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Class	9th	Chapter	10
Subject	Computer Science	Board	Punjab

CHAPTER 10: EMERGING TECHNOLOGIES IN COMPUTER SCIENCE

EXERCISE SOLUTION

PART I: MULTIPLE CHOICE QUESTIONS (MCQs)

Q1. Which of the following is not a subfield of AI?

a) Machine Learning b) Natural Language Processing c) Computer Vision d) Robotics

Answer: All listed options (Machine Learning, Natural Language Processing, Computer Vision, and Robotics) are recognized subfields or closely integrated branches of Artificial Intelligence. In some curricula, robotics is treated as an intersecting engineering discipline, but it heavily relies on AI. Check the specific textbook answer key.

Q2. Which of these AI algorithms is considered an "explainable" model?

a) Neural Networks b) Decision Trees c) Random Forests d) Convolutional Neural Networks

Answer: b) Decision Trees

Q3. Which of these is a security concern in IoT deployments?

a) Device vulnerability b) Data privacy c) Lack of standardization d) All of the above

Answer: d) All of the above

Q4. Which of the following is an application of AI in healthcare?

a) Personalized drug development b) Automated diagnosis c) Remote patient monitoring d) All of the above

Answer: d) All of the above

Q5. What is the primary purpose of using AI techniques in machine learning models?

a) To improve accuracy b) To enhance interpretability c) To reduce computational complexity d) All of the above

Answer: d) All of the above (primarily improving performance and accuracy)

Q6. What is the key difference between explainable (whitebox) and unexplainable (blackbox) AI models?

a) The complexity of the model b) The ability to understand the decision-making process c) The performance of the model d) The training data used

Answer: b) The ability to understand the decision-making process

Q7. Which of the following is an application of IoT in the transportation domain?

a) Smart traffic management b) Vehicle-to-Vehicle (V2V) communication c) Predictive maintenance of vehicles d) All of the above

Answer: d) All of the above

Q8. Which of these is a potential impact of AI and IoT on the job market?

a) Job displacement due to automation b) Increased demand for specialized skills c) Transformation of job roles and responsibilities d) All of the above

Answer: d) All of the above

Q9. What is the key concern associated with algorithmic bias in AI-powered decision-making processes?

a) Lack of transparency b) Perpetuation of existing societal biases c) Reduced accuracy of the model d) All of the above

Answer: d) All of the above

Q10. Which of the following is an ethical principle that should be considered in the development and deployment of AI and IoT technologies?

a) Transparency and accountability b) Respect for privacy and data rights c) Fairness and non-discrimination d) All of the above

Answer: d) All of the above

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PART II: SHORT QUESTIONS

Q1. Define Artificial Intelligence (AI).

Answer: Artificial Intelligence (AI) refers to the simulation of human intelligence processes by computer systems and machines, enabling them to learn, reason, solve problems, perceive, and make autonomous decisions.

Q2. What is the historical context and evolution of AI?

Answer: AI originated in the 1950s. The Dartmouth Workshop of 1956 marked its birth, following Alan Turing's work on machine intelligence. Its evolution experienced cycles of high optimism and funding followed by "AI winters," which were periods of reduced funding. AI later surged in the 21st century due to massive data availability, cloud computing power, and breakthroughs in deep learning.

Q3. Provide two examples of AI applications in healthcare.

Answer:

1. **Automated Medical Imaging Analysis:** AI algorithms analyze X-rays, MRIs, and CT scans to detect tumors or fractures with high precision.
2. **Personalized Medicine and Drug Discovery:** AI models predict how patients will respond to specific treatments and accelerate pharmaceutical molecule discovery.

Q4. Explain the role of AI techniques in advancing machine learning models.

Answer: AI techniques provide the overarching algorithmic frameworks, such as neural networks, deep learning architectures, and optimization algorithms, that allow machine learning models to process large volumes of data, recognize complex non-linear patterns, adapt autonomously, and improve predictive accuracy over time without explicit human programming.

Q5. Define the Internet of Things (IoT).

Answer: The Internet of Things (IoT) is a network of physical objects ("things") embedded with sensors, software, and network connectivity that enable them to collect, exchange, and act on data over the internet with other devices and systems.

Q6. Describe the significance of IoT in connecting devices and systems.

Answer: IoT bridges the physical world with digital computing systems, allowing real-time remote monitoring, automated device-to-device communication, predictive maintenance, and data-driven operational efficiency across homes, industries, and cities.

Q7. What are the potential risks associated with AI and IoT?

Answer: Key risks include severe data privacy breaches, cybersecurity vulnerabilities in connected hardware, algorithmic bias, widespread job displacement through automation, and a lack of system transparency.

Q8. Discuss the societal impact of AI and IoT on daily life.

Answer: AI and IoT revolutionize daily life by enabling smart homes, automated transport, personalized digital services, and efficient healthcare. However, they also raise critical challenges regarding screen addiction, privacy loss, and workforce disruption.

Q9. Explain the concept of algorithmic bias.

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Answer: Algorithmic bias occurs when computer systems produce systematically prejudiced outputs that reflect human prejudices, skewed historical data, or flawed design assumptions, leading to unfair discrimination against certain groups.

Q10. Outline the importance of ethical considerations in AI and IoT.

Answer: Ethical frameworks ensure that emerging technologies respect human rights, protect user privacy, maintain transparency, prevent discrimination, and hold developers accountable for societal harms.

PART III: LONG QUESTIONS

Q1. Discuss the various applications of AI in the field of education. Provide specific examples and explain how AI can enhance the educational experience.

Answer:

1. **Adaptive Learning Platforms:** AI systems analyze individual student performance in real time, tailoring course difficulty and learning pathways to match each student's pace.
2. **Automated Grading and Feedback:** AI tools assist teachers by grading objective assessments and providing instant formative feedback on student writing assignments.
3. **Virtual Tutors:** Intelligent chatbot tutors offer 24/7 homework assistance and explanations customized to a student's learning style.
4. **Enhancing the Learning Experience:** AI reduces administrative burdens on educators, identifies struggling students early to prevent dropouts, and democratizes access to personalized tutoring.

Q2. Differentiate between explainable (whitebox) and unexplainable (blackbox) AI models.

Answer:

1. Explainable AI (Whitebox Models):

These are models whose internal decision-making steps can be easily understood and traced by humans. Examples include Linear Regression and Decision Trees. They provide transparent explanations for their outputs, which is critical in high-stakes fields such as medicine and law.

2. Unexplainable AI (Blackbox Models):

These are complex models, such as Deep Neural Networks, in which inputs pass through millions of hidden weights. It is extremely difficult to trace why a specific decision was reached. Although these models can be highly accurate, their opaque nature creates challenges in accountability, debugging, and bias detection.

Q3. Describe the components of an IoT system. Explain how these components work together to enable IoT applications.

Answer:

1. **Sensors/Devices:** Collect raw physical data, such as temperature, motion, and light, from the environment.
2. **Connectivity:** Network protocols such as Wi-Fi, Bluetooth, cellular networks, and MQTT transmit collected data securely to the cloud.
3. **Data Processing (Cloud/Edge):** Software platforms analyze incoming data streams, check thresholds, and run analytics.

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4. **User Interface/Action:** Dashboards, mobile apps, or automated actuators execute physical responses, such as turning off an AC unit or sending an alert.

How the Components Work Together:

Sensors gather data → Data travels through connectivity networks → Cloud servers process the data → An action triggers an automated or user-driven response.

Q4. Explore the applications of IoT in the transportation domain.

Answer:

1. **Smart Traffic Management:** IoT sensors embedded in roadways and traffic lights monitor vehicle density in real time and dynamically adjust signal timings to minimize congestion.
2. **Vehicle-to-Vehicle (V2V) Communication:** Connected cars exchange speed and position data to prevent collisions and improve road safety.
3. **Fleet Tracking and Logistics:** GPS and IoT sensors monitor delivery truck locations, fuel consumption, and cargo temperatures remotely.
4. **Predictive Maintenance:** Sensors on engine parts monitor wear and tear, alerting technicians before mechanical failures occur.

Q5. Analyze the potential privacy concerns associated with IoT deployments.

Answer: IoT devices continuously collect intimate personal data through devices such as smart home cameras, fitness trackers, and smart utility meters. Privacy concerns include:

- Unauthorized surveillance.
- Potential interception of data streams by hackers.
- Lack of user consent regarding data monetization by third-party manufacturers.
- The risk of creating detailed digital behavioral profiles without adequate regulatory protection.

Q6. Evaluate the impact of AI and IoT on the job market and work environments.

Answer:

1. **Job Displacement:** Routine manual and clerical tasks are increasingly automated by AI software and robotics, replacing some traditional roles.
2. **Skill Shift:** Demand increases for specialized technical skills in data science, cybersecurity, AI engineering, and systems maintenance.
3. **Workplace Transformation:** Collaboration between humans and smart machines changes daily workflows, emphasizing critical thinking, problem-solving, and continuous upskilling.

Q7. Explain the role of policy and regulatory frameworks in addressing the challenges of AI and IoT. Provide examples of existing frameworks and discuss their effectiveness.

Answer:

Role of Policies and Regulations:

Policies and laws establish legal boundaries for data protection, safety standards, accountability, and the ethical deployment of technology.

Examples of Existing Frameworks:

1. **GDPR (General Data Protection Regulation):** Enforces strict data privacy and user consent rights across Europe.
2. **EU AI Act:** A risk-based regulatory framework that classifies AI applications by risk level, aims to ban harmful uses, and mandates transparency.

Effectiveness:

Regulations protect consumer rights and curb corporate overreach. However, policymakers face challenges in keeping pace with rapid technological innovation and addressing disparities in global enforcement.

Q8. Describe the concept of algorithmic bias and its implications in AI-powered decision-making processes. Suggest strategies to mitigate the risks of algorithmic bias.

Answer:

Concept and Implications:

Algorithmic bias occurs when AI systems replicate or amplify historical inequalities and prejudices present in training data. In critical domains such as hiring, loan approvals, and criminal justice sentencing, this can result in systemic discrimination against marginalized demographic groups.

Strategies to Mitigate Algorithmic Bias:

1. Curate diverse, representative, and balanced training datasets.
2. Implement regular algorithmic auditing and bias-testing frameworks during model development.
3. Maintain human oversight and intervention in high-stakes automated decisions.

Q9. Develop a set of ethical principles and guidelines for the responsible development and deployment of AI and IoT technologies.

Answer:

1. **Transparency and Explainability:** Systems must provide clear explanations for their decisions, avoiding unaccountable blackbox operations.
2. **Privacy and Data Sovereignty:** Users must retain ownership of their personal data, with mandatory consent protocols and robust end-to-end encryption.
3. **Fairness and Non-Discrimination:** Algorithms must be rigorously tested to ensure they do not discriminate against individuals based on race, gender, or socioeconomic status.
4. **Safety and Reliability:** IoT and AI systems must undergo strict safety testing to prevent physical harm or malicious cyber exploitation.
5. **Human Accountability:** Human operators and organizations—not autonomous systems—must remain ultimately responsible for all actions and outcomes produced by AI and IoT deployments.

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