# GEETA DEVI DAV PUBLIC SCHOOL

## BHANDARKOLA, SATAR ROAD, DEOGHAR

## DIWALI & CHHAT PUJA HOLIDAY HOMEWORK-(2026-27)

# Class: -X

## ENGLISH

## PROJECT WORK

◆Prepare an attractive, well-organised project file based on the chapter Glimpses of India including pictures and requisite details.

(Your project must include - attractive cover, appropriate headings, colourful illustrations, maps and captions. Originality, creativity and accuracy will be appreciated.)

## ASSIGNMENT

◆ Write all the literary devices with examples prescribed in your curriculum in the same project file itself.

## HINDI

**क्षितिज :** नौबतखाने में इबादत , संस्कृति तथा संगतकार पाठ के प्रश्नोत्तर याद करें।

**व्याकरण:-** अलंकार, पद परिचय, वाक्य, वाच्य का अभ्यास करें।

तीनों वाच्य के पाँच-पाँच उदाहरण कक्षाकार्य की कॉपी पर लिखें

**परियोजना कार्य :-** झारखंड और पंजाब राज्यों का तुलनात्मक अध्ययन निम्नलिखित बिंदुओं के अनुसार करें - वेशभूषा, खान पान, लोकनृत्य , संगीत चित्रकला , शिल्प कला

सचित्र वर्णन स्टीक फाइल पर करें

## SANSKRIT

- गृहकार्यम् – पाठ्यक्रमस्य सर्वेषां सन्धीनाम् पञ्च-पञ्च उदाहरणानि पाठ्यपुस्तकात् चित्वा लिखत।
- परियोजनाकार्यम् – झारखण्ड- पश्चिमबंगालयोः तुलनात्मकं विवरणं प्रस्तुतं कुर्वन्तु –

  बिन्दवः –

  संस्कृति-कला

भाषा

वेश-भूषा

भोज्यपदार्थाः

## MATHEAMTICS

**Assignment Work**

1. **CBSE Sample Question Paper:** Solve at least one CBSE Sample Question Paper for the Academic Session 2026–27 in a separate notebook.
2. **Areas Related to Circles:** Create a circular design using sectors and calculate the areas of its different parts.
3. **Real Numbers:** Explore prime factorisation using factor trees and verify the HCF and LCM of selected numbers.
4. **Statistics:** Collect a dataset from your class (such as the number of books read by students), group the data, and prepare a frequency distribution table.
5. **Surface Areas and Volumes:** Make models of a cone and a cylinder with the same base radius and height. Compare their volumes.
6. **Pair of Linear Equations in Two Variables:** Draw the graphs of two linear equations on graph paper and identify their point of intersection.
7. **Some Applications of Trigonometry:** Make a simple clinometer and use it to estimate the height of a tree or building from a safe location.
8. **Arithmetic Progressions:** Create a pattern using dots or tiles to represent an AP and derive the formula for the sum of its terms by pairing the terms.
9. **Circles:** Draw a tangent to a circle at a given point and verify that it is perpendicular to the radius at the point of contact.

## IMPORTANT INSTRUCTIONS

- Complete all assignments neatly and sincerely.
- Perform all activities in your **Mathematics Practical Notebook (40–50 pages)**.
- Draw all diagrams neatly and label them wherever necessary.
- Show all calculations and observations clearly.
- Submit the completed notebook after the holidays.

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## SUBJECT:- PHYSICS

# Section C Physics

**30.** A student wants to observe the distinct spectrum formed by the dispersion of white light using a glass prism. Which of the following practical procedures will give the most distinct and clear spectrum on a white screen? **(1)**

(a) Direct a broad beam of diffuse room light onto one of the refracting surfaces of the prism

(b) Allow a narrow beam of sunlight to enter a dark room through a small slit and fall on a refracting face of the prism at an appropriate angle

(c) Place the prism completely flat on a white sheet of paper illuminated evenly from all directions

(d) Align the screen parallel to the incident beam before the white light enters the first face of the prism

**31.** An electric lamp of resistance 20 Ω and a conductor of 4 Ω resistance connected in series are operated at 6 V. What current do they draw? **(1)**

(a) 0.15 A (b) 0.25 A (c) 1.5 A (d) 2.5 A

**Question number 32** The following one question consists of two statements – **Assertion (A)** and **Reason (R)**. Answer these questions by selecting the appropriate option given below:

(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.

**32.** **Assertion** (A) A pencil partially immersed in water appears bent or broken at the interface of air and water.
**Reason** (R) The bending of light rays as they travel from water to air causes this phenomenon. **(1)**

**33.** (a) State the laws of refraction.

(b) Define the refractive index of a material with respect to vacuum, giving the mathematical expression. **(1)**

**34.** **Attempt either option (a) or (b).**

(a) (i) State Fleming's left-hand rule. **(1)**

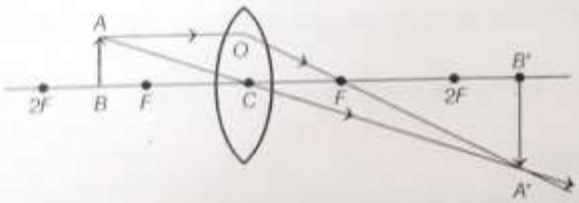
(ii) What happens to the magnetic force experienced by a current-carrying conductor if the current is doubled while keeping other variables constant? **(1)**

*Or*

(b) (i) Define magnetic field lines. **(1)**

(ii) Justify with a reason why two magnetic field lines never intersect each other? **(1)**

**35.** A convex lens forms a real image that is 2 times the size of the object. If the object is placed 15 cm in front of the lens, determine




(a) the type of image formed (real or virtual). **(1)**

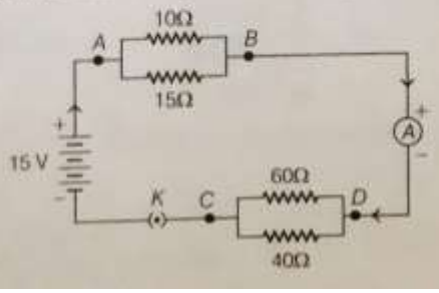
(b) the image distance. **(1)**

(c) the focal length of the lens. **(1)**

**36.** (a) State Ohm's law and describe how it helps determine the relationship between potential difference and current in a metallic conductor? **(2)**

(b) Explain how the resistance of a conductor changes with its length? **(1)**

**37.**

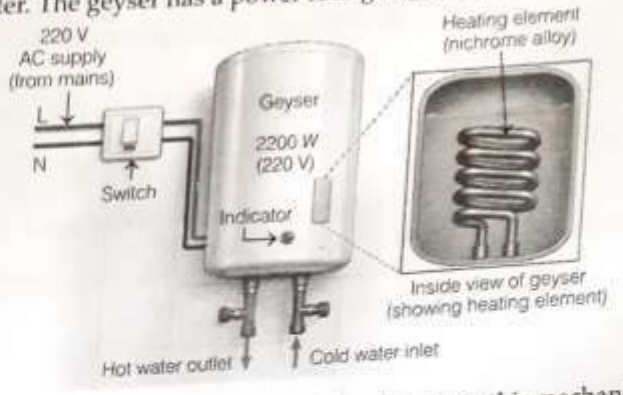


The figure shows a circuit with a 15 V battery connected to several resistors.
Using the given circuit diagram:

(a) Find the total current supplied by the battery.

(b) Calculate the potential difference between points *A* and *B*.

**38.** A family has installed an electric water geyser in their bathroom connected to the standard 220 V domestic power lin
The heating mechanism inside the geyser uses a coiled heating element made of nichrome alloy. When the switch i
turned on, an electric current flows through the element, generating a large amount of heat energy that rapidly raise
the temperature of the water. The geyser has a power rating of 2200 W when operated at 220 V.




(a) Why is a nichrome alloy core used for making the heating element in this mechanism instead of a pure metal like copper? **(1)**

(b) Which scientific law governs the amount of heat energy produced in this heating element over a given time interval? **(1)**

**Attempt either subpart (c) or (d).**

(c) If the voltage supplied to the geyser drops from 220 V to 110 V due to a fluctuation, explain how the heat produced per second changes and its effect on heating the water? **(2)**

*Or*

(d) If the source voltage is fixed at 220 V, how can we alter the length of the heating element wire to increase the rate of heat production in the geyser? **(2)**

**39. Attempt either option (a) or (b).**

(a) (i) What is meant by the least distance of distinct vision? **(1)**

(ii) What is the function of the iris in the human eye? **(1)**

(iii) Name the vision defect in which a person can see nearby objects distinctly, but cannot see distant objects clearly. **(2)**

(iv) Draw a labelled ray diagram showing the correction of this vision defect using an appropriate lens. **(2)**

*Or*

(b) (i) What is a glass prism? **(1)**

(ii) Which colour of light deviates the least during dispersion through a prism? **(1)**

(iii) State why a prism produces a spectrum when white light passes through it? **(1)**

(iv) Draw a simple labelled diagram to show the path of white light through a glass prism and the spectrum formed. **(2)**

(ii) Analyse the observations given in the following two cases. Are these observations correct? Give reasons to support your answer. (2)

(I) Copper turnings are added to an aqueous solution of iron sulphate.
**Observation** The green solution slowly fades and turns blue due to the formation of copper sulphate.

(II) Dilute hydrochloric acid is added to sodium carbonate powder.
**Observation** Brisk effervescence is seen due to the evolution of carbon dioxide gas.

## Section B ~~Chemistry~~ PHYSICS

**30.** A makeup artist uses a concave mirror to obtain a highly detailed, upright and magnified view of a client's face. Which of the following observations about this optical setup is incorrect? (1)

(a) Place the client's face between the pole and the principal focus of the mirror
(b) Observe a magnified image formed behind the mirror surface
(c) Obtain a virtual and erect image of the client's face
(d) Move the client's face closer to the mirror to increase the magnification

**31.** A current of 2 A flows through a 5 Ω resistor for 10 s. How much heat is produced? (1)

(a) 20 J (b) 50 J (c) 100 J (d) 200 J

**Question number 32** The following one question consists of two statements – **Assertion (A)** and **Reason (R)**. Answer these questions by selecting the appropriate option given below:

(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.

**32.** **Assertion** (A) A prism produces a spectrum when white light passes through it. (1)

**Reason** (R) All colours of white light undergo the same amount of deviation when passing through a prism. (1)

**33.** (a) State the cause of myopia. (1)

(b) Define the power of a lens and give its mathematical expression. (1)

**34.** (a) (i) State one condition under which a current-carrying conductor do not experience a force in a magnetic field. (1)

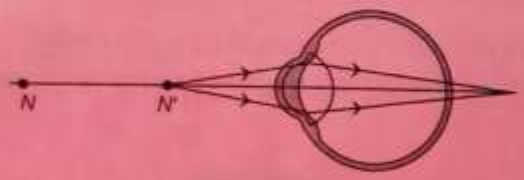
(ii) What is the effect of reversing the direction of current in a current-carrying conductor placed in a magnetic field? (1)

*Or*

(b) (i) Define the term magnetic field. (1)

(ii) Why do two magnetic field lines never intersect each other? (1)

**35.** A defective eye forms an image of a nearby object behind the retina, as shown in the diagram. If the near point of this eye has shifted to 50 cm and an object is placed 25 cm in front of the eye, determine:




(a) the type of lens required to correct the defect. (1)

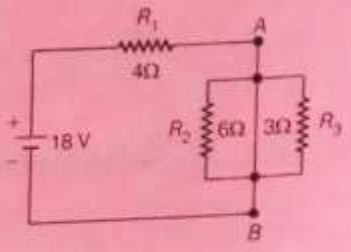
(b) the focal length of the correcting lens. (1)

(c) the power of the correcting lens. (1)

**36.** (a) State Ohm's law and describe how it mathematically relates the current flowing through a conductor to the potential difference across its ends. **(1.5)**

(b) Explain how the resistance of a conductor changes when its length is increased, keeping other factors constant? **(1.5)**

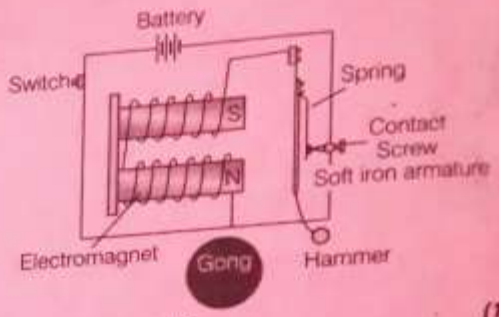
**37.** In the circuit diagram shown below, an 18 V battery is connected to a network of three resistors $R_1$, $R_2$ and $R_3$. Based on this diagram,




(a) Find the potential difference across resistor $R_1$. **(2)**

(b) Calculate the current passing through resistor $R_3$. **(1)**

**38.** A traditional school electric bell relies on the magnetic effect of electric current to produce a continuous ringing sound. When the switch is closed, current flows through a coil wound around a U-shaped core, turning it into an electromagnet. This attracts a soft iron armature attached to a hammer, causing it to strike the gong. As the armature moves forward, it loses touch with a contact screw. The electromagnet immediately loses its magnetism, and a spring pulls the armature back, restoring electrical contact to repeat the cycle.




(a) What role does the switch play in controlling the working of an electromagnet? **(1)**

(b) Why is soft iron commonly used as the core of an electromagnet? **(1)**

**Attempt either subpart (c) or (d).**

(c) If the terminals of the battery connected to the bell circuit are reversed, analyze whether the bell will continue to function. Provide a theoretical reason to support your answer. **(2)**

*Or* (d) A student observes that the hammer is striking the gong very weakly. Suggest two modifications to the electric bell's circuit that would increase the striking force. **(2)**

**39.** (a) (i) What is meant by the refractive index of a medium? **(1)**

(ii) What is the relationship between the angle of incidence and the angle of refraction when light passes obliquely from air into glass and what does it signify? **(1)**

(iii) Name the type of lens that is thicker at the centre and thinner at the edges. **(1)**

(iv) Draw a labelled diagram to show the bending of light as it passes from a rarer medium to a denser medium. **(2)**

*Or* (b) (i) What is meant by the principal focus of a convex lens? **(1)**

(ii) Where should an object be placed in front of a convex lens to obtain a virtual, erect and magnified image? **(1)**

(iii) Why is the focal length of a convex lens assigned a positive sign? **(1)**

(iv) Draw a simple labelled ray diagram to show the formation of a virtual, erect and magnified image by a convex lens. **(2)**

## SUBJECT - CHEMISTRY

1. Prepare lab copy and write all the experiments done in the chemistry lab.
2. Make one project related to chemistry.
3.write notes and all the exercise questions of metal and non metal.
**4.** What is a neutralisation reaction? Write one example with a balanced chemical equation.
**5.** Differentiate between acids and bases on the basis of their effect on litmus paper.

## SUBJECT - BIOLOGY

*MCQ Topic -SEXUAL REPRODUCTION*

*Q1. The male gamete in flowering plants is present in:*
a) Ovary b) Stigma c) Pollen grain d) Style
*Q2. Fertilization in human beings takes place in:*
a) Ovary b) Uterus c) Fallopian tube d) Vagina
*Q3. Which part of the flower becomes fruit after fertilization?*
a) Ovule b) Ovary c) Stamen d) Sepal
*Q4. The implantation of embryo takes place in:*
a) Ovary b) Fallopian tube c) Uterus d) Cervix
*Q5. Pollination is defined as:*
a) Transfer of pollen from anther to stigma b) Germination of pollen grain
c) Growth of pollen tube d) Fusion of male and female gametes
*Q6. Which is a bisexual flower?*
a) Papaya b) Watermelon c) Mustard d) Cucumber

*Q7. The number of chromosomes in human zygote is:*
a) 23 b) 46 c) 44 d) 22
*Q8. Menstruation occurs when:*
a) Egg is fertilized b) Egg is not fertilized c) Ovulation occurs d) Embryo is formed

*Q9. Which of the following is a sexually transmitted disease?*
a) Malaria b) AIDS c) Tuberculosis d) Cholera
*Q10. Sperms are produced in:*
a) Testis b) Ovary c) Vas deferens d) Uterus
Q11. The ovule after fertilization becomes:*
a) Fruit b) Seed c) Flower d) Bud
*Q12. What is the function of the placenta?*
a) To produce sperms b) To provide nutrition to embryo
c) To produce eggs d) To store urine.
Q13. Double fertilization is seen in:*

a) Humans b) Amoeba c) Flowering plants d) Hydra

*Q14. Which contraceptive method prevents implantation?*
a) Condom b) Copper-T c) Vasectomy d) Tubectomy

*Q15. Puberty in males is marked by:*
a) Growth of mammary glands b) Growth of beard and moustache
c) Start of menstruation d) Increase in fat

**:Topic – HEREDITY**
*Q1. The number of chromosomes in human sex cells is:*
a) 46 b) 23 c) 22 d) 44
*Q2. Who is known as the Father of Genetics?*
a) Darwin b) Mendel c) Lamarck d) Morgan
*Q3. A pure tall pea plant (TT) is crossed with pure dwarf (tt). What will be the F1 generation?*
a) All tall b) All dwarf c) 50% tall, 50% dwarf d) 75% tall, 25% dwarf

*Q4. Which of the following is a recessive trait in pea plant studied by Mendel?*
a) Tall height b) Round seed c) Wrinkled seed d) Yellow seed colour

*Q5. The chemical that carries genetic information is:*
a) Protein b) Lipid c) DNA d) Starch

*Q6. The ratio of F2 generation in Mendel's monohybrid cross is:*
a) 1:2:1 b) 3:1 c) 9:3:3:1 d) 2:1

*Q7. Sex of the child in humans is determined by:*
a) Mother's chromosome b) Father's chromosome
c) Both parents equally d) Environment
*Q8. A gene has two forms called:*
a) Chromosomes b) Alleles c) Traits d) Gametes

*Q9. Which of these is NOT an inherited trait?*
a) Eye colour b) Knowledge of music learned from teacher
c) Attached earlobe d) Height

*Q10. If a round seed (RR) is crossed with wrinkled seed (rr), the phenotype of F1 will be:*
a) Wrinkled b) Round c) Both d) Intermediate

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***PART B: ASSERTION-REASON QUESTIONS***

*Instructions:*

A) Both A and R are true, and R is the correct explanation of A
B) Both A and R are true, but R is NOT the correct explanation of A
C) A is true, R is false
D) A is false, R is true

*Q11.*
*Assertion (A):* Variations are important for evolution.
*Reason (R):* Variations help organisms to adapt to changing environment.

Q12
Assertion (A):* Mendel chose pea plants for his experiments.
Reason (R):* Pea plants have a short life cycle and have many contrasting visible characters.
Q13.*
Assertion (A):* A child who has blood group O can have parents with blood groups A and B.
Reason (R):* Blood group O is recessive and can appear when both parents carry O allele.
Q14.*
Assertion (A):* All the offspring of F1 generation are similar in Mendel's experiment.
Reason (R):* One trait is dominant over the other.

*Q15.*
Assertion (A): Sex of child is determined by mother.
Reason (R):* Mother has XX chromosomes and father has XY.
Q16.
Assertion (A):* Acquired traits are not passed to the next generation.
Reason (R):* Changes in somatic cells are not transmitted to germ cells.

Project:
1: Heredity Family Tree
Make a family tree of your family up to grandparents. Observe 2 traits – height (tall/short) and eye colour. Note who resembles whom. Write 3 lines conclusion on variation in your family.
2.Do mind map on Heredity.

## SOCIAL SCIENCE

Art Integrated Project: Prepare an Art Integrated Project comparing the states of Jharkhand and Rajasthan. Compare their geographical features, climate, natural vegetation, historical monuments, traditional dresses, festivals, folk dances, art forms, and cultural heritage.

(Group of 5 students)

# ECONOMICS

**Chapters: Money and Credit & Globalisation in India**

**Part A: Money and Credit**

**Section I: Multiple Choice Questions (1 Mark Each)**

1. Which of the following agencies issues currency notes on behalf of the Central Government in India?

a) Commercial Banks
b) Cooperative Societies
c) Reserve Bank of India
d) State Bank of India

2. The double coincidence of wants is an essential feature of which of the following systems?

a) Barter system
b) Banking system
c) Monetary system
d) Globalisation system

3. Collateral is:

a) A type of deposit in a bank
b) An asset that the borrower owns and uses as a guarantee to a lender
c) The interest rate charged by a bank
d) The paper currency authorized by the government

**Section II: Short Answer Questions (3 Marks Each)**

4. Why is modern currency accepted as a medium of exchange without any use of its own? Explain.
5. Distinguish between formal and informal sources of credit in India. (Give any three points)
6. Why do lenders ask for collateral while lending? Explain with an example.

**Section III: Long Answer / Case-Based Questions (5 Marks Each)**

7. "Credit can play a positive role or it can push the borrower into a debt trap." Support this statement with suitable examples.
8. What are Self-Help Groups (SHGs)? Explain their functioning and importance in rural areas.

**Part B: Globalisation in India**

**Section I: Multiple Choice Questions (1 Mark Each)**

1. Globalisation involves:

a) Greater foreign investment and foreign trade
b) Lessening of control by the government
c) Free flow of goods, services, investments, and technology across countries
d) All of the above

2. MNC stands for:

a) Maximum National Corporation
b) Multi-National Corporation
c) Major Non-trading Company
d) Mutual National Co-operation

3. Which of the following organisations lays down rules for international trade globally?

a) World Bank
b) International Monetary Fund (IMF)
c) World Trade Organisation (WTO)
d) Reserve Bank of India (RBI)

**Section II: Short Answer Questions (3 Marks Each)**

4. What is an MNC? How do MNCs spread their production across the globe?
5. How has liberalisation of foreign trade and investment policies helped globalisation? Explain.
6. What is 'Fair Globalisation'? How can it be achieved?

**Section III: Long Answer / Case-Based Questions (5 Marks Each)**

7. "The impact of globalisation has not been uniform." Explain this statement with suitable examples from India.
8. How has technology stimulated the globalisation process? Explain with examples.

## ARTIFICIAL INTELLEGENCE (AI)

## 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:**




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.

### 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**

## 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.

**c.Automatic 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 Frameworks:

The various types of ethical frameworks are classified as follows:

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

### 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.

# 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.

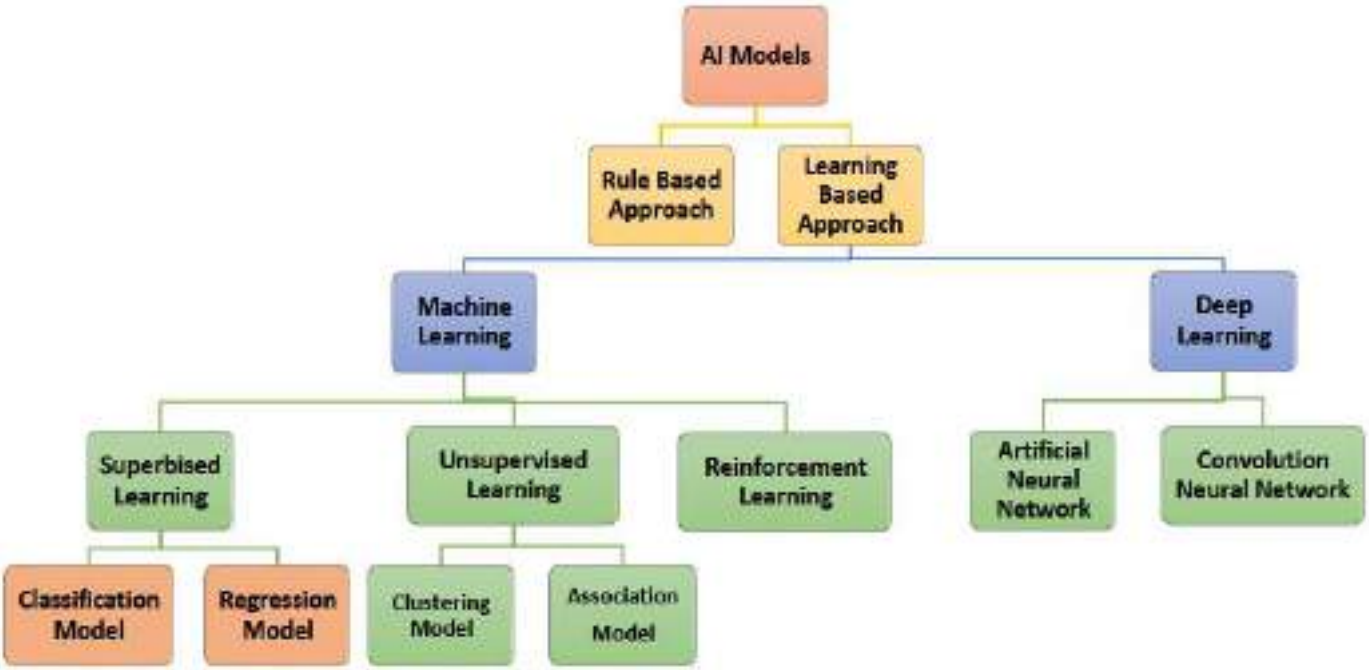
# Chapter 2.2

# 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 Chabot 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.

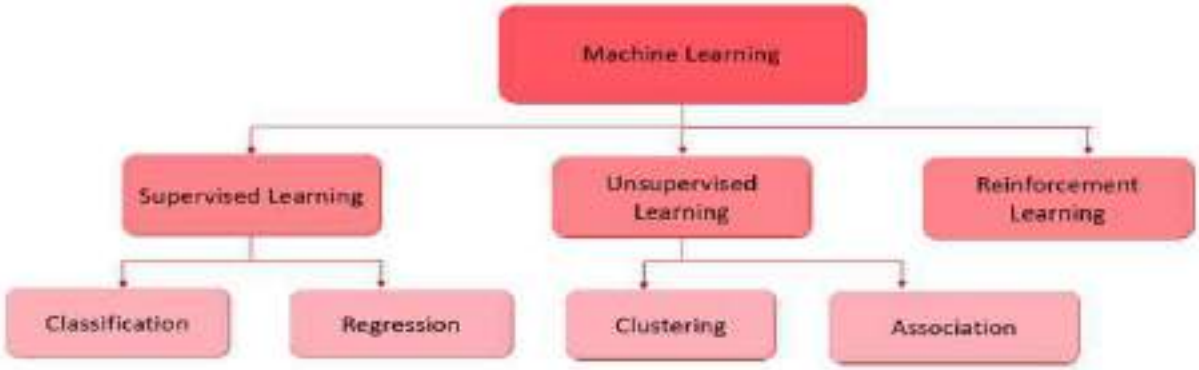
Instead of being explicitly programmed for a task, the computer learns to perform it by analysing data and finding patterns or rules on its own.

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 abl to design a model which is adaptive to the change in data.

### 1. 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.

**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:

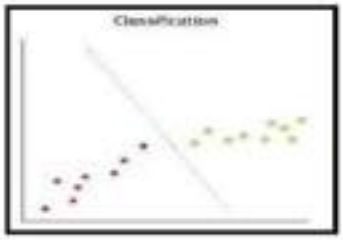
Classification model and Regression model.




### 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.**

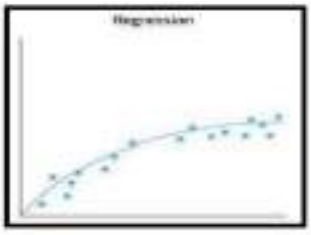
**Examples:**

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.

### b) Association:

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

## 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

# 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?**

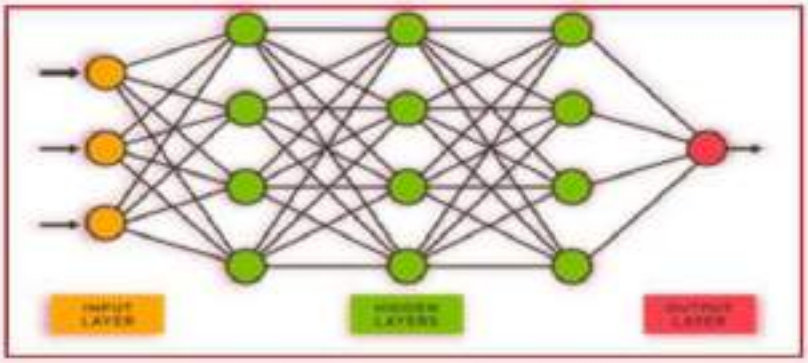
Neural networks are loosely modelled after how neurons in the human brain behave.

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.**

**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**.

### 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.

**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.

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

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

**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.

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

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

**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.

# 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 vs Image Processing:

**Computer Vision Vs. Image Processing**

| Computer Vision | Image Processing |
|---|---|
| • Computer vision deals with extracting information from the input images or videos toinfer meaningful information and understanding them to predict the visual input<br>• Computer Vision is a superset of ImageProcessing.<br>• 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<br>• Image Processing is a subset of ComputerVision.<br>• 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

### 5.4 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).

| Classification | Classification + Localization | Object Detection | Instance Segmentation |
|---|---|---|---|

**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.

## 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.

## 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:

| Convolutional Layer | Rectified linear unit (ReLU) | Pooling Layer | Fully Connected Layer |
|---|---|---|---|

### 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.

### 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.

# 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.



## 6.5 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

#### 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.

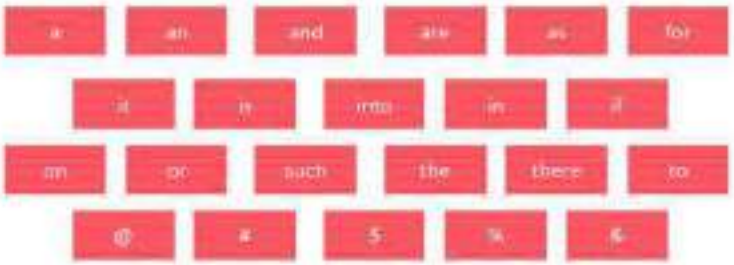
#### 2. Tokenization

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:




***Enjoy your holidays while learning something new!***

***Wishing you all a Happy Diwali and a Blessed Chhath Puja!***

**********XXXXX**********