with the interaction between computers and humans using natural language

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

A) Step-by-step guidance

7. How are Ethical Frameworks for AI categorized?

A) Into sector-based and value-based frameworks

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

A) Aligning actions with ethical principles and beliefs

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

A) Prioritizing human rights and dignity, valuing human life over other considerations

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

A) Healthcare and life sciences

Unit-2

Advanced Concepts of Modelling in AI

2.1 Differentiate between AI, ML, and DL

Artificial Intelligence (AI)

It refers to any technique that enables computers to mimic human intelligence. An artificially intelligent machine works on algorithms and data fed to it and gives the desired output.

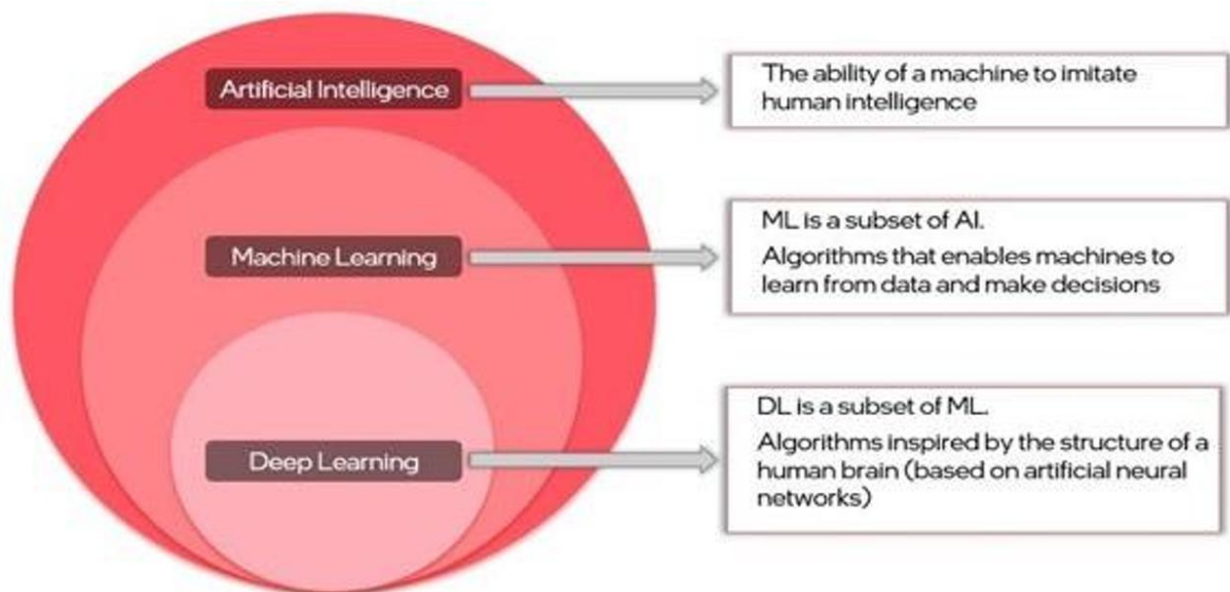
Machine Learning (ML)

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

Deep Learning (DL)

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

Artificial Intelligence is the umbrella terminology which covers machine and deep learning under it and Deep Learning comes under Machine Learning.



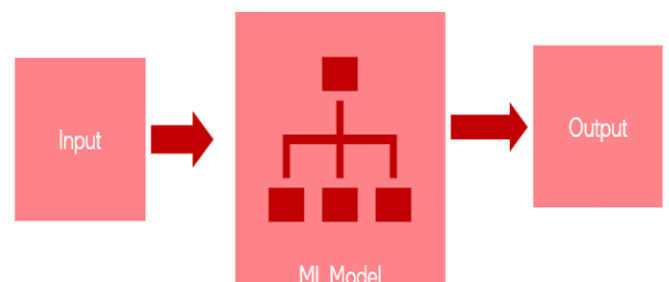
Machine Learning (ML):

Machine Learning, or ML, enables machines to improve at tasks with experience.

The machine learns from its mistakes and takes them into consideration in the next execution.

It improvises itself using its own experiences.

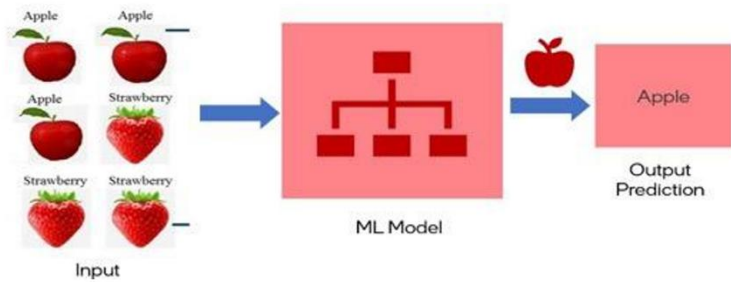
Input (past or historical data) is given to the ML model and the model generates output by learning from the input data



Block Representation – Machine Learning (ML)

Eg:

ML model learns from the input data to classify between apples and strawberries and predicts the correct output as shown.



Examples of Machine Learning (ML):

a) Object Identification:

Identifies and labels objects present within an image or data point. It determines the category an object belongs to.

b) Object Classification:

Identifies and labels objects present within an image or data point. It determines the category an object belongs to.

Deep Learning (DL):

Deep Learning, or DL, enables software to train itself to perform tasks with vast amounts of data.

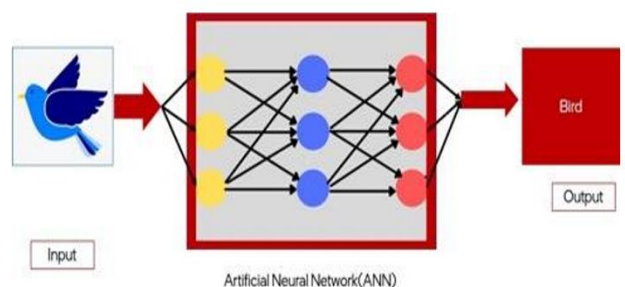
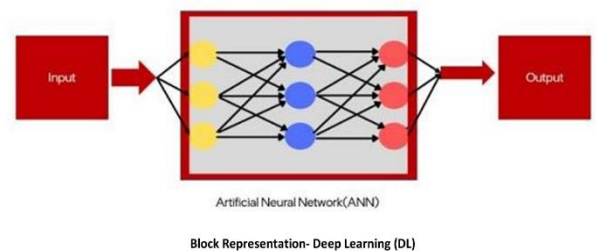
In deep learning, the machine is trained with huge amounts of data which helps it into training itself around the data. Such machines are intelligent enough to develop algorithms for themselves.

Deep Learning is the most advanced form of Artificial Intelligence out of these three.

Eg:

Input is given to an ANN, and after processing, the output is generated by the DL block.

Here is an example which shows pixels of a bird image given as input to the DL Model and the model is able to analyse and correctly predict that it is a bird using a deep learning algorithm (ANN).



Examples of Deep Learning (DL)

a) Object classification:

Object classification in deep learning tackles the task of identifying and labelling objects within an image. It essentially uses powerful algorithms to figure out what's in a picture and categorize those things.

b) Digit Recognition:

Digit recognition in deep learning tackles the challenge of training computers to identify handwritten digits (0-9) within images.

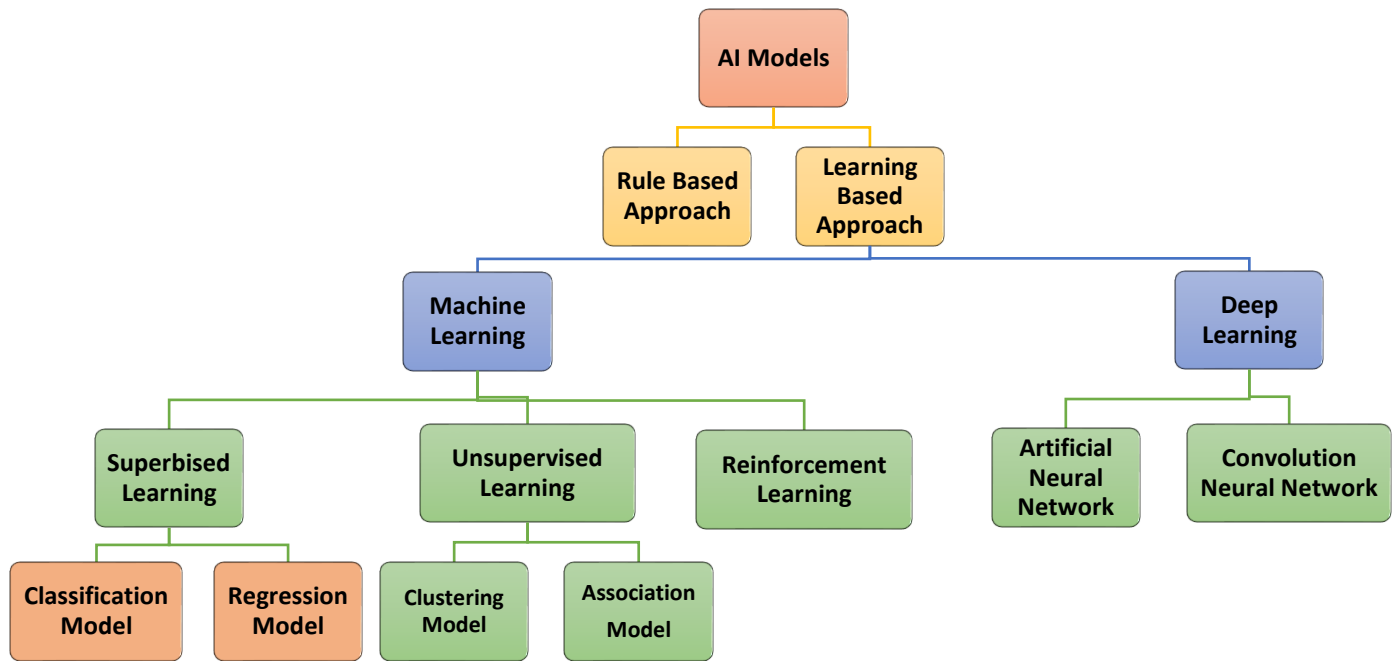
Chapter 2.2

Modelling

Modelling:

AI Modelling refers to developing algorithms, also called models which can be trained to get intelligent outputs. That is, writing codes to make a machine artificially intelligent.

Types of AI Models Generally, AI models can be classified as follows:



1) Rule Based Approach



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

Rule-based Chatbots are commonly used on websites to answer frequently asked questions (FAQs) or provide basic customer support. **It does what it has been taught once.**

A drawback/feature for this approach is that the learning is static. The machine once trained, does not take into consideration any changes made in the original training dataset.

Example: A clothing website has a Chatbot to answer questions about order tracking.

2) Learning Based Approach

A learning-based approach is a method where a computer learns how to do something by looking at examples or getting feedback, similar to how we learn from experience.

Instead of being explicitly programmed for a task, the computer learns to perform it by analysing data and finding patterns or rules on its own.

Learning based approach refers to the AI modelling where the machine learns by itself.

Under the Learning Based approach, the AI model gets trained on the data fed to it and then is able to design a model which is adaptive to the change in data.



Example: suppose you have a dataset of 1000 images of random stray dogs of your area. Now you do not have any clue as to what trend is being followed in this dataset as you don't know their breed, or colour or any other feature but learning based approach might cluster the data on the basis of colour, size, fur style, etc. It might also come up with some very unusual clustering algorithm which you might not have even thought of!

Example: A learning-based spam email filter is a computer program that automatically identifies whether an incoming email is spam or not. Instead of being explicitly programmed with rules for identifying spam, the filter learns from examples of labelled emails during a training phase.

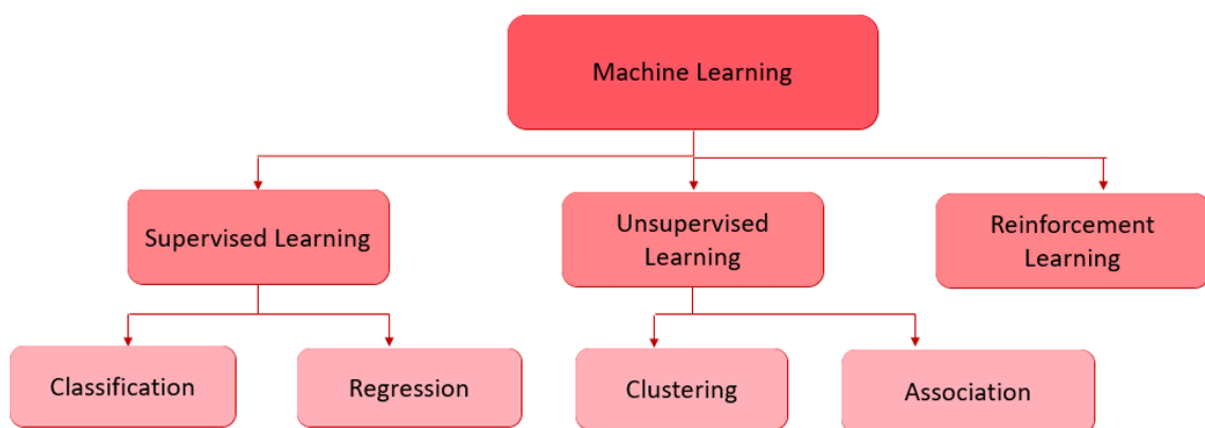
Once trained, the filter can classify new incoming emails as spam or not spam based on the patterns it learned.

It continuously adapts and improves its accuracy over time as it encounters new examples.

This learning-based approach allows the filter to effectively identify and filter out spam emails, helping users manage their email inbox more efficiently.

I. Categories of Machine learning based models:

Learning-based approaches are indeed a broad category that encompass both machine learning and deep learning. Machine learning can further be divided into three parts:



1) Supervised Learning:

Supervised Learning **Unsupervised Learning** **Reinforcement Learning** In a supervised learning model, the dataset which is fed to the machine is labelled.

In other words, we can say that the dataset is known to the person who is training the machine only then he/she is able to label the data. A label is some information which can be used as a tag for data.

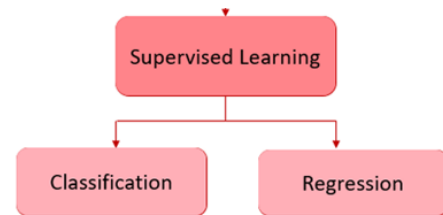
For e.g.: A math teacher teaches the class by making the students learn using a lot of solved examples(training) and then test the knowledge gained by giving the class, problems to solve on their own.

Supervised learning models are used when we want to determine relationships through training.

Sub-categories of Supervised Learning Model

There are two types of Supervised Learning models:

Classification model and Regression model.



a) Classification Model

Here the data is classified according to the labels.

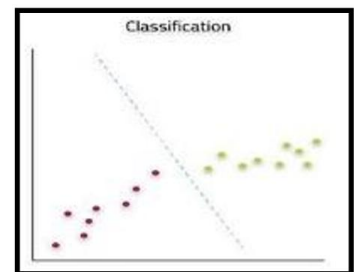
For example, in the grading system, students are classified on the basis of the grades they obtain with respect to their marks in the examination.

This model works on discrete dataset which means the data need not be continuous.

Examples:

Weather be cool or hot tomorrow

Classifying emails as spam or not:



b) Regression Model

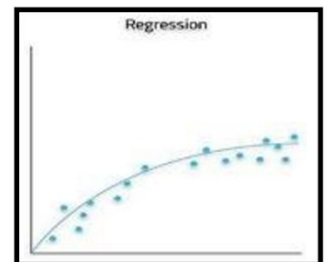
Regression: Such models work on continuous data. For example, if you wish to predict your next salary, then you would put in the data of your previous salary, any increments, etc., and would train the model.

Here, the data which has been fed to the machine is continuous.

Regression algorithms predict a continuous value based on the input variables.

Continuous values as Temperature, Price, Income, Age, etc.

Examples: Predicting temperature, Predicting the price of the house, Used Car Price Prediction



2) Unsupervised Learning

An unsupervised learning model works on unlabelled dataset. This means that the data which is fed to the machine is random and there is a possibility that the person who is training the model does not have any information regarding it.

Unsupervised learning models are used when we want to discover new patterns from data.

It is a type of learning without any guidance.

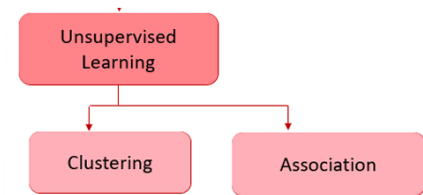
The unsupervised learning models are used to identify relationships, patterns and trends out of the data which is fed into it. It helps the user in understanding what the data is about and what are the major features identified by the machine in it.

Example: You have a random data of 1000 dog images and you wish to understand some pattern out of it, you would feed this data into the unsupervised learning model and would train the machine on it. Here, the machine is responsible to discover patterns, similarities, and differences on its own based on the unlabelled dataset.

Sub-categories of Unsupervised Learning Model :

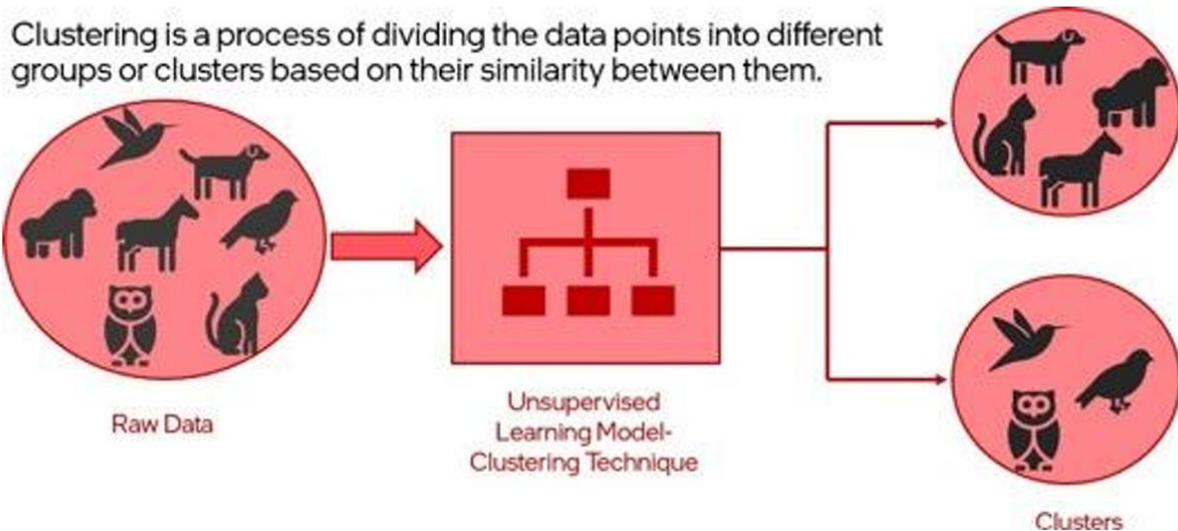
Unsupervised learning models can be further divided into two categories:

Clustering model and Association model.



a) Clustering:

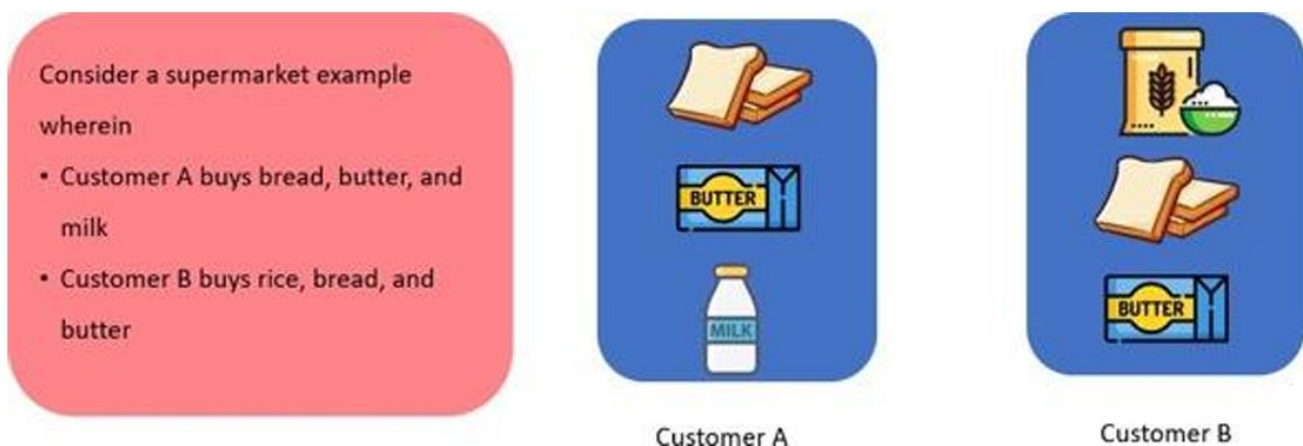
What is Clustering?



Clustering finds similarities between objects and places them in the same cluster and it differentiates them from objects in other clusters.

b) Association:

Association Rule is an unsupervised learning method that is used to find interesting relationships between variables from the database.



Based on the purchase pattern of other customers, we can predict that there is high probability that any customer x who buys bread will most probably buy butter.

Therefore, such meaningful associations can be useful to recommend items to customers. This is called Association Rule.

3) Reinforcement Learning

This learning approach enables the computer to make a series of decisions that maximize a reward metric for the task without human intervention and without being explicitly programmed to achieve the task.

Reinforcement learning models are used when we want to implement machine learning through a reward mechanism.

Reinforcement learning is a type of learning in which a machine learns to perform a task through a repeated trial-and-error method. ▪ Let's say you provide an image of an apple to the machine and ask the machine to predict it- ▪ The machine first predicts it as 'cherry' and you give negative feedback that it's incorrect. ▪ Now, the machine learns that it's not a cherry

PRACTICE BITS

Q1. Which learning approach uses labelled data for training? **Supervised Learning**

Q2. The target variable is categorical in which type of problem? **Classification Problem**

Q3. Which algorithmic model would you use when you have to predict a continuous valued output?
Regression Model

Q4. Which of the following is false about Reinforcement Learning? [D]

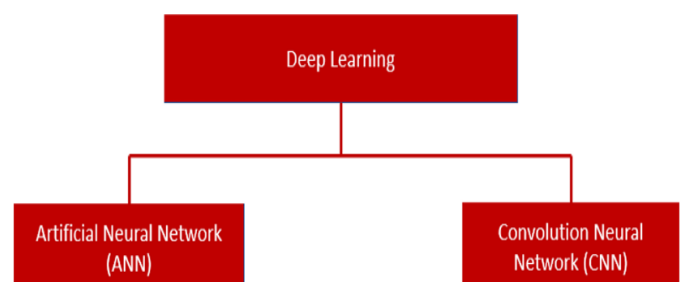
- A) Uses Reward Mechanism
- B) Classification
- C) Target is to Maximize the Reward
- D) Predicts a continuous value as output

Q5. Clustering is **Unsupervised learning** and its goal is to **Divide the data points into different groups**

II) Sub-Categories of Deep Learning:

Deep Learning enables software to train itself to perform tasks with vast amounts of data.

In deep learning, the machine is trained with huge amounts of data which helps it to train itself around the data. Such machines are intelligent enough to develop algorithms for themselves.



There are two types of Deep Learning models:

Artificial Neural Networks (ANN) and Convolution Neural Network (CNN).

a) Artificial Neural networks (ANN) –

Artificial Neural networks are modelled on the human brain and nervous system. They are able to automatically extract features without input from the programmer. Every neural network node is essentially a machine learning algorithm. It is useful when solving problems for which the data set is very large.

b) Convolutional Neural Network (CNN) –

Convolutional Neural Network is a Deep Learning algorithm which 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 out of all.

Most commonly used for analysing **visual data** such as images and videos. CNNs are especially effective in **image classification, object detection, face recognition**, and more.

Applications of CNNs:

- Image and video recognition
- Medical image analysis (e.g., tumor detection)
- Self-driving cars (object detection)
- Facial recognition
- Satellite image classification

Chapter 2.3

Artificial Neural Networks

What is Neural Network?

Neural networks are loosely modelled after how neurons in the human brain behave.

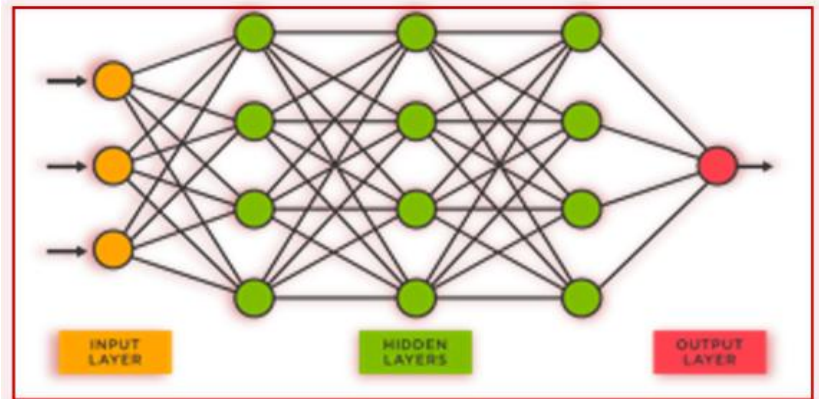
The key advantage of neural networks is that they are able to extract data features automatically without needing the input of the programmer.

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.

Here is a representation of how neural networks work:

- A Neural Network is divided into multiple layers and each layer is further divided into several blocks called nodes. Each node has its own task to accomplish which is then passed to the next layer.

- Neural Network consists of an input layer, hidden layer which performs computation using weights and biases on each node and finally, information is passed through these layers to reach the output layer.



- The first layer of a Neural Network is known as the input layer. The job of an input layer is to acquire data and feed it to the Neural Network. No processing occurs at the input layer.
- Next to it, are the hidden layers. Hidden layers are the layers in which the whole processing occurs. Their name essentially means that these layers are hidden and are not visible to the user.

Each node of these hidden layers has its own machine learning algorithm which it executes on the data received from the input layer.

- The hidden layer performs computation by means of weights and biases. Information passes from one layer to the other after the value found from this calculation passed through a selected activation function.
- The process of finding the right output begins with trial and error until the network finally learns.

- With each try, the weights are adjusted based on the error found between the desired output and the network output.

There can be multiple hidden layers in a neural network system and their number depends upon the complexity of the function for which the network has been configured. Also, the number of nodes in each layer can vary accordingly.

The last hidden layer passes the final processed data to the output layer which then gives it to the user as the final output. Similar to the input layer, output layer too does not process the data which it acquires. It is meant for user-interface

Real-world applications of neural network are facial recognition, customer support chatbot, vegetable price prediction etc.

PRACTICE BITS

1. In which type of machine learning is the data labeled with the desired output? **Supervised Learning**
2. An email spam filter that learns to identify spam emails based on labelled examples is an application of: **Supervised Learning**
3. A machine learning algorithm that groups similar customer purchases into clusters for recommendation systems uses: **Unsupervised Learning**
4. An AI agent playing a game and learning from its rewards and penalties is an example of: **Reinforcement Learning**
5. Which of the following statements is NOT true about supervised learning?
Can be less efficient for large datasets
6. In an unsupervised learning scenario, the goal is to:
Identify patterns and relationships within unlabelled data
7. Clustering algorithms are commonly used in unsupervised learning for:
Grouping similar data points
8. Reinforcement learning is particularly useful for scenarios where:
The desired outcome is clear, but the path to achieve it is unknown
9. Imagine an AI playing a game and learning to win by trial and error. This is an example of:
Reinforcement Learning

10. Artificial neural networks are inspired by the structure and function of: **The human brain**

11. The process of adjusting the weights in a neural network to improve performance is called: **Training**

12. A neural network with multiple layers of interconnected neurons is called a:
Deep Neural Network

13. Neural networks are particularly well-suited for tasks involving:
Recognizing patterns in complex data like images and text

14. Training a neural network often requires:
A significant amount of data and computational resources

Unit-3

Evaluating Models

3.1: Importance of Model Evaluation

Model Evaluation is an integral part of the model development process. It helps to find the best model that represents our data and how well the chosen model will work in the future

Model evaluation is the process of using different evaluation metrics to understand a machine learning model's performance

- An AI model gets better with constructive feedback:

You build a model, get feedback from metrics, make improvements and continue until you achieve a desirable accuracy.

Need of model evaluation:

Model evaluation helps you understand its strengths, weaknesses, and suitability for the task at hand. This feedback loop is essential for building trustworthy and reliable AI systems.

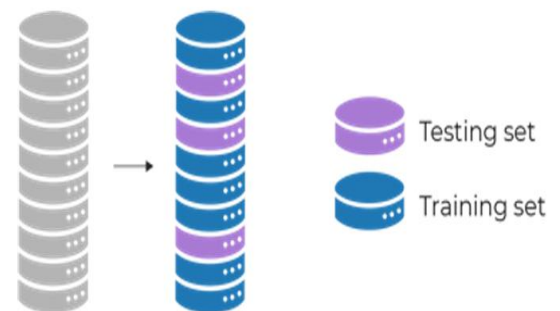
3.2: Splitting the training set data for Evaluation:

Train-test split:

- The train-test split is a 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 and the testing dataset.

- The train-test procedure is appropriate when there is a sufficiently large dataset available

Need of Train-test split

- The train dataset is used to make the model learn.
- The input elements of the test dataset are provided to the trained model. The model makes predictions, and the predicted values are compared to the expected values.
- The objective is to estimate the performance of the machine learning model on new data: Data not used to train the model.

If model simply remembers the whole training set, and will therefore always predict the correct label for any point in the training set. This is known as overfitting.

3.3: Accuracy and Error

Accuracy

- Accuracy is an evaluation metric that allows you to measure the total number of predictions **a model gets right**.

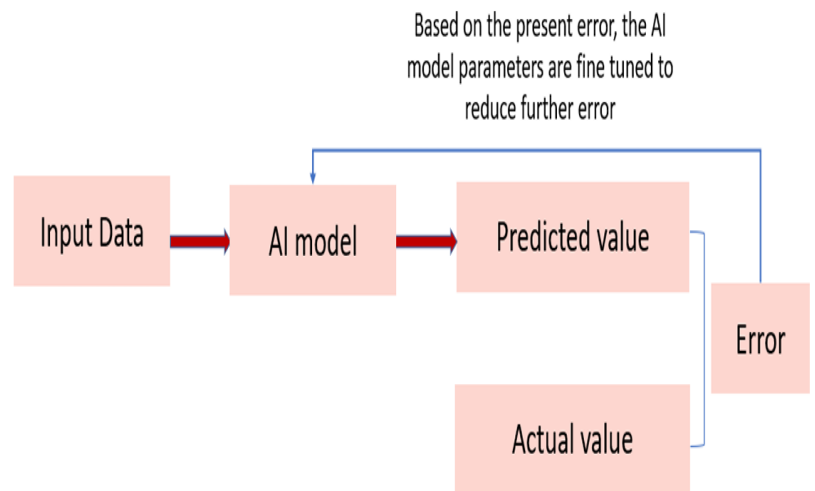
- The accuracy of the model and performance of the model is directly proportional, and Hence better the performance of the model, the more accurate are the predictions.

Error

- Error can be described as an action that is inaccurate or wrong.
- In Machine Learning, the error is used to see how accurately our model can predict data it uses to learn new, unseen data.
- Based on our error, we choose the machine learning model which performs best for a Particular dataset.

Error refers to the difference between a model's prediction and the actual outcome. It quantifies how often the model makes mistakes.

Eg:



Predicted House Price (USD)	Actual House Price (USD)	Error Abs (Actual-Predicted)	Error Rate (Error/Actual)	Accuracy (1-Error rate)	Accuracy% (Accuracy*100)%
391k	402k	Abs (402k-391k)= 11k	11k/402k=0.027	1-0.027= 0.973	0.973*100%= 97.3%

*Abs means the absolute value, which means only the magnitude of the difference without any negative sign (if any).

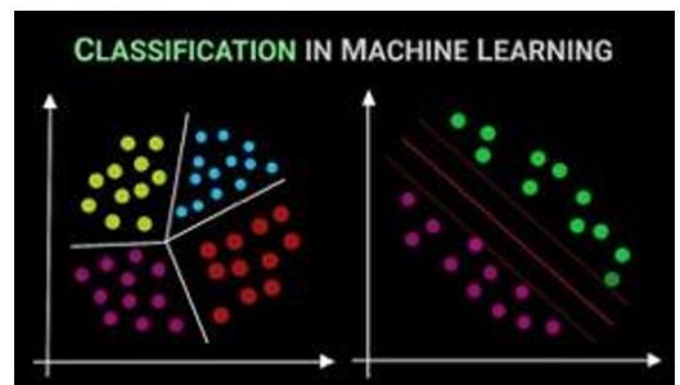
3.4: Evaluation metrics for Classification

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

Classification Metrics:

Popular metrics used for classification model

- Confusion matrix
- Classification accuracy
- Precision
- Recall



Confusion matrix:

True Positive ▪ True Positive (TP) is the outcome of the model correctly predicting the positive class

Eg: You had predicted that France would win the world cup, and it won.

True Negative ▪ True Negative (TN) is the outcome of the model correctly predicting the negative class.

Eg: You had predicted that Germany would not win, and it lost.

False Positive ▪ False Positive (FP) is the outcome of the model wrongly predicting the negative class as positive class.

Eg: You had predicted that Germany would win, but it lost.

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

Eg: You had predicted that France would not win but it won

Accuracy from Confusion matrix:

Classification accuracy is the number of correct predictions made as a ratio of all predictions made.

Correct predictions=TP+TN

Total predictions=TP+TN+FP+FN

$$\begin{aligned}\text{Classification accuracy} &= \frac{\text{Correct predictions}}{\text{Total predictions}} \\ &= \frac{TP+TN}{TP+TN+FP+FN} \\ &= \frac{12+21}{12+21+04+06} = 0.767\end{aligned}$$

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

Precision from Confusion matrix:

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

▪ Precision = 0.843 means that when our model predicts a patient has heart disease, it is correct around 84% of the time.

$$\begin{aligned}\text{Precision} &= \frac{\text{Correct positive predictions}}{\text{Total positive predictions}} \\ &= \frac{TP}{TP+FP}\end{aligned}$$

Recall from Confusion matrix :

The recall is the measure of our model correctly identifying True Positives

Thus, for all the patients who actually have heart disease, recall tells us how many we correctly identified as having a heart disease.

Recall = 0.86 tells us that out of the total patients who have heart disease 86% have been correctly identified.

$$\begin{aligned}\text{Recall} &= \frac{\text{Correct positive predictions}}{\text{Total actual positive values}} \\ &= \frac{TP}{TP+FN}\end{aligned}$$

F1 Score :

- F1-Score provides a way to combine both precisions and recall into a single measure that captures both properties

In those use cases, 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.

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

3.2 Ethical concerns around model evaluation:

While evaluating an AI model, the following ethical concerns need to be kept in mind

Bias

Ensure that the evaluation metrics chosen don't result in any kind of bias

Transparency

Honest explanation how the chosen evaluation metrics work and produce results without keeping any information hidden

Accountability

Take responsibility for your choice of metrics and methodology of evaluation in case any user faces a disadvantage because of your chosen methodology

Examine the following case studies. Draw the confusion matrix and calculate metrics such as accuracy, precision, recall, and F1-score for each one of them.

Case Study 1: Spam Email Detection System

A spam email detection system is used to classify emails as either spam (1) or not spam (0). Out of 1000 emails:

- True Positives (TP): 150 emails were correctly classified as spam.
- False Positives (FP): 50 emails were incorrectly classified as spam.
- True Negatives (TN): 750 emails were correctly classified as not spam.
- False Negatives (FN): 50 emails were incorrectly classified as not spam.

Solution

1. Accuracy

Formula: $\text{Accuracy} = (TP + TN) / (TP + TN + FP + FN)$

Calculation: $(150 + 750) / 1000 = 900 / 1000 = 90\%$

2. Precision

Formula: $\text{Precision} = TP / (TP + FP)$

Calculation: $150 / (150 + 50) = 150 / 200 = 0.75 = 75\%$

3. Recall (Sensitivity)

Formula: $\text{Recall} = TP / (TP + FN)$

Calculation: $150 / (150 + 50) = 150 / 200 = 0.75 = 75\%$

4. F1 Score

Formula: $F1 = 2 \times (\text{Precision} \times \text{Recall}) / (\text{Precision} + \text{Recall})$

Calculation: $2 \times (0.75 \times 0.75) / (0.75 + 0.75) = 1.125 / 1.5 = 0.75 = 75\%$

Final Results

- Accuracy = 90%
- Precision = 75%
- Recall = 75%
- F1 Score = 75%

Case Study 2 : Medical Diagnosis System

A medical diagnosis system is used to classify patients as having a certain disease (1) or not having it (0). Out of 1000 patients:

- True Positives (TP): 120 patients were correctly diagnosed with the disease.
- False Positives (FP): 20 patients were incorrectly diagnosed with the disease.
- True Negatives (TN): 800 patients were correctly diagnosed as not having the disease.
- False Negatives (FN): 60 patients were incorrectly diagnosed as not having the disease.

Confusion Matrix

Actual / Predicted	Predicted: Disease (1)	Predicted: No Disease (0)
Actual: Disease (1)	TP = 120	FN = 60
Actual: No Disease (0)	FP = 20	TN = 800

Metrics Calculation

1. Accuracy

Formula: $\text{Accuracy} = (\text{TP} + \text{TN}) / (\text{TP} + \text{TN} + \text{FP} + \text{FN})$

Calculation: $(120 + 800) / 1000 = 920 / 1000 = 92.00\%$

2. Precision

Formula: $\text{Precision} = \text{TP} / (\text{TP} + \text{FP})$

Calculation: $120 / (120 + 20) = 120 / 140 = 85.71\%$

3. Recall (Sensitivity)

Formula: $\text{Recall} = \text{TP} / (\text{TP} + \text{FN})$

Calculation: $120 / (120 + 60) = 120 / 180 = 66.67\%$

4. F1 Score

Formula: $\text{F1} = 2 \times (\text{Precision} \times \text{Recall}) / (\text{Precision} + \text{Recall})$

Calculation: $\text{F1} = 2 \times (0.86 \times 0.67) / (0.86 + 0.67) = 75.00\%$

Final Results

- Accuracy = 92.00%
- Precision = 85.71%
- Recall = 66.67%
- F1 Score = 75.00%

Comparison Table of Metrics

Metric	Value
Accuracy	92.00%
Precision	85.71%
Recall	66.67%
F1 Score	75.00%

2. A teacher's marks prediction system predicts the marks of a student as 75, but the actual marks obtained by the student are 80. What is the absolute error in the prediction?

A) 5 B) 10 C) 15 D) 20

Solution:

Absolute Error = Actual – Predicted

$$= 80 - 75 = 5$$

3. A student solved 90 out of 100 questions correctly in a multiple-choice exam. What is the error rate of the student's answers?

$$\begin{aligned}\text{Error rate} &= (\text{wrong answers} \div \text{total questions}) \times 100 \\ &= (10 \div 100) \times 100 = \mathbf{10\%}.\end{aligned}$$

4. The goal when 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

5. 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

5. How is the relationship between model performance and accuracy described?

- A) Inversely proportional
- B) Not related
- C) Directly proportional**
- D) Randomly fluctuating

Choose the correct option:

- (a) Both A and R are true and R is the correct explanation for A
- (b) Both A and R are true and R is not the correct explanation for A
- (c) A is True but R is False
- (d) A is false but R is True

Q1. Assertion: Accuracy is an evaluation metric that allows you to measure the total number of predictions a model gets right.

Reasoning: 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.

(a) Both A and R are true and R is the correct explanation for A

Q2. Assertion: The sum of the values in a confusion matrix's row represents the total number of instances for a given actual class.

Reasoning: This enables the calculation of class-specific metrics such as precision and recall, which are essential for evaluating a model's performance across different classes.

(b) Both A and R are true and R is not the correct explanation for A

6. In a medical test for a rare disease, out of 1000 people tested, 50 actually have the disease while 950 do not. The test correctly identifies 40 out of the 50 people with the disease as positive, but it also wrongly identifies 30 of the healthy individuals as positive. What is the accuracy of the test?

Let's carefully calculate step by step:

- **Total people tested** = 1000
- **Actually diseased** = 50
- **Actually healthy** = 950

Test results given:

- True Positives (TP) = 40 (correctly identified diseased)
- False Negatives (FN) = 50 - 40 = 10
- False Positives (FP) = 30 (healthy but wrongly identified as diseased)
- True Negatives (TN) = 950 - 30 = 920

👉 Accuracy formula = $\frac{TP + TN}{Total}$

$$Accuracy = \frac{40 + 920}{1000} = \frac{960}{1000} = 96\%$$

7. In a spam email detection system, out of 1000 emails received, 300 are spam. The system correctly identifies 240 spam emails as spam, but it also marks 60 legitimate emails as spam. What is the precision of the system?

$$Precision = TP \div (TP + FP)$$

$$= 240 \div (240 + 60)$$

$$= 240 \div 300 = \mathbf{0.8 = 80\%}.$$

8. 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?

-
- **Predicted positives** = 70
 - **True positives (TP)** = 50
 - So, **False positives (FP)** = 70 - 50 = 20

For recall, we also need the **actual positives**.

- Actual positives = TP + FN
- Since TP = 50, but FN is not given directly, we assume the problem means that out of all actual positives, 50 were correctly predicted.
- So recall = $TP \div (TP + FN)$

👉 Given info suggests TP = 50, FN not provided, so recall = $50 \div \text{Actual positives}$.

⚠️ The question seems incomplete. If we assume **actual positives** = 100 (a common setup), then:

$$Recall = \frac{50}{100} = 50\%$$

9. 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?

Given:

- Actual positives = 200
- Correctly predicted positives (TP) = 120
- False negatives (FN) = $200 - 120 = 80$
- False positives (FP) = 40

Step 1: Precision

$$\text{Precision} = \frac{TP}{TP + FP} = \frac{120}{120 + 40} = \frac{120}{160} = 0.75$$

Step 2: Recall

$$\text{Recall} = \frac{TP}{TP + FN} = \frac{120}{120 + 80} = \frac{120}{200} = 0.6$$

Step 3: F1 Score

$$F1 = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$
$$F1 = \frac{2 \times 0.75 \times 0.6}{0.75 + 0.6} = \frac{0.9}{1.35} = 0.6667$$

↓

✅ F1 Score ≈ 0.67 (67%)

10. A medical diagnostic test is designed to detect a certain disease. Out of 1000 people tested, 100 have the disease, and the test identifies 90 of them correctly. However, it also wrongly identifies 50 healthy people as having the disease. What is the precision of the test? A) 90% B) 80% C) 70% D) 60%

Given:

- Total = 1000
- Actual positives (disease cases) = 100
- Test correctly identifies 90 → True Positives (TP) = 90
- So, False Negatives (FN) = $100 - 90 = 10$
- Test wrongly identifies 50 healthy as diseased → False Positives (FP) = 50

Precision formula:

$$\text{Precision} = \frac{TP}{TP + FP}$$
$$\text{Precision} = \frac{90}{90 + 50} = \frac{90}{140} = 0.6429 \approx 64\%$$

Closest option = D) 60% ✅

Unit-4

Statistical Data

(TO BE ASSESSED BY THE PRACTICAL ONLY)

Unit 5

Computer Vision

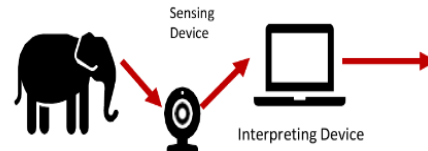
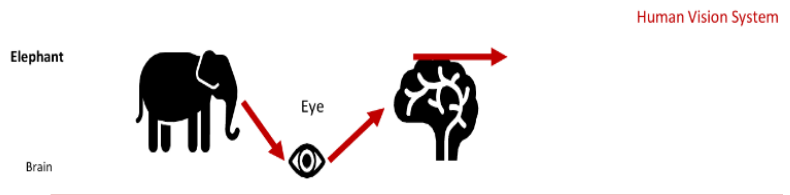
5.1 Introduction to Computer Vision:

The Computer Vision domain of Artificial Intelligence, enables machines to see through images or visual data, process and analyse them on the basis of algorithms and methods to analyse actual phenomena with images.

Eg: Emoji Scavenger Hunt game

Computer vision is the process of extraction of information from images, text, videos, etc.

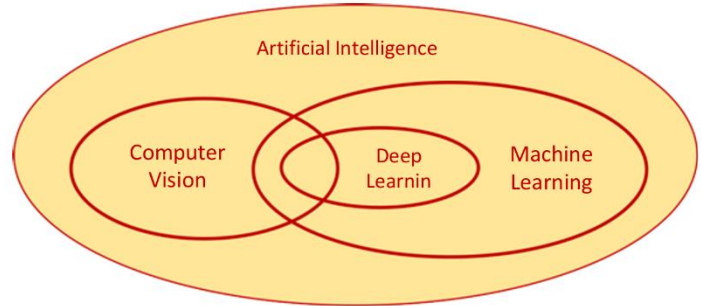
A system that can process, analyze and make sense of visual data in the same way as humans do.



Computer Vision and Artificial Intelligence :

Computer vision is a field of artificial intelligence (AI).

AI enables computers to think, and computer vision enables AI to see, observe and make sense of visual data (like images & videos).



Computer Vision vs Image Processing:

Computer Vision Vs. Image Processing

Computer Vision	Image Processing
• Computer vision deals with extracting information from the input images or videos to infer meaningful information and understanding them to predict the visual input • Computer Vision is a superset of ImageProcessing. • Examples - Object detection, Handwritingrecognition, etc.	• Image processing is mainly focused on processing the raw input images to enhance them or preparing them to do other tasks • Image Processing is a subset of ComputerVision. • Examples - Rescaling image, Correcting brightness, Changing tones, etc.

5.2 Applications of Computer Vision:

- Facial Recognition
- Face Filters
- Google's Search by Image
- Computer Vision in Retail
- Inventory Management
- Self-Driving Cars
- Medical Imaging
- Google Translate App

5.3 Computer Vision Tasks:

The tasks used in a computer vision application are:

Classification:

The image Classification problem is the task of **assigning an input image one label from a fixed set of categories**.

Classification+ Localisation:

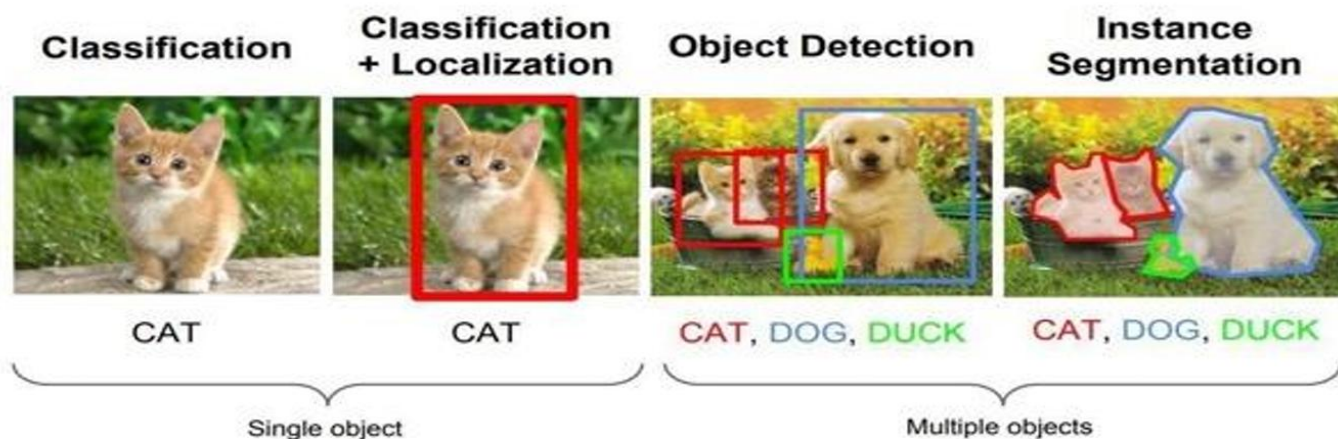
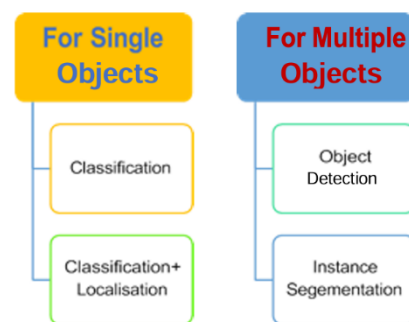
This is the task that involves both processes of identifying what object is present in the image and **at the same time identifying at what location that object is present in that image**. It is used only for single objects.

Object Detection:

Object detection is the process of **finding instances of real-world objects such as faces, bicycles, and buildings in images or videos**. It is commonly used in applications such as image retrieval and automated vehicle parking systems.

Instance Segmentation:

Instance Segmentation is the process of **detecting instances of the objects, giving them a category, and then giving each pixel a label based on that**. A segmentation algorithm takes an image as input and outputs a collection of regions (or segments).



Basics of Images:

Basics of Pixels:

The word "pixel" means a **picture element**.

Every photograph, in digital form, is made up of pixels.

They are the **smallest unit of information** that make up a picture. Usually **round or square**, they are typically arranged in a **2-dimensional grid**.

Resolution:

The **number of pixels** in an image is sometimes called the resolution.

Pixel value:

The most common pixel format is the byte image, where this number is stored as an **8-bit** integer giving a range of possible values **from 0 to 255**

Grayscale Images

Grayscale images are images that have a range of **shades of gray without apparent colour**. The darkest possible shade is **black**, which is the total **absence of colour or zero value** of pixel. The lightest possible shade is **white**, which is the total **presence of colour or 255 value** of a pixel. **Intermediate shades of gray** are represented by equal brightness levels of the three primary colours.

RGB Images

All the images that we see around us are coloured images. These images are made up of **three primary colours Red, Green, and Blue**. All the colours that are present can be made by combining different intensities of red, green, and blue.

No-Code AI Tools

Lobe.ai is an Auto-ML tool, which means that it is a no-code AI tool • It works with image classification and allows a set of images with labels and will automatically find the most optimal model to classify the images

Teachable Machine is an AI, Machine Learning, and Deep Learning tool that was developed by Google in 2017

Orange Data Mining Tool

5.4 Image Features

In computer vision and image processing, a feature is a piece of information that is relevant for solving the computational task related to a certain application. Features may be specific structures in the image such as points, edges, or objects.

In image processing, we can get a lot of features from the image. It can be either a blob, an edge, or a corner.

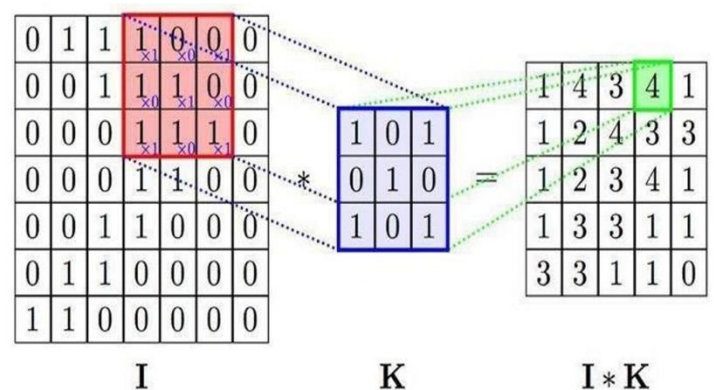
5.5 Convolution

Different filters applied to an image change the pixel values evenly throughout the image. This is done with the help of the **process of convolution and the convolution operator** which is commonly used to create these effects.

Convolution is a simple mathematical operation that is fundamental to many common image processing operators.

Convolution provides a way of multiplying together two arrays of numbers, generally of different sizes, but of the same dimensionality, to produce a third array of numbers of the same dimensionality.

An (image) convolution is simply an element-wise multiplication of image arrays and another array called the kernel followed by sum.



I= Image Array

K = Kernel Array

$I * K$ = Resulting array after performing the convolution operator

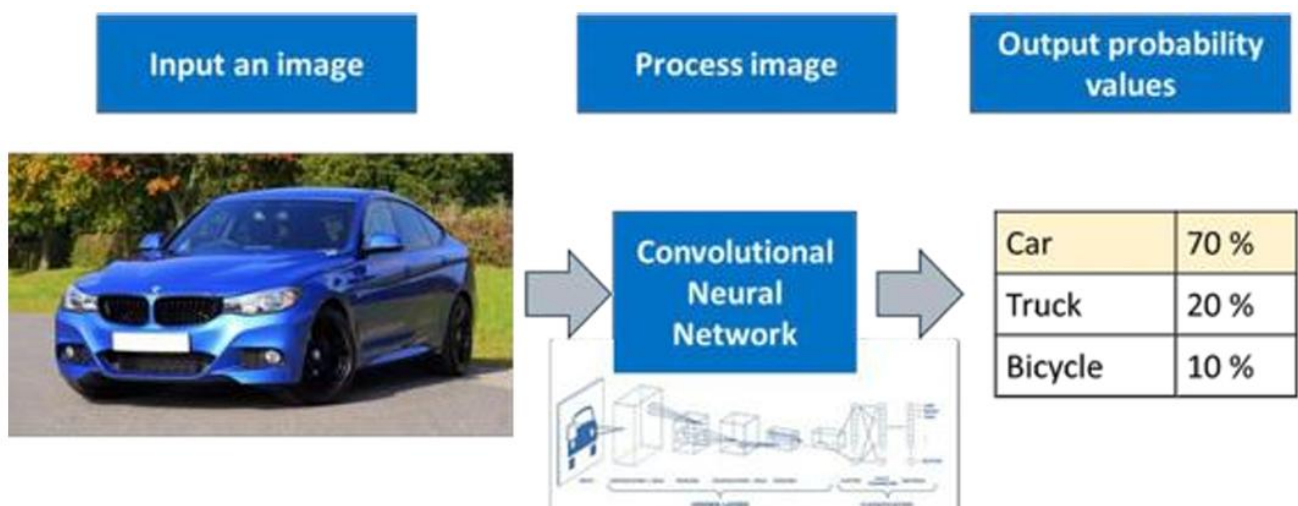
Note: The Kernel is passed over the whole image to get the resulting array after convolution.

What is a Kernel?

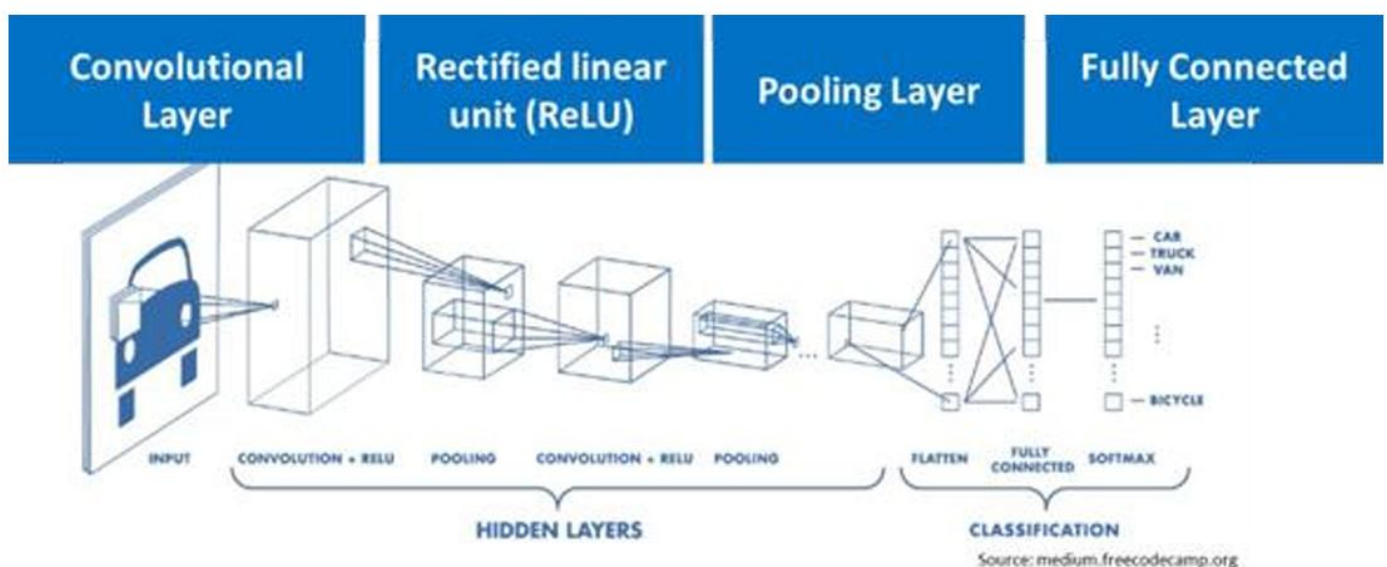
A Kernel is a matrix, which is slid across the image and multiplied with the input such that the output is enhanced in a certain desirable manner. Each kernel has a different value for different kinds of effects that we want to apply to an image.

5.6 Convolution Neural Networks (CNN) Introduction

A Convolutional Neural Network (CNN) is a Deep Learning algorithm that 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. The process of deploying a CNN is as follows:



The different layers of a Convolutional Neural Network (CNN) are as follows:



5.7.1 Convolution Layer

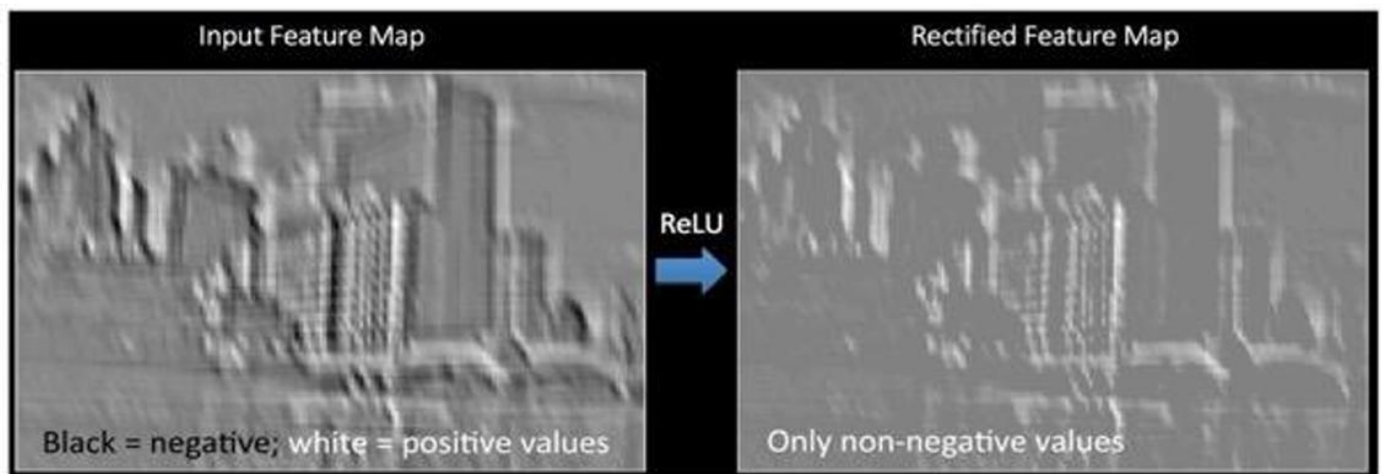
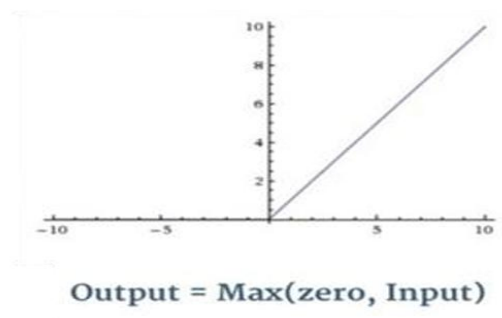
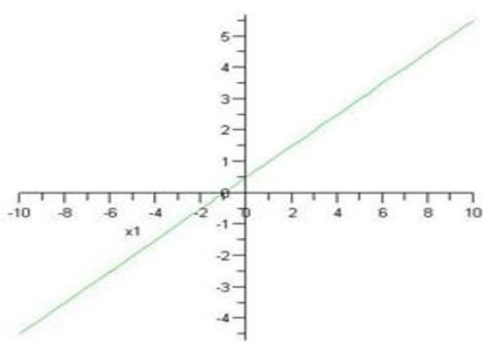
It is the first layer of a CNN. The objective of the Convolution Operation is to extract the high-level features such as edges, from the input image.

There are several uses we derive from the feature map:

- We **reduce the image size** so that it can be processed more efficiently.
- We only **focus on the features of the image** that can help us in processing the image further

5.7.2 Rectified Linear Unit Function(ReLU)

The next layer in the Convolution Neural Network is the Rectified Linear Unit function or the ReLU layer. After we get the feature map, it is then passed onto the ReLU layer. **This layer simply gets rid of all the negative numbers in the feature map and lets the positive number stay as it is.**



5.7.3 Pooling Layer

Similar to the Convolutional Layer, the **Pooling layer is responsible for reducing the spatial size of the Convolved Feature while still retaining the important features.** Two types of pooling can be performed on an image.

1. **Max Pooling:** Max Pooling **returns the maximum value** from the portion of the image covered by the Kernel.
2. **Average Pooling:** Max Pooling **returns the maximum value** from the portion of the image covered by the Kernel.

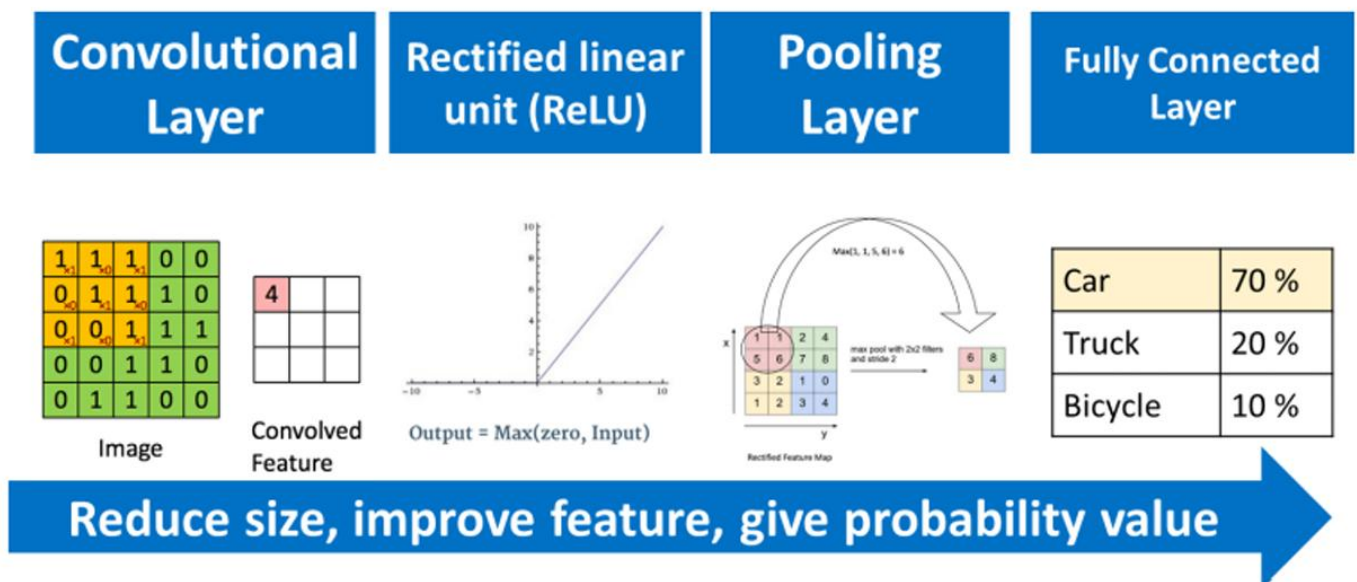
The pooling layer is important in the CNN as it performs a series of tasks which are as follows:

1. **Makes the image smaller** and more manageable
2. **Makes the image more resistant to small transformations**, distortions, and translations in the input image.

5.7.4 Fully Connected Layer

The final layer in the CNN is the Fully Connected Layer (FC layer). The objective of a fully connected layer is **to take the results of the convolution/pooling process and use them to classify the image into a label** (in a simple classification example). The output of convolution/pooling is flattened into a single vector of values, each representing a probability that a certain feature belongs to a label.

Convolutional Neural Network



1. What is the primary objective of the Convolution Layer in a Convolutional Neural Network (CNN)?

- A) To flatten the input image B) To assign importance to various aspects/objects in the image
C) To reduce the spatial size of the input image D) To perform element-wise multiplication of image arrays

2. Which of the following tasks is an example of computer vision?

- A) Rescaling an image B) Correcting brightness levels in an image
C) Object detection in images or videos D) Changing tones of an image

3. How is resolution typically expressed?

A) By the number of pixels along the width and height, such as 1280x1024

B) By the brightness level of each pixel, ranging from 0 to 255

C) By the total number of pixels, such as 5 megapixels D) By the arrangement of pixels in a 2-dimensional grid

4. What is the core task of image classification?

A) Identifying objects and their locations in images

B) Segmenting objects into individual pixels

C) Assigning an input image one label from a fixed set of categories

D) Detecting instances of real-world objects in images

5. What is the function of the Rectified Linear Unit (ReLU) layer in a CNN?

A) To reduce the image size for more efficient processing

B) To assign importance to various aspects/objects in the input image

C) To get rid of negative numbers in the feature map and retain positive numbers

D) To perform the convolution operation on the input image

6. Object detection and handwriting recognition are examples of tasks commonly associated with:

A) Computer vision

B) Image processing

C) Both computer vision and image processing

D) Neither computer vision nor image processing

7. What does the pixel value represent in an image?

A) Width of the pixel

B) Brightness or color of the pixel

C) Height of the pixel

D) Resolution of the pixel

8. In the byte image format, what is the range of possible pixel values?

A) 0 to 10

B) 0 to 100

C) 0 to 1000

D) 0 to 255

9. In a grayscale image, what does the darkest shade represent?

A) Total presence of color

B) Zero value of pixel

C) Lightest shade of gray

D) Maximum pixel value

10. In an RGB image, what does a pixel with an intensity value of 0 represent?

A) Full presence of color

B) No presence of color

C) Maximum brightness level

D) Minimum brightness level

11. Assertion: Object detection is a more complex task than image classification because it involves identifying both the presence and location of objects in an image.

Reasoning: Object detection algorithms need to not only classify the objects present in an image but also accurately localize them by determining their spatial extent.

Select the appropriate option for the statements given above:

A) Both A and R are true and R is the correct explanation of A

B) Both A and R are true and R is not the correct explanation of A

C) A is true but R is false

D) A is False but R is true

12. Assertion: Grayscale images consist of shades of gray ranging from black to white, where each pixel is represented by a single byte, and the size of the image is determined by its height multiplied by its width.

Reasoning: Grayscale images are represented using a three intensities per pixel, typically ranging from 0 to 255.

Select the appropriate option for the statements given above:

A) Both A and R are true and R is the correct explanation of A

B) Both A and R are true and R is not the correct explanation of A

C) A is true but R is false

D) A is False but R is true

Unit 6

Natural Language Processing

6.1 Introduction

A natural language is a human language, such as French, Spanish, English, Japanese, etc.

Features of Natural Languages:

- They are governed by set rules that include syntax, lexicon, and semantics.
- All natural languages are redundant, i.e., the information can be conveyed in multiple ways.
- All natural languages change over time.

Why is NLP important?

Computers can only process electronic signals in the form of binary language (0s and 1s). Natural Language Processing facilitates this conversion to digital form from the natural form. Thus, the whole purpose of NLP is to **make communication between computer systems and humans possible**. This includes creating different tools and techniques that facilitate better communication of intent and context.

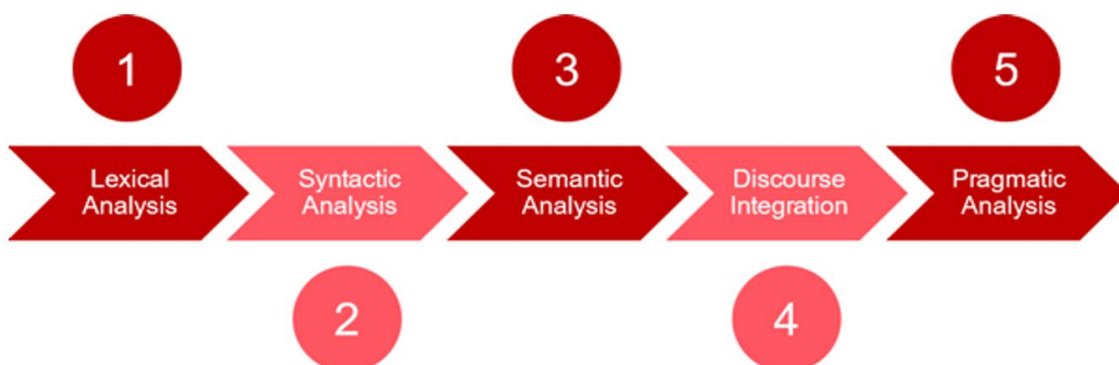
Natural Language Processing, or NLP, is the **sub-field of AI** that is focused on **enabling computers to analyse, understand and process human languages to derive meaningful information from human language**.

6.2 Applications of Natural Language Processing

- Voice assistants
- Autogenerated captions
- Language Translation
- Sentiment Analysis
- Text Classification
- Keyword Extraction

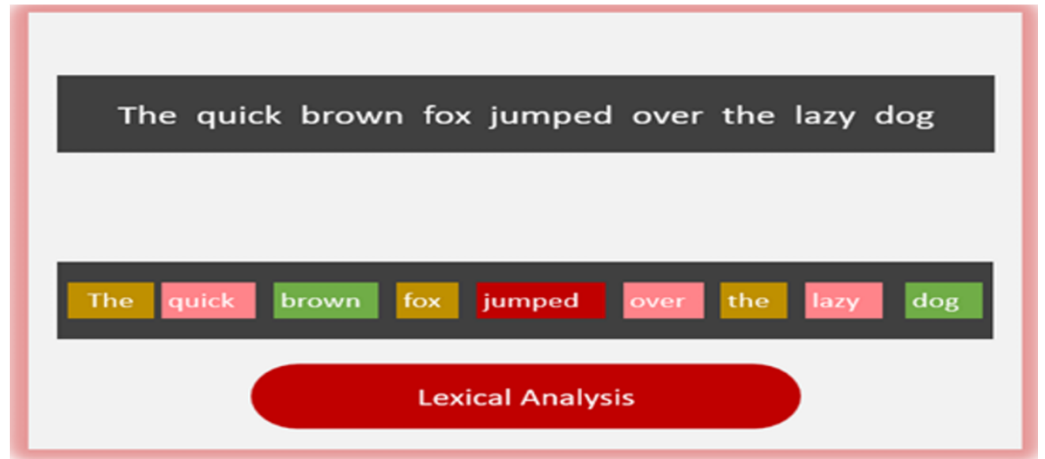
6.3 Stages of Natural Language Processing (NLP)

The different stages of Natural Language Processing (NLP) serve various purposes in the overall task of understanding and processing human language. The stages of Natural Language Processing (NLP) typically involve the following:



Lexical Analysis:

NLP starts with identifying the structure of input words. It is the process of **dividing a large chunk of words into structural paragraphs, sentences, and words**. **Lexicon** stands for a collection of the various words and **phrases** used in a language.



Syntactic Analysis / Parsing:

It is the process of **checking the grammar** of sentences and phrases. It forms a relationship among words and eliminates logically incorrect sentences.



Semantic Analysis:

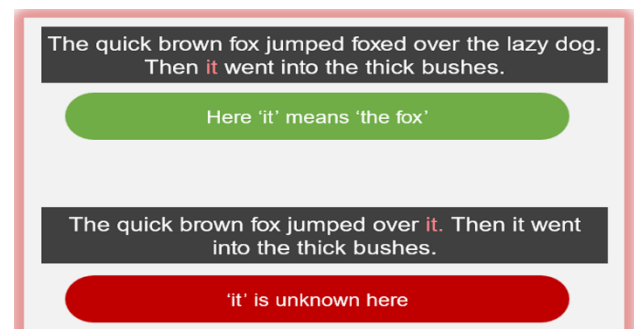


In this stage, the input text is now **checked for meaning**, and every word and phrase is checked for meaningfulness.

Discourse Integration

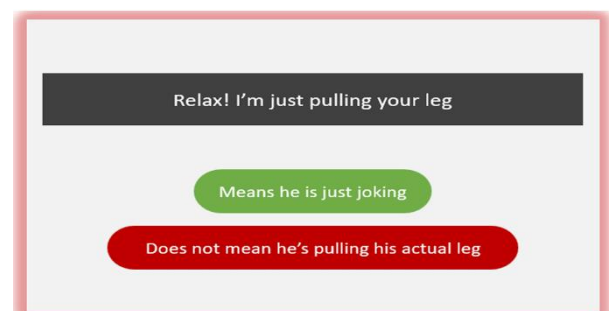
It is the process of **forming the story of the sentence**.

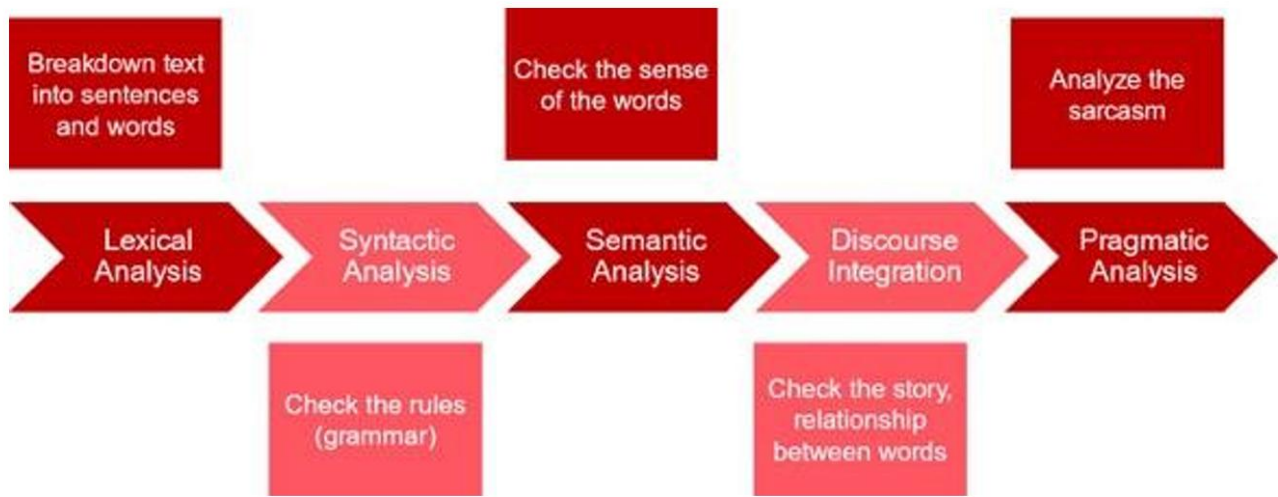
Every sentence should have a relationship with its preceding and succeeding sentences.



Pragmatic Analysis:

In this stage, sentences are checked for their relevance in the real world. Pragmatic means **practical or logical**, i.e., this step requires knowledge of the intent in a sentence. It also means to discard the actual word meaning taken after semantic analysis and take the intended meaning.





6.4 Chatbots

One of the most common applications of Natural Language Processing is a chatbot. A chatbot is a **computer program that's designed to simulate human conversation through voice commands or text chats or both.**

It can learn over time how to **best interact with humans**. It can answer questions and troubleshoot customer problems, evaluate and qualify prospects, generate sales leads and increase sales on an ecommerce site. There are a lot of chatbots available. Let us try some of the chatbots and see how they work.

Elizabot - <https://www.masswerk.at/elizabot/>

Mitsuki - <https://www.kuki.ai/>

Cleverbot - <https://www.cleverbot.com/>

Singtel - <https://www.singtel.com/personal/support>

Differences between Smart bots and scripted bots

Script bot	Smart bot
• Script bots are easy to make. • Script bots work around a script which is programmed in them. • Mostly they are free and are easy to integrate to a messaging platform. • No or little language processing skills. • Limited functionality.	• Smart-bots are flexible and powerful. • Smart bots work on bigger databases and other resources directly. • Smart bots learn with more data. • Coding is required to take this up on board. • Wide functionality.

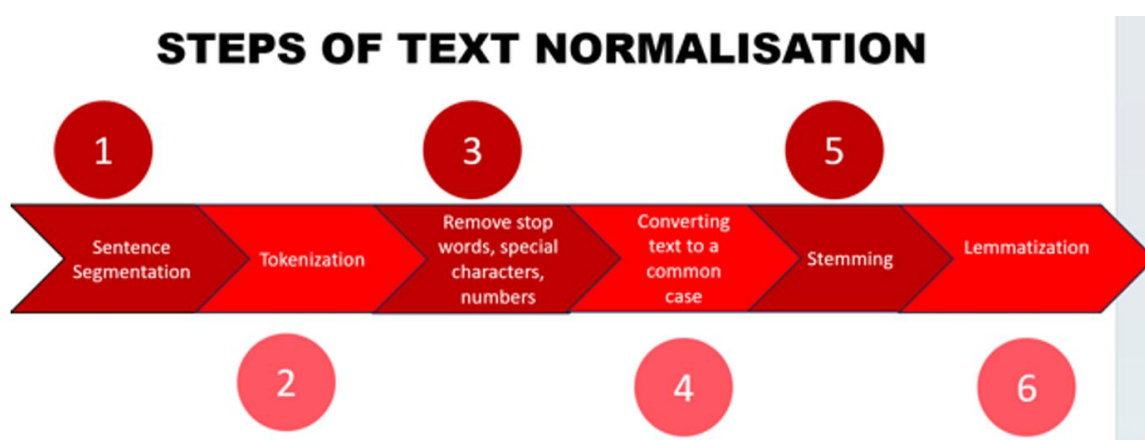
6.5 Text Processing

Humans interact with each other very easily. For us, the natural languages that we use are so convenient that we speak them easily and understand them well too. But for computers, our languages are very complex. Natural Language Processing makes it possible for machines to understand and speak in Natural Languages just like humans.

Since we all know that the language of computers is Numerical, the very first step that comes to our mind is **to convert our language to numbers**. This conversion takes a few steps to happen. The first step to it is Text Normalisation. Text Normalisation helps in cleaning up the textual data in such a way that it comes down to a level where its complexity is lower than the actual data.

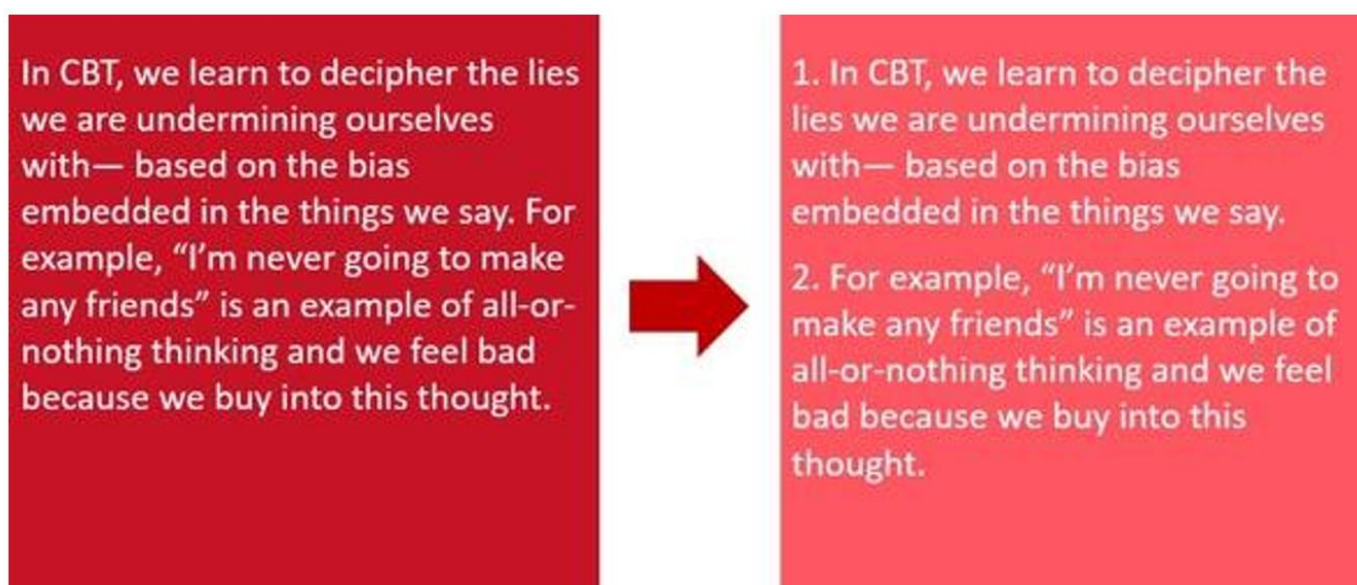
Text Normalisation

In Text Normalisation, we undergo several steps to normalise the text to a lower level.



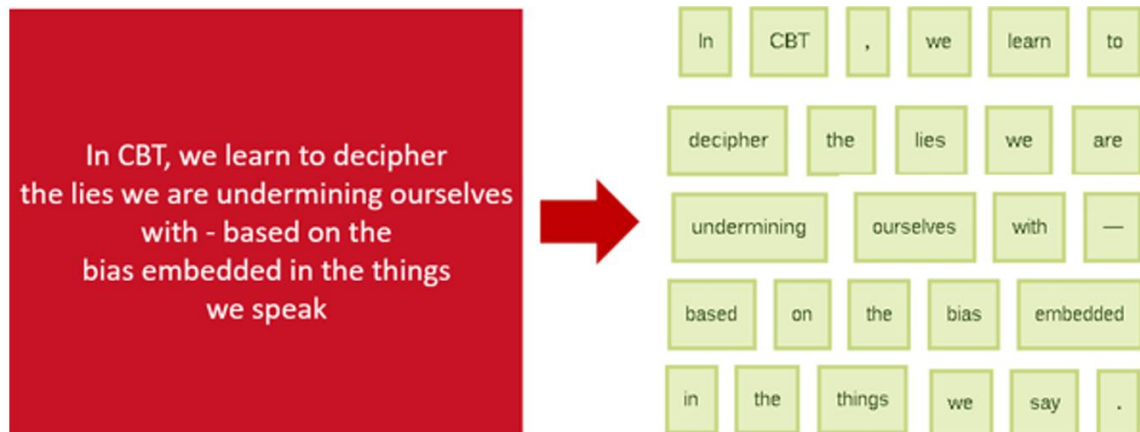
1. Sentence Segmentation

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.



2. Tokenization

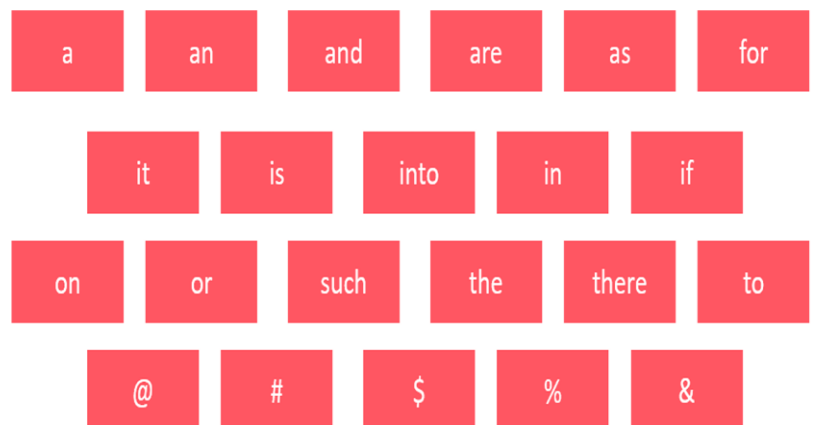
After segmenting the sentences, each sentence is then further divided into tokens. Tokens is a term used for any word or number or special character occurring in a sentence. Under tokenisation, every word, number and special character is considered separately and each of them is now a separate token.



3. Removing Stop words, Special Characters and Numbers:

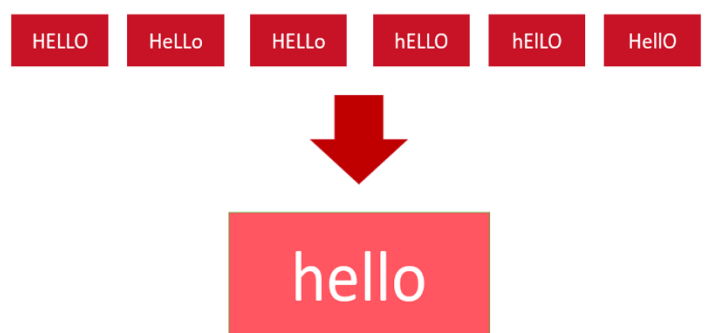
In this step, the tokens **which are not necessary are removed from the token list**. Stop words are the words which occur very frequently in the corpus but do not add any value to it. Humans use grammar to make their sentences meaningful for the other person to understand. But grammatical words do not add any essence to the information which is to be transmitted through the statement hence they come under stop words.

Some examples of stop words are:



4. Converting Text to a Common Case:

After the stop words removal, we convert the **whole text into a similar case, preferably lowercase**. This ensures that the case sensitivity of the machine does not consider the same words as different just because of different cases.



5. 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.

Word	Affixes	Stem
healed	-ed	heal
healing	-ing	heal
healer	-er	heal
studies	-es	studi
studying	-ing	study

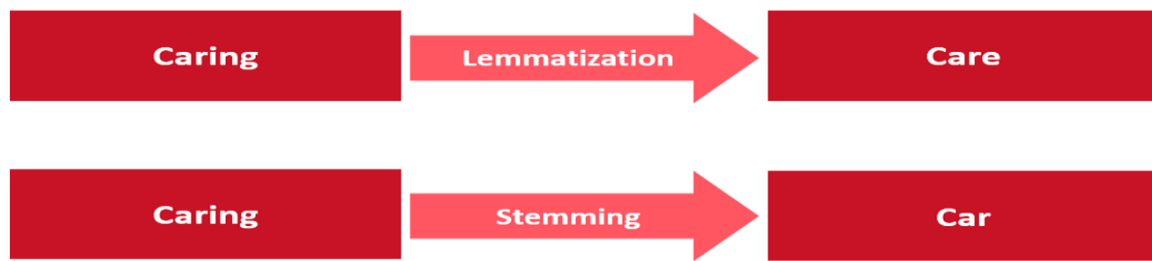
Note that in stemming, the stemmed words (words that we get after removing the affixes) might not be meaningful.

6. Lemmatization:

Stemming and lemmatization both are **alternative processes** to each other as the role of both the processes is same – **removal of affixes**. But the difference between both of them is that in lemmatization, **the word we get after affix removal (also known as lemma) is a meaningful one**. Lemmatization makes sure that a **lemma** is a word with meaning and hence it takes a **longer time to execute** than stemming.

Word	Affixes	Stem
healed	-ed	heal
healing	-ing	heal
healer	-er	heal
studies	-es	study
studying	-ing	study

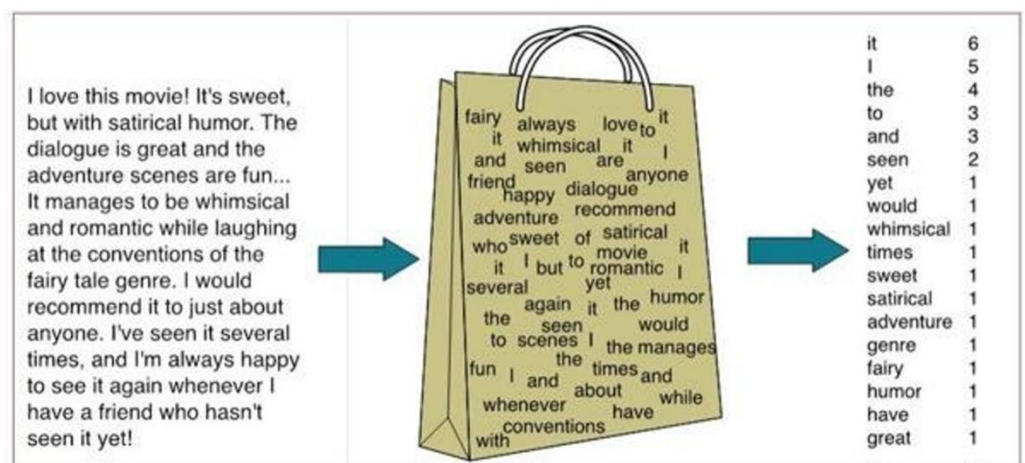
The difference between stemming and lemmatization can be summarized by this example:



With this, we have normalised 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**.

Bag of Words

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 the bag of words, we get the occurrences of each word and construct the vocabulary for the corpus.



Let us assume that the text on the left in this image is the normalised corpus which we have got after going through all the steps of text processing. Now, as we put this text into the bag of words algorithm, the algorithm returns to us the unique words out of the corpus and their occurrences in it.

The bag of words gives us two things:

1. **A vocabulary** of words for the corpus
2. **The frequency** of these words (number of times it has occurred in the whole corpus).

Here calling this algorithm a “bag” of words symbolises that the sequence of sentences or tokens does not matter. In this case, all we need are the unique words and their frequency.

Here is the step-by-step approach to implementing the bag of words algorithm:

1. **Text Processing:** Collect data and pre-process it
2. **Create a Dictionary:** Make a list of all the unique words occurring in the corpus. (Vocabulary)
3. **Create document vectors:** For each document in the corpus, find out how many times the word from the unique list of words has occurred.
4. **Create document vectors for all the documents.**

Let us go through all the steps with an example:

Step 1: Collecting data and pre-processing it.

Document 1: Aman and Avni are stressed

Document 2: Aman went to a therapist

Document 3: Avni went to download a health chatbot

Here are three documents having one sentence each. After text normalisation, the text becomes:

Document 1: [aman, and, avni, are, stressed]

Document 2: [aman, went, to, a, therapist]

Document 3: [avni, went, to, download, a, health, chatbot]

Step 2: Create a Dictionary

Go through all the steps and create a dictionary i.e., list down all the words which occur in all three documents:

Dictionary:

aman	and	avni	are	stressed	went
download	health	chatbot	therapist	a	to

Note that even though some words are repeated in different documents, they are all written just once as while creating the dictionary, **we create the list of unique words**.

Step 3: Create a document vector

In this step, the vocabulary is written in the top row. Now, for each word in the document, **if it matches the vocabulary, put a 1 under it. If the same word appears again, increment the previous value by 1. And if the word does not occur in that document, put a 0 under it.**

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0

Step 4: Create document vectors for all the documents.

The same exercise has to be done for all the documents. Hence, the table becomes:

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0
1	0	0	0	0	1	1	1	1	0	0	0
0	0	1	0	0	1	1	1	0	1	1	1

In this table, the header row contains the vocabulary of the corpus and three rows correspond to three different documents.

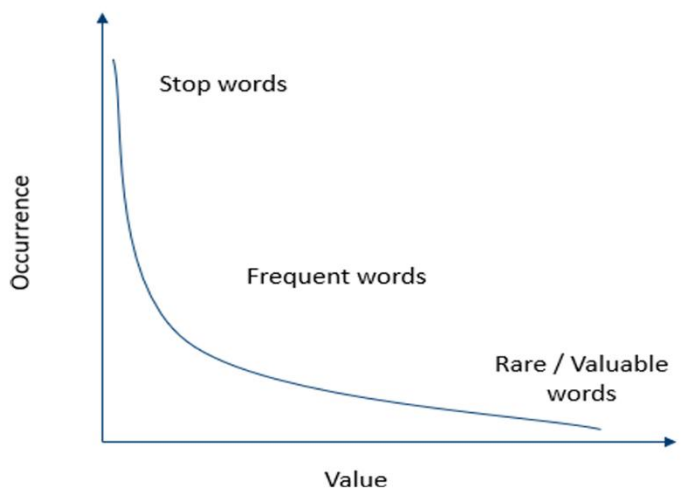
Finally, this gives us the document vector table for our corpus. However, the tokens have still not been converted to numbers. **This leads us to the final step of our algorithm: TFIDF.**

The bag of words algorithm gives us the frequency of words in each document we have in our corpus. It gives us an idea that if the word is occurring more in a document, its value is more for that document.

For example, if I have a document on air pollution, air and pollution would be the words which occur many times in it. And these words are valuable too as they give us some context around the document. But let us suppose we have 10 documents and all of them talk about different issues. One is on women's empowerment; the other is on unemployment and so on.

The words have the highest frequency in all of them are **and, this, is, the, etc.** are the words which occur the most in almost all the documents. **But these words do not talk about the corpus at all.** Though they are important for humans as they make the statements understandable to us, for the machine they are a complete waste as they do not provide us with any information regarding the corpus. **Hence, these are termed as stop words and are mostly removed at the pre-processing stage only.**

Take a look at this graph. It is a plot of the occurrence of words versus their value. **If the words have the highest occurrence in all the documents of the corpus, they are said to have negligible value** hence they are termed as stop words. These words are mostly removed at the pre-processing stage only.



TFIDF: Term Frequency & Inverse Document Frequency

TFIDF helps us identify the value of each word.

Term Frequency:

Term frequency is the frequency of a word in one document. Term frequency can easily be found in the document vector table as in that table we mention the frequency of each word of the vocabulary in each document.

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0
1	0	0	0	0	1	1	1	1	0	0	0
0	0	1	0	0	1	1	1	0	1	1	1

Here, you can see that the frequency of each word for each document has been recorded in the table.

These numbers are nothing but the Term Frequencies!

Inverse Document Frequency:

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 for the exemplar vocabulary would be:

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
2	1	2	1	1	2	2	2	1	1	1	1

The document frequency of 'aman', 'avni', 'went', 'to' and 'a' is 2 as they have occurred in two documents. The rest of them occurred in just one document hence the document frequency for them is one.

Inverse Document Frequency is we need to put the **document frequency in the denominator** while the **total number of documents is the numerator**. Here, the total number of documents is 3, hence inverse document frequency becomes:

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
3/2	3/1	3/2	3/1	3/1	3/2	3/2	3/2	3/1	3/1	3/1	3/1

Finally, the formula of TFIDF for any word W becomes:

$$\text{TFIDF}(W) = \text{TF}(W) * \log(\text{IDF}(W))$$

Here, log is to the base of 10.

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
$1 * \log(3/2)$	$1 * \log(3)$	$1 * \log(3/2)$	$1 * \log(3)$	$1 * \log(3)$	$0 * \log(3/2)$	$0 * \log(3/2)$	$0 * \log(3/2)$	$0 * \log(3)$	$0 * \log(3)$	$0 * \log(3)$	$0 * \log(3)$
$1 * \log(3/2)$	$0 * \log(3)$	$0 * \log(3/2)$	$0 * \log(3)$	$0 * \log(3)$	$1 * \log(3/2)$	$1 * \log(3/2)$	$1 * \log(3/2)$	$1 * \log(3)$	$0 * \log(3)$	$0 * \log(3)$	$0 * \log(3)$
$0 * \log(3/2)$	$0 * \log(3)$	$1 * \log(3/2)$	$0 * \log(3)$	$0 * \log(3)$	$1 * \log(3/2)$	$1 * \log(3/2)$	$1 * \log(3/2)$	$0 * \log(3)$	$1 * \log(3)$	$1 * \log(3)$	$1 * \log(3)$

After calculating all the values, we get:

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
0.176	0.477	0.176	0.477	0.477	0	0	0	0	0	0	0
0.176	0	0	0	0	0.176	0.176	0.176	0.477	0	0	0
0	0	0.176	0	0	0.176	0.176	0.176	0	0.477	0.477	0.477

Finally, the words have been converted to numbers. These numbers are the values of each for each document.

Here, you can see that since we have less amount of data, words like 'are' and 'and' also have a high value. But as the IDF value increases, the value of that word decreases.

That is, for example:

Total Number of documents: 10

Number of documents in which 'and' occurs: 10

Therefore, $IDF(\text{and}) = 10/10 = 1$

Which means: $\log(1) = 0$. Hence, the value of 'and' becomes 0.

On the other hand, **the number of documents in which 'pollution' occurs: 3** $IDF(\text{pollution}) = 10/3 = 3.3333\dots$

This means **$\log(3.3333) = 0.522$; which shows that the word 'pollution' has considerable value in the corpus.**

Summarising the concept TFIDF:

1. Words that occur in all the documents with high term frequencies have the **lowest values and are considered to be the stop words.**
2. For a word to have a high TFIDF value, the word needs to have a high term frequency but less document frequency which shows that the word is important for one document but is not a common word for all documents.
3. **These values help the computer understand which words are to be considered while processing the natural language. The higher the value, the more important the word is for a given corpus.**

Applications of TFIDF:

TFIDF is commonly used in the Natural Language Processing domain. Some of its applications are:

Document Classification	Topic Modelling	Information Retrieval System	Stop word filtering
Helps in classifying the type and genre of a document.	It helps in predicting the topic for a corpus.	To extract the important information out of a corpus.	Helps in removing unnecessary words from a text body.

Examples of Code and No-code NLP Tools

Code NLP	No-Code NLP
NLTK package: Natural Language Tool Kit or NLTK is a package readily available for text processing in Python. The package contains functions and modules which can be used for Natural Language Processing.	Orange Data Mining: It is a machine learning tool for data analysis through Python and visual programming. We can perform operations on data through simple drag-and-drop steps.
SpaCy: SpaCy is an open-source natural language processing (NLP) library designed to build NLP applications. It offers various features such as tokenization, part-of-speech tagging, named entity recognition, dependency parsing, and more.	MonkeyLearn: MonkeyLearn is a text analysis platform that offers NLP tools and machine learning models for text analysis, supporting tasks such as classification, sentiment analysis, and entity recognition. Users can create custom models or use pre-trained ones for tasks like social media monitoring and customer feedback analysis.

1. What is the primary challenge faced by computers in understanding human languages?

A) Complexity of human languages

B) Lack of computational power

C) Incompatibility with numerical data

D) Limited vocabulary

2. How do voice assistants utilize NLP?

A) To analyze visual data

B) To process numerical data

C) To understand natural language

D) To execute tasks based on computer code

3. Which of the following is NOT a step in Text Normalisation?

A) Tokenization

B) Lemmatization

C) Punctuation removal

D) Document summarization

4. In the context of text processing, what is the purpose of tokenisation?

A) To convert text into numerical data

B) To segment sentences into smaller units

C) To translate text into multiple languages

D) To summarize documents for analysis

5. What distinguishes lemmatization from stemming?

A) Lemmatization produces meaningful words after affix removal, while stemming does not.

B) Lemmatization is faster than stemming.

C) Stemming ensures the accuracy of the final word.

D) Stemming generates shorter words compared to lemmatization.

6. What is the primary purpose of the Bag of Words model in Natural Language Processing?

A) To translate text into multiple languages

B) To extract features from text for machine learning algorithms

C) To summarize documents for analysis

D) To remove punctuation marks from text

7. In the context of text processing, what are stop words?

A) Words with the frequent occurrence in the corpus

B) Words with negligible value that are often removed during preprocessing

C) Words with the lowest occurrence in the corpus D) Words with the most value added to the corpus

8. What is the characteristic of rare or valuable words in the described plot?

A) They have the highest occurrence in the corpus

B) They are often considered stop words

C) They occur the least but add the most value to the corpus

D) They are typically removed during preprocessing

9. What information does the document vector table provide?

A) The frequency of each word across all documents

B) The frequency of each word in a single document

C) The total number of words in the entire corpus

D) The average word length in the entire corpus

10. What is the primary purpose of TFIDF in text processing?

A) To identify the presence of stop words in documents

B) To remove punctuation marks from text

C) To identify the value of each word in a document

D) To translate text into multiple languages

11. Assertion: Pragmatic analysis in natural language processing (NLP) involves assessing sentences for their practical applicability in real-world scenarios.

Reasoning: Pragmatic analysis requires understanding the intended meaning behind sentences and considering their practical or logical implications, rather than solely relying on literal word meanings obtained from semantic analysis.

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.

12. Assertion: Converting the entire text into lowercase following stop word removal is a crucial preprocessing step in natural language processing.

Reasoning: This process ensures uniformity in word representation, preventing the machine from treating words with different cases as distinct entities, thereby enhancing the accuracy of subsequent text analysis.

A) Both Assertion and Reasoning are true, and Reasoning is the correct explanation of the Assertion.

B) Assertion is true, but Reasoning is false.

D) Assertion is false, but Reasoning is true.

C) Both Assertion and Reasoning are true, but Reasoning is not the correct explanation of the Assertion.

Unit 1

Communication Skills-II

SESSION 1: METHODS OF COMMUNICATION

The word 'communication' comes from the Latin word **commūnicāre**, meaning 'to share'.

There are three types of communication. They are: 1. Verbal Communication

2. Non-verbal communication and 3. Visual communication.

Communication has three important parts:

1. **Transmitting** — The sender transmits the message through one medium or another.
2. **Listening** — The receiver listens or understands the message.
3. **Feedback** — The receiver conveys their understanding of the message to the sender in the form of feedback to complete the communication cycle.

Elements of a communication cycle:

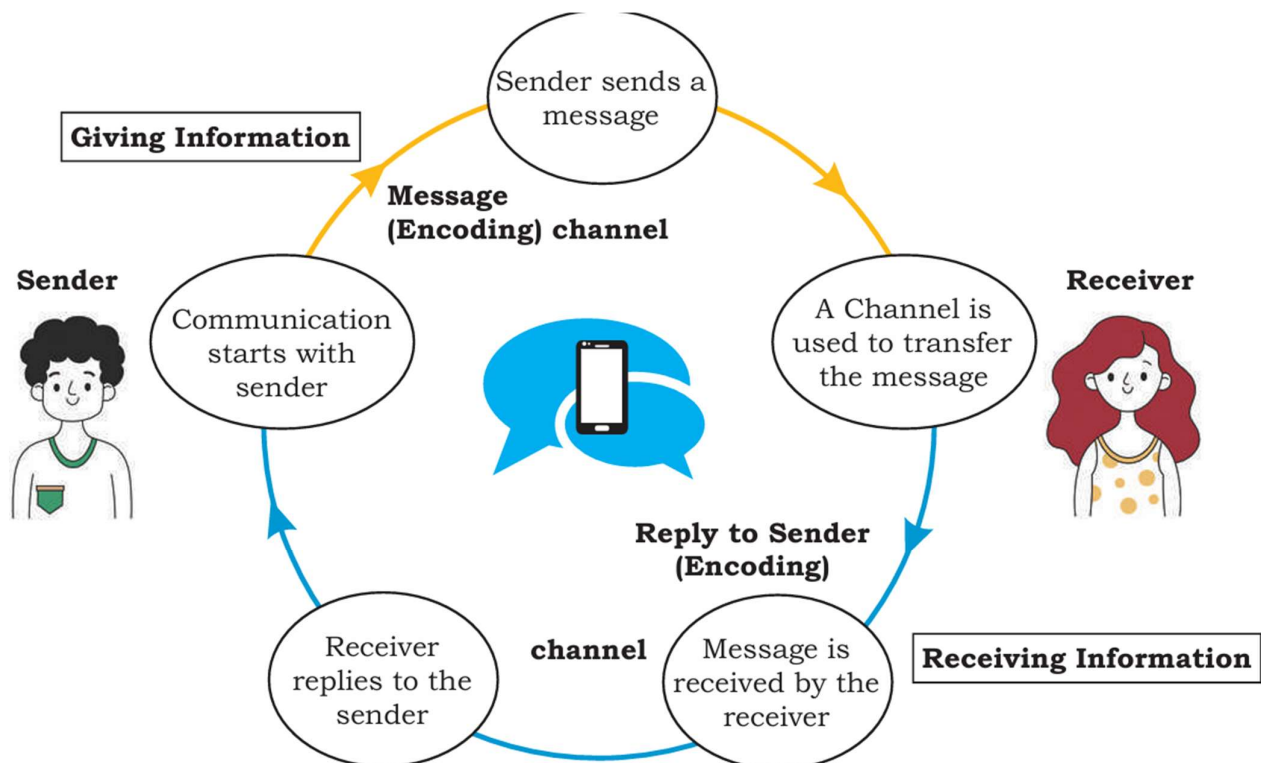


Figure 1.2: Elements of Communication

The various elements of a communication cycle are:

- **Sender:** the person beginning the communication.
- **Message:** the information that the sender wants to convey.
- **Channel:** the means by which the information is sent.
- **Receiver:** the person to whom the message is sent.
- **Feedback:** the receiver's acknowledgement and response to the message.

Methods of Communication:

Face-to-face informal communication:

There is nothing better than face-to-face communication. It helps the message to be understood clearly and quickly.

e-mail :

It can be used to communicate quickly with one or many individuals in various locations

Notices/Posters:

It is effective when the same message has to go out to a large group of people.

Business Meetings:

Communication during business meetings at an organisation are generally addressed to a group of people

Other Methods:

There can be various other methods like social networks, message, phone call for communication, newsletter, blog, etc.

Choosing the right method of communication depends on

- target audience
- costs
- kind/type of information
- urgency/priority

SESSION 2: VERBAL COMMUNICATION

Verbal communication includes sounds, words, language, and speech.

Types of Verbal Communication:

Interpersonal Communication:

This form of communication takes place between two individuals and is thus a one-on-one conversation. It can be formal or informal.

Written Communication:

This form of communication involves writing words. It can be letters, circulars, reports, manuals, SMS, social media chats, etc. It can be between two or more people

Small Group Communication:

This type of communication takes place when there are more than two people involved. Each participant can interact and converse with the rest.

Examples 1. Press conferences 2. Board meetings 3. Team meetings

Public Communication:

This type of communication takes place when one individual addresses a large gathering.

Examples 1. Election campaigns 2. Public speeches by dignitaries

Advantages of Verbal Communication:

It is an easy mode of communication in which you can exchange ideas by saying what you want and get a quick response.

Verbal communication also enables you to keep changing your interaction as per the other person's response.

Disadvantages of Verbal Communication:

Since verbal communication depends on written or spoken words, sometimes the meanings can be confusing and difficult to understand if the right words are not used.

Mastering Verbal Communication:

Think Before You Speak	• Think about your topic. • Think about the most effective ways to make your listeners understand the topic. • Write or note down whatever you plan to say.
Concise and Clear	• Speak clearly, loudly and at moderate speed. • Be sure the information you want to share is to the point. • Do not repeat the same sentences.
Confidence and Body Language	• Be confident. • Maintain eye contact, stand straight and be attentive. • Be friendly.

SESSION 3: NON-VERBAL COMMUNICATION

Non-verbal communication is the expression or exchange of information or messages without using any spoken or written word.

In other words, we send signals and messages to others, through expressions, gestures, postures, touch, space, eye contact and para language.

Importance of Non-verbal Communication:

In our day-to-day communication

- 55% communication is done using body movements, face, arms, etc.
- 38% communication is done using voice, tone, pauses, etc.
- only 7% communication is done using words.

Types of Non-verbal Communication:

- Facial Expressions
- Posture
- Gestures or Body Language
- Touch
- Space
- Eye Contact
- Paralanguage

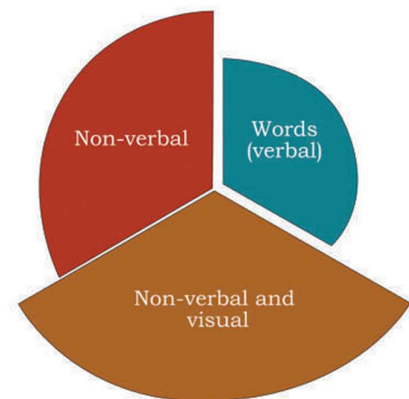


Figure 1.4: Methods of Communication

VISUAL COMMUNICATION

Visual communication proves to be effective since it involves interchanging messages only through images or pictures and therefore, you do not need to know any particular language for understanding it.

It is simple and remains consistent across different places.

Visual Communication: Exchanging Information through Images:

Example:

No parking zone		No entry	
Danger warning		Radiation/biohazard warning	
Under CCTV surveillance		No mobile phone	

SESSION 4: COMMUNICATION CYCLE AND IMPORTANCE OF FEEDBACK

Feedback is an important part of the communication cycle.

For effective communication, it is important that the sender receives an acknowledgement from the receiver about getting the message across.

While a sender sends information, the receiver provides feedback on the received message.

A good feedback is always • specific • helpful • kind

A good feedback is one that is:

- **Specific:** Avoid general comments. Try to include examples to clarify your statement.
- **Timely:** Being prompt is the key, since feedback loses its impact if delayed for too long.

- **Polite:** While it is important to share feedback, the recipient should not feel offended by the language of the feedback.

- **Offering continuing support:** Feedback sharing should be a continuous process. After offering feedback, let recipients know you are available for support.

Importance of Feedback:

Feedback is the final component and one of the most important factors in the process of communication since it is defined as the response given by the receiver to the sender. Let us look at certain reasons why feedback is important.

- It validates effective listening
- It motivates
- It is always there
- It boosts learning
- It improves performance

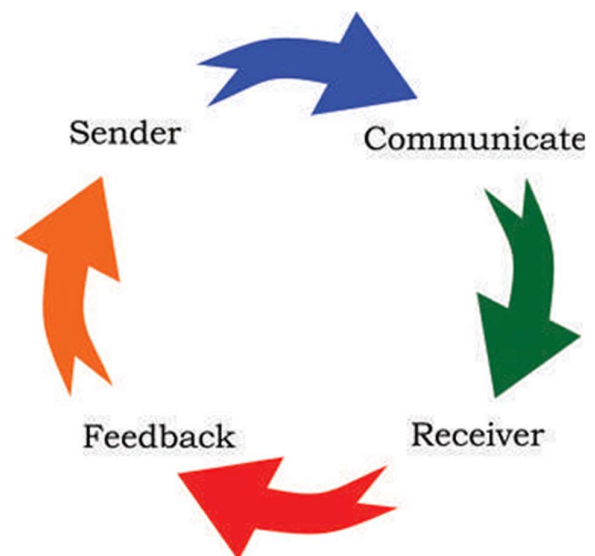


Figure 1.5: Communication Cycle

Type of Feedback	Examples	
Positive Feedback	- I noticed you finished the work perfectly. Great job! - I really appreciate you taking that call. Can you please also share the details?	 POSITIVE FEEDBACK
Negative Feedback	- You keep forgetting to smile at the hotel guests when you talk to them. - You take really long to reply to e-mails! Are you always so busy?	 NEGATIVE FEEDBACK
No Feedback	It is also a feedback in itself which indicates disagreement of ideas.	

SESSION 5: BARRIERS TO EFFECTIVE COMMUNICATION

Effective Communication:

Communication can be effective when you follow the below mentioned **7C's principle**

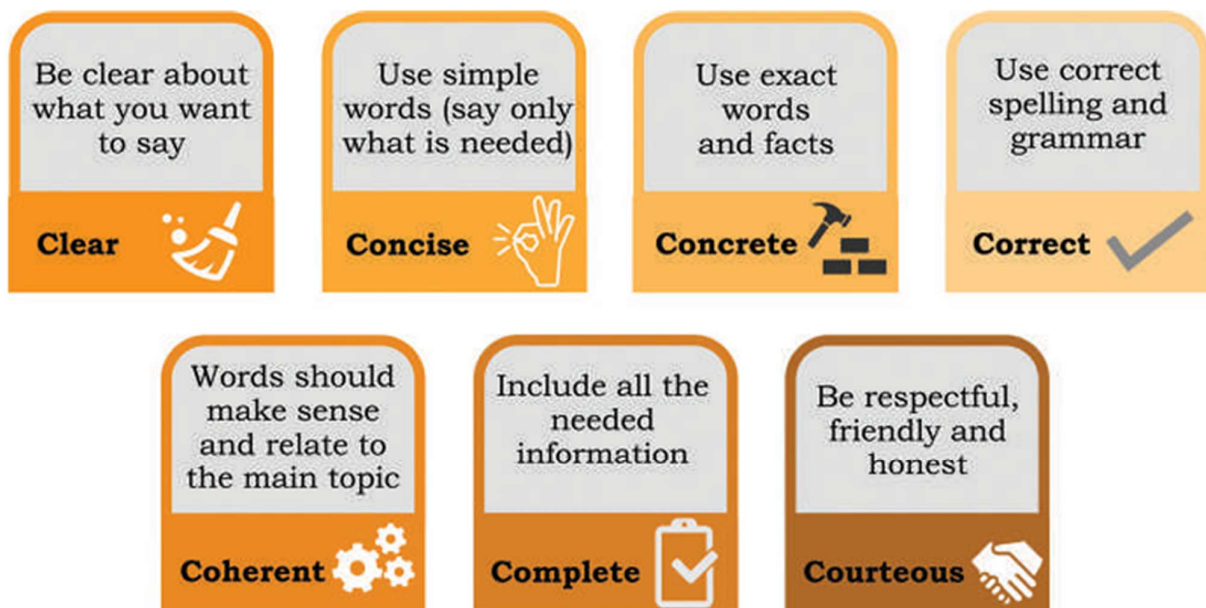


Figure 1.6: 7Cs of Effective Communication

Barriers to Effective Communication

Physical Barriers:

Physical barrier is the environmental and natural condition that act as a barrier in communication in sending message from sender to receiver. Not being able to see gestures, posture and general body language can make communication less effective.

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.

Organisational Barriers:

Organisations are designed on the basis of formal hierarchical structures that follow performance standards, rules and regulations, procedures, policies, behavioural norms, etc. All these affect the free flow of communication in organisations and therefore, need to be suitably managed

Cultural Barriers:

Cultural barriers is when people of different cultures are unable to understand each other's customs, resulting in inconveniences and difficulties.

Ways to Overcome Barriers to Effective Communication:

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



Figure 1.7: Barriers to Effective Communication

SESSION 6: WRITING SKILLS — PARTS OF SPEECH

Capitalisation:

Here's in a sentence where we should use capital letters. ‘

Table 1.7: Capitalisation Rules

Alphabet	T	I	N	S
What it shows:	Titles	word 'I'	Names	Starting letter of sentences

Punctuation

Certain set of marks, such as full stop, comma, question mark, exclamation mark and apostrophe are used in communication to separate parts of a sentence for better clarity of message.

The parts of speech:

It indicates how a particular word functions in meaning as well as grammatically within the sentence.

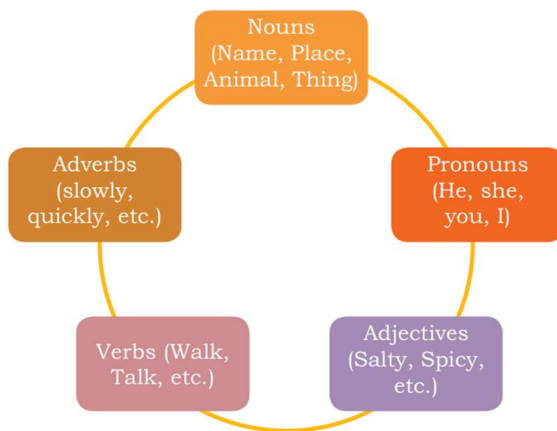


Figure 1.8: Parts of Speech

Supporting Parts of Speech Types

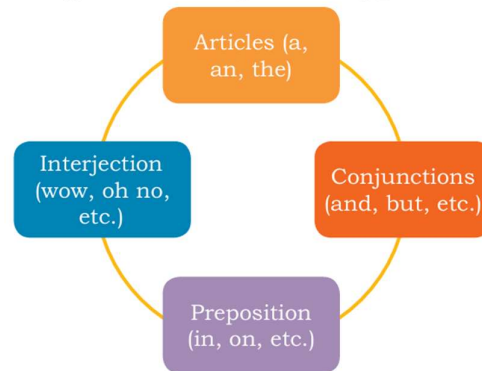


Figure 1.9: Supporting Parts of Speech

SESSION 7: WRITING SKILLS — SENTENCES

Parts of a Sentence:

Subject: Person or thing that performs an action.

Verb: Describes the action.

Object: Person or thing that receives the action.

Types of Sentences:

Active and Passive Sentences

Active: 1. Radha is reading a book.

Passive: 2. A book is being read by Radha.

Table 1.12: Active and Passive Sentences

Active Voice	Passive Voice
Ali changed the flat tire.	The flat tire was changed by Ali.
I will clean the house every Saturday.	The house will be cleaned by me every Saturday.
Ravi painted the entire house.	The entire house was painted by Ravi.

Paragraph:

A group of words form a sentence, a group of sentences forms a paragraph. However, to qualify as a paragraph, all the sentences within it must have a common idea or theme.

Unit 2

Self-Management Skills-II

Session 1: Stress Management

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.

Stress Management

Stress is a part of everyday life. There are many instances when stress can be helpful. Managing stress is about making a plan to be able to cope effectively with daily pressures.

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

Step 2: Identify what is causing you stress

Step 3: Apply stress management methods

Stress Management Techniques

- Time management
- Physical exercise and fresh air
- Healthy diet
- Positivity
- Organising academic life; no delaying
- Sleep
- Holidays with family and friends
- Ability to Work Independently

Emotional Intelligence

Emotional intelligence is the ability to identify and manage one's own emotions, as well as the emotions of others.

Emotional awareness, harnessing emotions, managing emotions

Some steps to manage emotional intelligence are:

Understand your emotions, Rationalise, Practise.

Session 2: Self-Awareness — Strength And Weakness Analysis

Techniques for Identifying your Strengths and Weaknesses:

Finding Strengths (or abilities) :

- Think of anything that you are always successful at.

Finding Weaknesses:

- Point out the areas where you struggle and the things you find difficult to do.

Table 2.1: Difference between Interests and Abilities

S.No	Interests	Abilities
1.	Things that you like to do in your free time that make you happy.	An acquired or natural capacity
2.	Things you are curious about or would do even if no one asked you to do it.	Enable you to perform a particular job or task with considerable proficiency.
3.	Things you want to learn or would like to do in the future.	

Session 3: 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. In other words, it is our ability to do the things that need to be done without someone or something influencing us.

Types of Motivation



Internal Motivation: LOVE

We do things because they make us happy, healthy and feel good. For example, when you perform on your annual day function and you learn something new, such as dancing, singing, etc., you feel good.



External Motivation: REWARD

We do things because they give us respect, recognition and appreciation. For example, Suresh participated in a 100m race and won a prize. This motivated him to go for practice every morning.

Qualities of Self-motivated People

Know what they want from life, Are focussed, Know what is important, Are dedicated to fulfil their dreams.

Building Self-motivation:

There are four steps for building self-motivation, which are as given below.

- Find out your strengths
- Set and focus on your goals
- Develop a plan to achieve your goals
- Stay loyal to your goals

Session 4: Self-Regulation — Goal Setting

Goals and Setting SMART Goals:

Goals : They are a set of dreams with a deadline to get them.

Goal setting : It is all about finding and listing your goals and then planning on how to achieve them.

SMART method to set goals.

SMART stands for:

- Specific • Measureable • Achievable • Realistic • Time bound

Session 5: Self-Regulation — Time Management

Four Steps for Effective Time Management

Organise:

We plan our day to-day activities.

Prioritise:

We make a to-do list that has all our activities and we rank them in the order of importance.

Control:

We have a control over our activities and time.

Track:

We identify and note where we have spent our time.

Unit 3

Information and Communication Technology Skills-II

Session 1: Basic Computer Operations

ICT stands for Information and Communication Technology. ICT refers to all the methods, tools, concepts related to storing, recording and sending digital information.

Computer Hardware and Software:

A computer system consists of two main parts— the hardware and the software.

The physical parts that we can see and touch are called hardware. It is the machinery of a computer. These are the keyboard, monitor, CPU, etc.

There is another important part i.e., the software. Though we cannot see it, it makes the hardware work the way we want. The most important software in any computer is the Operating System (OS).

Session 2: Performing Basic File Operations Basic File Operations

Files and Folders All information stored in a computer is kept in files.

A folder is a location where a group of files can be stored.

Commonly used shortcut keys:

To paste a file- Ctrl +V

To copy a file Ctrl+C

To cut a file Ctrl+X

To create a new file Ctrl+N

Session 3: Computer Care And Maintenance

Importance Of Care And Maintenance Of Computers

Computers and mobiles are very expensive. When we take good care of them on a regular basis, we can use them for a longer time. This will help us save money as we do not need to buy new devices too often.

Basic Tips for Taking Care of Devices

Keeping a Device Clean

Cleaning a device, such as a computer or mobile means to keep the screen, keyboard and mouse clean.

Be careful with food and drinks

Handle devices carefully

Keep the computer cool

Do not overcharge your battery

Always plug in devices carefully

Do not run too many programs at a time

Prepare a Maintenance Schedule

Backup your Data: Backing up data means to save the information present on your computer on another device, such as CD/DVD drives

Scanning and Cleaning Viruses

Increasing Computer Performance

Removing SPAM from your Computer

Session 4: Computer Security And Privacy

Computer Security Deals with Protecting Computers, Computer security and privacy deals with the measures used to prevent loss of data.

Personal information can be lost or leaked in two ways:

- We are not careful in giving out personal information over the Internet.
- A person gets unauthorised access to our computer.

1) Threats to Computer: Threats are the ways in which personal information can be leaked from a computer without our knowing.

Eg: Physical, Identity, and Software Piracy

2) Virus: Viruses are computer programs that can damage the data and software programs or steal the information stored on a computer. Major types of viruses are Worms and Trojan horse.

a) Worms: These are viruses that replicate themselves and spread to all files once they attack a computer. This makes it very difficult to remove them.

b) Trojan Horse: A Trojan Horse disguises itself i.e., it appears to be a useful software program but once it reaches a computer it starts behaving like a virus and destroying data
Online Predator: Online predators are people who trap you into inappropriate relationships. They may be older people posing to be your age, bullying you into doing illegal activities online and sometimes face to face.

3) Internet Scams: Sometimes you may receive very attractive offers saying you have won a huge money in a lottery and that you can claim the prize by depositing a certain amount of money.

Protecting your Data:

To protect our data from theft and viruses we can take the following measures:

- Use passwords to login to your computer (strong passwords)
- Install Anti-virus and Firewall
- Encrypt Data
- Visit Secure sites

If the site address starts with https:// and a lock symbol, then it is safe to give your credit card and bank details.

Unit 4

Entrepreneurial Skills-II

Session 1: Entrepreneurship and Society

Entrepreneurship is the type of self-employment where one is running a business to satisfy the needs of people and looking for ways to make the business better to make profits.

Successful entrepreneurs have the following qualities.

- They are confident. They believe in themselves and their abilities.
- They keep trying new ideas in their business.
- They are patient.
- They are creative and think differently about business ideas.
- They take responsibility for their actions.
- They take decisions after thinking about them.
- They work hard.
- They do not give up when they face a difficulty.

What do entrepreneurs do when they run their business?

Fulfil Customer Needs

Use Local Materials

Help Society

Create Jobs

Sharing of Wealth

Lower Price of Products

Session 2: Qualities and functions of an entrepreneur

Qualities of an Entrepreneur:

Be confident and take business decision

Keep trying new ideas

Patient

Creative

Take responsibility for the mistakes made

Take decisions after thinking about whether they are good or bad for my business.

Work hard

Do not give up

Functions of an Entrepreneur:



Session 3: Myths about Entrepreneurship

- 1: The misconception is that every business idea needs to be unique or special.
- 2 The misconception we have is that a person needs a lot of money to start a business.
- 3 A misconception we have is that only a person having a big business is an entrepreneur

Session 4: Entrepreneurship as A Career Option

A career is a line of work that a person takes for life. There are two ways a person can earn a living. They are

1. Self-employment
2. Wage employment

For example, a doctor who works for a hospital is a **wage employed** person.

If the same doctor has their own clinic, he or she is a **self-employed** person.

A self-employed person running a business to satisfy a need by trying new ideas is an entrepreneur.

A person who becomes an entrepreneur goes through a career process. This process is as follows:

ENTER	SURVIVE	GROW
		
When an entrepreneur is starting, they are just entering the market to do business.	There are many entrepreneurs in the market. The entrepreneur has to remain in a competitive market.	Once the business is stable, an entrepreneur thinks about expanding his or her business.
For example, Sanjana is starting a small grocery store in a locality.	For example, there are many other grocery stores in the area. Yet, Sanjana's store survives the competition and does well. She also expands the store to two more floors.	For example, after five years, Sanjana has opened a chain of four more grocery stores in the same city. In the next two years, she plans to expand to two other cities.

Unit 5

Green Skills-II

Session 1: Sustainable Development

Sustainable development is the development that satisfies the needs of the present without compromising the capacity of future generations, guaranteeing the balance between economic growth, care for the environment and social well-being.

Importance of Sustainable Development

Sustainable development is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987)

Problems Related to Sustainable Development

Three major problems related to sustainable development are:

(a) Food: The amount of rich, fertile land needed to grow crops, such as wheat, rice, etc., is becoming less as we are using up more and more land for other purposes. Soil nutrients are also getting depleted and lots of chemicals are spoiling the soil due to use of chemical fertilisers.

(b) Water: We use fresh water from rivers and ponds for drinking and cleaning but dump garbage into them. The rivers and ponds are getting polluted. This way after several years, we will have no clean water for our use.

(c) Fuel: We are using a lot of wood from trees as fuels and for construction of homes and furniture. As more and more trees are being cut, it is affecting the climate of the place. Extreme weather conditions, such as floods, extreme cold or heat, are seen in many places, which affect the people living there.

Sustainable development includes:

- Reducing excessive use of resources and enhancing resource conservation;
- Recycling and reuse of waste materials;
- Scientific management of renewable resources, especially bio-resources;
- Planting more trees;
- Green grassy patches and trees to be interspersed between concrete buildings;
- Using more environment friendly material or biodegradable material and
- Use of technologies, which are environmental friendly and based on efficient use of resources.

Sustainable Development Goals:

The Sustainable Development Goals (SDGs) were launched at the United Nations Sustainable Development Summit in New York in September 2015, forming the 2030 Agenda for Sustainable Development. It has set targets that the countries have to should work towards and achieve by 2030. The 17 SDGs have been made with the aim to take care of important issues facing businesses, governments and society.



Fig. 5.1 Sustainable Development Goals

Session 2: Our Role in Sustainable Development

Our Role towards Sustainable Development United Nations has formed 17 Sustainable Development Goals (SDGs) so that countries and nations can work towards finding a solution to the growing problems in the world

Quality Education

Education is the most important factors for sustainable development. Children who have gone to school will be able to do jobs so that they can take care of themselves and their families. Education helps us become aware of our role as a responsible citizen. We should

1. Use the facilities present in our areas.
2. Take our friends to school.
3. Help friends study.
4. Stop friends from dropping out of school

Clean Water and Sanitation

We must make efforts to make India free of open defecation by building toilets and creating awareness towards Industrial is sanitation.

Pollution: polluting our water resources, which in near future will cause scarcity of clean drinking and usable water.

Affordable and Clean Energy

Using solar power i.e., power generated using the sun does not cause pollution as it does not require burning of non-renewable fuels, such as coal

Decent Work and Economic Growth

- (a) Study and find good jobs to take care of ourselves and our families.

(b) Work hard and contribute to society.

(c) Learn and develop skills so that we get add value in our community

Reduced Inequalities

To reduce inequalities we can

1. Be helpful to one another.
2. Be friendly with everyone.
3. Include everyone while working or playing.
4. Help others by including everyone whether they are small or big, girl or boy, belong to any class or caste

Sustainable Cities and Communities

Creating Sustainable Cities

1. Save energy by switching off lights and fans when not in use.
2. Use natural light as much as possible.
3. Use energy efficient lights (LED bulbs) and appliances

Responsible Consumers and Producers

1. Reusing paper, glass, plastic, water, etc.
2. Taking cloth bags to market carrying fruits and vegetables.
3. Donate things we do not use such as clothes, books, furniture, food, etc.
4. Buy and eat seasonal fruits and vegetables from local growers.
5. Repair leaking taps and pipes to avoid wasting water.
6. Sort and treat garbage before disposing.

Protect Life below Water

Tons of plastic is found in the seas, which is killing marine life. Protecting marine life, saving our oceans from pollution is necessary to preserve the marine life.

Protect Life on Land

Cutting of trees is leading to soil erosion and making land dry and unusable for cultivation. Planting more tree to replace the ones that we have cut is an important step towards sustainable development.
