

CBCGS SCHEME

USN 22DESCSOO1

1BAIA103

First Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Introduction to AI and Applications

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.*

Module - 1			M	L	C
Q.1	a.	Explain in detail the different types of Artificial Intelligence based on functionality and capabilities.	7	L2	CO1
	b.	Explain different types of knowledge used in AI with suitable examples.	6	L2	CO1
	c.	Compare traditional programming with machine learning.	7	L2	CO1
OR					
Q.2	a.	What is Machine Learning? Relate AI and Machine Learning?	7	L2	CO1
	b.	What is AI Agent? Classify the agents in an AI system.	7	L2	CO1
	c.	Compare weak AI and strong AI.	6	L2	CO1
Module - 2					
Q.3	a.	Differentiate between Zero-shot, One-shot, and Few-shot prompting.	6	L2	CO4
	b.	Explain Self-Consistency Prompting and how does it improve model performance.	6	L2	CO4
	c.	Apply LLM-based writing prompts to produce creative content for digital marketing campaigns.	8	L3	CO4
OR					
Q.4	a.	Build a zero-shot prompt to classify comments as positive or negative. Explain why it qualifies as zero-shot.	6	L3	CO4
	b.	Explain the steps for Effective Prompt Engineering.	6	L2	CO4
	c.	Build a creative prompt that encourages ChatGPT to propose futuristic transportation ideas. Explain how this promotes imaginative thinking.	8	L3	CO4
Module - 3					
Q.5	a.	Is Labelled data supervised or unsupervised machine learning? Extend your answer explaining different types of machine learning.	6	L2	CO2
	b.	Outline K-Means Algorithm with merits and demerits.	8	L2	CO2
	c.	Summarize the features of: (i) Reinforcement Learning (ii) Support Vector Machines (SVM)	6	L2	CO2
OR					

Q.6	a.	Explain the four steps to create Decision Trees with suitable example for each step.	6	L2	CO2
	b.	Define conditional probability and the Bayes rule with examples.	8	L2	CO2
	c.	How does computer vision work with deep learning? Explain the tasks involved in computer vision.	6	L2	CO2
Module - 4					
Q.7	a.	List and explain any four Trusted AI principles.	8	L2	CO5
	b.	Describe the concept of AI as a Service (AIaaS). Outline two advantages and two challenges of using AIaaS in organizations.	6	L2	CO5
	c.	Relate the role of ethics in AI.	6	L2	CO5
OR					
Q.8	a.	What is expert system? Explain three components of expert system.	6	L2	CO5
	b.	Differentiate between the following: (i) AI Programs and Robots (ii) Human-controlled and fully - autonomous bots	6	L2	CO5
	c.	What is Neuromorphic Computing? Explain its architecture, features resembling the human brain, and how it contributes toward achieving Artificial General Intelligence (AGI).	8	L2	CO5
Module - 5					
Q.9	a.	Relate the role of AI in Biology and Environmental Sciences.	6	L2	CO3
	b.	What is No-Code AI. Explain why No-Code AI Must be Used?	6	L2	CO3
	c.	Identify the role of AI in scientific experimentation by examining how it supports different disciplines and breaking down the specific experimental activities such as data collection, pattern identification, simulation, and hypothesis testing that AI enhances.	8	L3	CO3
OR					
Q.10	a.	Explain the role of AI in early disease prevention.	6	L2	CO3
	b.	What is Low Code AI. Compare Traditional tools with Low Code AI.	6	L2	CO3
	c.	Explain how AI contributes to environmental science by breaking down its role in climate modelling, air and water quality monitoring, waste management, and resource conservation. Describe the specific data, techniques, and decision-making processes involved in each area.	8	L3	CO3

First Semester B.E./B.Tech. Degree Examination, ^①
Dec. 2025 / Jan. 2026

Introduction to AI and Applications

[1BAIA103]

Max. Marks : 100

Prepared by :- Prof. P. L. Chavan.

Module-1

1a. Explain in detail the different types of Artificial Intelligence based on functionality and Capabilities (7)

AI Can be categorized into:

→ Based on Capabilities.

◦ Weak AI (Narrow AI)

• Weak AI, also known as narrow AI, is designed to do one specific task.

◦ Strong AI

• Strong AI, also called Artificial General Intelligence (AGI) or Superintelligence (ASI), tries to mimic human thinking.

→ Based on Functionalities

◦ Reactive Machines

• Reactive machines are simplest type of AI that react to situations based on immediate input, but they have no memory or ability to learn from past experiences.

◦ Limited Memory

• Limited memory AI systems can remember data for a short time and use it to make decisions, but they don't keep data permanently.

- Theory of Mind
- The theory of mind in AI aims to create machines that can understand thoughts, emotions, and memories - just like humans.
- Self-Awareness
- Self-awareness in AI means machines that have a human-level consciousness - they can understand their own existence and feelings.

1b. Explain different types of knowledge used in AI with suitable examples. (6)

- 1) Meta knowledge is the knowledge about knowledge.
- 2) Heuristic knowledge is the knowledge about a specific topic. For example, it can be knowledge of some experts in a field or subject. Heuristic knowledge is treated as the rule of thumb as it is based on previous experiences and awareness of approaches, which are good to work but not guaranteed.
- 3) Procedural knowledge, also known as imperative knowledge, gives information about how to achieve or do something. This knowledge includes rules, strategies, procedures, agendas, etc. that can be directly applied to perform any task.
- 4) Declarative knowledge is the information that we have about an object. This knowledge helps us to describe a particular concept, fact, object and its attributes. Declarative knowledge is simpler than procedural language and is also called descriptive knowledge as it is usually represented using declarative sentences.

5) Structural knowledge is the basic knowledge⁽³⁾ to solve complex problems. It describes relationships between various concepts or objects such as kind of, part of, and grouping of something.

1c. Compare traditional programming with machine learning (7)

◦ Traditional Programming:

- **Manual Coding:** In traditional programming, the programmer manually writes code that accepts input data and returns output based on pre-defined rules.
- **Languages Used:** It uses procedural programming languages like C, C++, Java, Python, etc., where the logic and rules are explicitly coded by the programmer.
- **Algorithm-Dependent:** The program is created based on specific algorithms chosen by the programmer, who also analyzes their performance to pick the best one for the task.
- **Static Rules:** The rules and logic of the program are fixed and cannot change unless modified by the programmer.

◦ Machine Learning Programming:

- **Data-Driven Approach:** Machine learning programming learns automatically from data.
- **Predictive modeling:** For example, if we input customer data and transactions, machine learning can create a predictive model to forecast.
- **Embedded Analytics:** Machine learning introduces embedded analytics, like natural language processing, automatic anomaly detection, and

recommendation systems, to make intelligent predictions

- Automated Learning: Adapt and improve over time as more data is processed.

2a. what is machine learning? Relate AI and machine learning? (7)

Machine learning is a branch of AI that teaches machines to learn from data and make decisions without being explicitly programmed.

AI vs ML:

- AI is the larger goal (the superset) that aims to make machines intelligent.
- Machine learning is a subset of AI, used specifically for learning from data to make decisions.
- In simple terms, ML helps achieve AI by making machines learn and adapt.

Example:

- If you want a robot that can see, talk, walk, and learn, you would use AI because it requires many different technologies.
- Machine learning would only be used to help the robot learn from its environment or past experiences.

2b. what is AI Agent? classify the agents in an AI system (7)

AI agents act in their environment, which may include other agents.

- They perceive their environment using sensors.
- They act upon the environment using effectors.

Types of Agents in an AI System:

1] Human Agent:

- Sensors: Sensory organs like eyes, ears, nose, skin, etc.
- Effectors: Hands, legs, mouth for taking action.

2] Robotic Agent:

- Sensors: Cameras, infrared range finders.
- Effectors: Motors, actuators to perform actions.

3] Software Agent:

- Sensors: Users bit strings as its programs.
- Effectors: Executes programmed actions based on those bit strings.

2c. Compare weak AI and Strong AI (6)

1] weak AI

weak AI, also known as narrow AI, is specifically designed to perform a specific type of task, for example, Siri and Alexa are weak AI systems. These systems are already trained with appropriate responses to classify things accordingly. when you instruct Alexa to play a song, it responds by playing that song.

In fact, majority of AI applications that we use today (predicting weather stock prices, optimizing business, etc.) come under this category of weak AI systems.

a limited Context & are the most Successful realization of AI to date. Application of narrow AI has resulted in Significant Societal benefits. Google Search, Image recognition software, self-driving cars & IBM's watson are Some examples of Such Systems.

2] Strong AI

Strong AI, also known as artificial general intelligence or artificial Super intelligence (ASI) or Superintelligence, makes full attempt to resemble the human brain. It utilizes Cognitive skills and fuzzy logic to perform tasks for which it had not been trained earlier. Such a System needs capability for visual perception, Speech recognition, decision-making & translations between languages.

Module-2

3a. Differentiate between zero-shot, One-shot, and Few-shot Prompting (6)

Technique	Description	Example
Zero Shot Prompting	The model generates a response without any example or context.	"write a poem about nature"

Technique	Description	Example: (7)
One shot prompting	The model uses one example to understand the task and generate a response.	"Summarize this sentence: The Sun rises in the east."
Few shot prompting	The model uses a few examples to generate a more accurate and relevant response.	"Write a product review based on these features..."

3b. Explain Self-Consistency Prompting and how does it improve model performance (6)

- The self-consistency prompt is a sophisticated technique used in prompt engineering to ensure that the generated text remains coherent and logically consistent with the information provided.
- This technique is particularly useful when you want the AI model, such as ChatGPT, to adhere to specific facts, opinions, or constraints throughout a conversation or task.
- How it works:
 - The main aim of the self-consistency prompt is to maintain coherence and logical consistency in the model's responses.
 - Process:
 - You provide the model with a prompt that contains key information or facts that the model must remain consistent with during the interaction. This could include background knowledge, established facts, or constraints that the model should adhere to.

to while generating text.

30. Apply LLM-based writing prompts to produce Creative Content for digital marketing Campaigns (8)

In the evolving landscape of digital marketing, leveraging large language models (LLMs) such as GPT can significantly enhance the creativity and effectiveness of campaign content. LLMs can generate engaging, tailored, and innovative text that resonates with target audiences across various platforms.

To apply LLM-based writing prompts effectively, marketers should begin by defining clear campaign goals and audience personas. For example, prompts can be designed to create catchy taglines, persuasive product descriptions, engaging social media posts, or compelling email newsletters. By inputting specific instructions or context into the LLM, such as the product features, target demographics, and desired tone, the model can produce diverse content variations.

In conclusion, integrating LLM-based writing prompts into digital marketing strategies empowers marketers to generate high-quality, creative content efficiently. This approach not only saves time but also enhances audience engagement by delivering personalized and innovative messaging tailored to specific campaign needs.

4a. Build a zero-shot prompt to classify Comments as positive or negative. Explain why it qualifies as zero-shot. (6)

A zero-shot prompt is a prompt given to a language model to perform a task without any prior examples or training on that specific task.

The model uses its general knowledge to understand and respond to the prompt.

Zero-shot prompt Example:

"I really enjoyed the movie, it was fantastic!"

Explanation of why This is Zero-shot.

- No examples or labeled data are provided in the prompt.
- The model uses its pre-trained knowledge to infer sentiment without any fine-tuning or few-shot examples.

This contrasts with few-shot prompting, where you provide examples of positive and negative comments along with their labels before asking the model to classify a new comment.

4b. Explain the steps for Effective Prompt Engineering. (6)

Step 1: understand the Task Thoroughly

° Goal: know exactly what you want the LLM to do before crafting the prompt.

° Questions to ask yourself:

- what outcome am I expecting?
- what kind of answer am I looking for (e.g., creative, factual, instructional)?

° Example: If you want a poem, understand if you need it to be creative or educational. If you need the model to generate a formal email.

The prompt needs to be task-specific.

Step 2: Use prompt precise & simple language.

- Goal: Make sure the LLM understands your prompt clearly.
- Tip: Avoid using technical jargon or overly complex terms. Your language should be direct and simple.

Example:

- Vague prompt: "Create a response to the user's inquiry."
- Precise prompt: "Write a formal email apologizing for a delayed response."

Step 3: Add specific details

- Goal: The more detailed the prompt, the better, the response.
- Tip: Provide enough context or constraints to guide the model effectively. Specificity helps the model understand your exact requirements.

Example:

- General prompt: "Write a poem."
- Specific prompt: "Write a poem about the joy of summer, with imagery of the beach and sunshine."

Step 4: Provide examples

- Goal: Help the LLM understand the type of output you're expecting.
- Tip: If possible, provide a sample output that demonstrates the desired style or format. This helps the model align its output with your expectations.

Example:

- Prompt: "Write a summary of the following article in bullet points."

• Example Output :

- "Article Summary:
- "Discusses the impact of climate change.
- "Explores renewable energy solutions."

Step 5: Experiment and Refine

- Goal: Prompt engineering isn't perfect from the first try.
- Tip: Test different prompts to find the one that works best. Experimentation and iteration are key to discovering the most effective approach.

Example:

- If you're not getting the right answer, try rephrasing the prompt or adding more context to see if the response improves.

4C. Build a Creative prompt that encourages ChatGPT to propose futuristic transportation ideas. Explain how this promotes imaginative thinking

Prompt Example (8)

Imagine you are a visionary transportation designer in the year 2050.

Propose five innovative and futuristic transportation concepts that could revolutionize the way humans travel.

Think beyond current technology and consider speed, sustainability, safety, and user experience.

How This Prompt Promotes Imaginative Thinking

1] Role Assignment

- By asking ChatGPT to "Imagine you are a visionary designer," the model adopts a creative mindset, encouraging out-of-the-box ideas.

2] Future-Oriented Context.

- Specifying the year 2050 removes present-day limitations and inspires forward-thinking concepts.

3] Freedom to Explore

- The prompt encourages ideas beyond existing technology allowing for bold, unconventional suggestions.

4] Structured Creativity

- Asking for five concepts with short descriptions gives a clear format while still leaving room for innovation.

5] Focus on Multiple Aspects.

- Including speed, sustainability, safety, and user experience encourages the model to consider multiple dimensions, fostering holistic and imaginative solutions.

Module-3

5a. Is Labelled data Supervised or unsupervised machine learning? Extend your answer explaining different types of machine learning. (6)

Supervised machine learning.

Explanation:

- Supervised learning uses labelled data, where each input has a corresponding correct output, much like learning with a teacher. The algorithm learns a mapping $f: X \rightarrow Y$ from the input to the output, adjusting itself to minimize errors. It is used for tasks like classification and regression.

- Unsupervised learning, in contrast, works with unlabeled data. The algorithm analyzes the data on its own to find hidden patterns, groups, or relationships without prior knowledge of the

Correct output. It is commonly used for clustering and data visualization. (13)

• Machine learning also includes a third primary type: reinforcement learning. In this approach, an agent learns by interacting with an environment and receiving feedback in the form of rewards or penalties.

5b. Outline k-Means Algorithm with merits and demerits (8)

The k-means algorithm is a popular unsupervised learning technique used for clustering. It groups data points into k distinct, non-overlapping clusters based on their similarities.

The process:

- 1] Initialize: Choose the no. of clusters k and randomly pick k data points as initial "Centroids."
- 2] Assign: Assign each data point to the nearest centroid based on a distance metric (usually Euclidean distance).
- 3] Update: Calculate the new mean (center) of all points in each cluster. These means become the new centroids.
- 4] Repeat: keep repeating the assign & update steps until the centroids no longer move significantly.

Merits:

- Simplicity: Very easy to understand & implement.
- Efficiency: Computationally fast, especially for large datasets.

Demerits:

- Choosing k : You must specify the no. of clusters (k) beforehand, which isn't always obvious.
- Sensitivity to Outliers: Outliers can significantly pull the Centroids away from the actual Center of the main data mass.

5c. Summarize the features of:

(i) Reinforcement Learning

(ii) Support Vector machines (SVM) (6)

(i) Reinforcement Learning (RL)

- Agent-Environment Interaction: An agent interacts with a dynamic environment.
- Feedback Loop: Learning is based on a reward/penalty system rather than a fixed dataset.
- Goal-Oriented: The primary objective is to learn a "policy" that maximizes long-term cumulative rewards.

(ii) Support Vector machines (SVM)

- Classification & Regression: Primarily used for classification tasks.
- Hyperplane maximization: It works by finding the "optimal hyperplane" that separates different classes with the widest possible margin.
- Kernel Trick: Can handle non-linear data by transforming it into a higher-dimensional space where it becomes linearly separable.

6a. Explain the four steps to Create Decision Trees with Suitable example for each step. (6) (15)

A decision tree is built using a top-down, "divide and Conquer" approach.

1] Select the Best Attribute: Use a metric like information Gain or Gini Impurity to find the feature that best splits the data into pure classes

Example: choosing "Outlook" (Sunny, Overcast, Rainy) to decide if a match will be played.

2] Split the Dataset: Create branches for each possible value of the selected attribute.

Example: Creating three branches from the "Outlook" node.

3] Create Leaf Nodes: If a branch results in a group where all items belong to the same class, create a leaf node with that class label.

Example: All "Overcast" days result in "Yes" (play) so that branch ends.

4] Repeat (Recursion): For branches that aren't pure, repeat steps 1-3 on the remaining attributes until a stopping condition is met (e.g., no attributes left).

6b. Define Conditional probability and the Bayes rule with examples. (8)

* Conditional probability: It is the probability of an event occurring given that another event has already occurred.

Explanation

* It is denoted as $P(A|B)$, which is the probability of event A happening given that event B has already happened.

- The formula for Conditional probability is:

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

where $P(A \cap B)$ is the probability of both events A and B occurring, and $P(B)$ is the probability of event B occurring ($P(B) > 0$).

- Example: In a deck of 52 cards, the probability of drawing a Queen given that the card drawn is a face card.

$$P(\text{Queen} | \text{Face Card}) = \frac{P(\text{Queen and face card})}{P(\text{face card})}$$

$$\frac{4/52}{12/52} = \frac{4}{12} = \frac{1}{3}$$

- Baye's Rule := (or Baye's theorem) is a formula that describes how to update the probability of a hypothesis based on new evidence.

Explanation

- It is a direct application of Conditional probability and the law of total probabilities of two random events.

- The formula for Bayes' rule is:

$$P(A|B) = \frac{P(B|A) P(A)}{P(B)}$$

- Example: A medical test for a disease has a 99% accuracy rate. 1% of the population has the disease - Se. if a person tests positive, what is the probability they actually have the disease? Bayes' rule helps calculate this revised probability using the prior probability (1%) of the population has it) and the test's accuracy (new evidence).

60. How does Computer Vision work with deep learning?
Explain the tasks involved in Computer Vision (6) (17)

Computer vision with deep learning and tasks.

Computer vision with deep learning works by using artificial neural networks, specifically Convolutional Neural Networks (CNNs), to enable computers to interpret and "understand" visual information from the world. CNNs automatically learn to extract features from images, such as edges, textures, and shapes, which are then used to make classifications or detections.

The main tasks involved in Computer Vision include

- Image Classification: Assigning a label to an entire image (e.g., identifying a picture as containing a "cat" or "dog").
- Object Detection: Identifying the location of objects in an image & drawing bounding boxes around them (e.g., detecting multiple cars and pedestrians in a street scene).
- Object Tracking: Following the movement of objects across a sequence of frames in a video.
- Semantic Segmentation: Classifying every single pixel in an image into a specific category (e.g., labeling all pixels belonging to the "sky", "road", or "building").
- Instance Segmentation: Similar to semantic segmentation, but it also distinguishes between different instances of the same object (e.g., identifying multiple individual cars as separate entities).

Module - 4

7a. List and explain any four Trusted AI Principles. (8)

- **Fairness**: AI Systems should avoid bias and ensure equitable treatment for all individuals, regardless of characteristics like race, gender, or age.
- **Transparency**: The operations & logic behind AI decisions should be explainable and understandable to users & stakeholders, not a "black box".
- **Privacy**: AI must protect user data, ensure confidentiality, and comply with privacy laws, using data only with proper consent.
- **Accountability**: Developers & organizations are responsible for the outcomes of AI systems, with mechanisms in place to address harms or errors.

7b. Describe the concept of AI as a Service (AIaaS). Outline two advantages and two challenges of using AIaaS in organizations. (6)

- **Concept**: AIaaS is a cloud-based offering where third-party providers provide ready-to-use AI tools (like machine learning, NLP, and computer vision) on demand, allowing companies to integrate AI without building infrastructure from scratch.
- **Advantages**:
 - 1) **Cost Savings**: Eliminates the need for large upfront capital investment in expensive hardware and specialized in-house AI teams.

2] Scalability: Organizations can easily scale their AI usage up or down based on current demand through the provider's cloud infrastructure. (19)

• Challenges:

1] Data Security & Privacy: Storing sensitive data on third-party cloud platforms can raise security risks and compliance concerns.

2] Integration Complexity: Connecting AIaaS tools with an organization's existing legacy systems can be technically difficult.

7c. Relate the role of ethics in AI. (6)

Ethics in AI provides a moral framework of guidelines to ensure that AI technologies are developed and used responsibly. Its role includes

- Preventing Harm: Guiding the creation of systems that prioritize safety and human well-being.
- Mitigating Bias: Actively working to ensure that algorithms do not perpetuate human prejudices or discriminatory outcomes.
- Fostering Trust: By ensuring transparency and accountability, ethics helps build public and user trust in AI systems.

8a. What is expert system? Explain three components of expert system. (6)

- Expert System: A computer program designed to emulate the decision-making ability of a human expert in a specific, well-defined

domain using a knowledge base and reasoning rules.

• Three Components:

1) User interface

- Role: Allows users to interact with the system.
- Function: Accepts user queries in natural language & provides understandable results.
- Key features:
 - Helps users accomplish tasks quickly.
 - Customizable for user requirements.
 - Efficiently handles user input.

2) Inference Engine (Rules Engine)

- Role: The "brain" of the expert system.
- Function: Processes information from the knowledge base to draw conclusions.
- Types:
 - Deterministic: Draws conclusions with certainty.
 - Probabilistic: Deals with uncertainty & probability.
- Strategies:
 - * forward chaining: starts with known facts to predict what can happen next (e.g., predicting stock prices).
 - * backward chaining: starts with the goal to work backward & understand the cause (e.g., diagnosing diseases).

3) Knowledge Base

- Role: Stores domain-specific knowledge.
- Types of knowledge:
 - 1) ~~F~~ factual knowledge: Based on facts accepted in the domain.
 - 2) Heuristic knowledge: Based on experience, probability and practices.

8 b. Differentiate betⁿ the following:

(21)

(i) AI Programs and Robots

(ii) Human-Controlled and fully-autonomous bots

(i) AI Programs and Robots

(6)

• AI Programs: These are software-based systems designed to perform intelligent tasks, such as decision-making, natural language processing, or problem-solving. They exist purely as code and data within a computer system.

• Robots: These are physical, electromechanical machines that can sense their environment, process information (often using AI programs), and perform actions in the real world. They have a physical body and actuators.

(ii) Human-Controlled and fully-autonomous bots

• Human-Controlled bots: These bots require continuous or intermittent human input to operate, whereas fully-autonomous bots can perceive their environment, make decisions, & perform tasks without human intervention.

8c. What is Neuromorphic Computing? Explain its architecture, features resembling the human brain and how it contributes toward achieving Artificial General Intelligence (AGI)

(8)

Neuromorphic Computing is a design methodology for building computer chips that mimic the structure & function of the human brain.

• Architecture: It uses artificial neurons and synapses, often implemented in parallel processing networks, to process information in a distributed and event-driven manner, unlike traditional sequential processors.

- Features resembling the human brain: It uses principles like plasticity (the ability to learn and adapt), low power consumption, and parallel processing, allowing it to handle complex, real world data efficiently.

- Contribution to AGI: By providing a hardware foundation that can potentially support more brain-like cognitive functions, it may help overcome the limitations of current AI hardware and facilitate the development of systems capable of general intellectual abilities (AGI).

Module - 5

9a. Relate the role of AI in Biological and Environmental Sciences. (6)

AI plays a crucial role in both biological and environmental sciences by enhancing data analysis, modeling, and decision-making processes.

In biology, AI aids in:

- Genomics & Proteomics: Analyzing vast amounts of DNA & protein data to identify patterns, predict protein structures & understand genetic diseases.
- Drug discovery: Accelerating the identification of potential drug candidates and predicting their efficacy and side effects.
- Medical Imaging: Assisting in the analysis of medical images (like MRIs and X-rays) for faster and more accurate diagnoses.
- Medical Imaging: Assisting in the analysis of medical images.

In environmental Sciences, AI aids in: (23)

- Climate modeling: Creating complex models to predict climate change patterns and their impacts.
- Biodiversity Monitoring: Analyzing sensor data and images to track animal populations and ecosystem health.
- Resource management: Optimizing the use of natural resources like water and energy.

9b. What is No-code AI. Explain why No-code AI Must be Used (6)

No-code AI refers to platforms that allow users to build and deploy AI models without writing traditional programming code.

It must be used because:

- Accessibility: It democratizes AI, allowing domain experts (e.g., biologists, environmental scientists) to use AI without needing a data science background.
- Speed: It significantly accelerates the development and deployment of AI solutions.
- Cost-Effectiveness: It reduces the need for specialized, highly paid data scientists for every project.

9c. Identify the role of AI in Scientific experimentation by examining how it supports different disciplines & breaking down the specific experimental activities such as data collection, pattern identification, simulation, and hypothesis testing that AI enhances.

AI plays a transformative role in scientific experimentation by enhancing various activities across different disciplines, including data collection, pattern identification, simulation, and hypothesis testing. (8)

AI significantly enhances scientific experimentation in the following ways:

- **Data collection:** AI algorithms, particularly in fields like biology & astronomy, automate the processing of vast datasets generated by modern instruments (e.g., telescopes, gene sequencers). This allows for faster and more accurate data acquisition & filtering.
- **Pattern Identification:** Machine learning models excel at identifying complex, non-obvious patterns within large datasets that human researchers might miss. This is crucial in disciplines like materials science for discovering new compounds or in medicine for identifying disease biomarkers.
- **Simulation:** AI models can simulate complex systems, such as climate change scenarios or protein folding, much faster and often more accurately than traditional computational methods. This enables researchers to test hypotheses in a virtual environment before conducting costly or time-consuming physical experiments.

- Hypothesis Testing: AI assists in refining and testing hypotheses by analyzing existing data to suggest new avenues of research or validate current theories. It helps in determining the validity of arguments (25) based on available evidence.

10a. Explain the role of AI in early disease prevention. (6)

AI plays a significant role in early disease prevention through early detection, predictive analytics, personalized prevention plans, and monitoring.

- Early Detection & Diagnosis: AI algorithms analyze complex medical data (Imaging, lab results, patient history) to identify subtle patterns that may indicate the early onset of diseases like cancer or diabetes, often before human clinician can.
- Predictive Analytics: By leveraging large data sets, AI models can assess an individual's risk of developing specific conditions based on genetic, lifestyle, and environmental factors, allowing for targeted preventive measures.
- Personalized Prevention Plans: AI systems create tailored prevention strategies, including personalized diet, exercise, and monitoring plans, optimized for an individual's unique health profile.
- Monitoring & Alerts: AI-powered wearable devices continuously track vital signs and health parameters, providing real-time alerts for potential health issues.

10b. what is Low Code AI. Compare Traditional tools with Low Code AI (6)


Low-Code AI refers to platforms that allow users to build AI applications with minimal manual coding, often using visual interfaces and pre-built components.

Feature	Traditional AI Tools	Low-Code AI Tools
Coding Required	Extensive, requiring expertise in languages like Python or R.	minimal, using drag-and-drop interfaces and visual modeling
Target users	Data Scientists and software engineers.	Business analysts, citizen data scientists, and developers.
Development Speed	Slower, due to manual coding and configuration.	Faster, enabling rapid prototyping and deployment.
Flexibility	Highly customizable and flexible for complex, unique models.	Less flexible than traditional coding, limited by platform's pre-built components.
Complexity management.	Requires manual management of infrastructure and deployment.	platforms often abstract away infrastructure complexity.

10c. Explain how AI contributes to environmental science by breaking down its role in climate modelling, air and water quality monitoring, waste management, and resource conservation. Describe the specific data, techniques, and decision-making processes involved in each area.

AI contributes to environmental science (8) through enhanced modeling, monitoring, and management across several key areas.

- **Climate modelling:** AI techniques like machine learning help process vast amounts of climate data (satellite imagery, sensor readings) to improve the accuracy and speed of complex climate models, aiding predictions of future climate scenarios and related decision-making.
- **Air and water quality monitoring:** AI analyzes data from IoT sensors and satellite images to monitor pollution levels in real-time. Techniques involve using machine learning to identify pollution sources and predict future quality changes, informing regulatory actions and public health warnings.
- **Waste Management:** Computer vision and machine learning algorithms in sorting facilities help automate and optimize waste sorting processes. Data on waste composition is used for more efficient recycling strategies and resource recovery, reducing landfill usage.
- **Resource Conservation:** AI optimizes resource allocation in agriculture and water management by analyzing data on soil moisture, weather patterns, and crop health. Predictive models help in precise irrigation & fertilization, ~~conserving~~ conserving water & nutrients while


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