

Student Learning Outcomes

By the end of this chapter, you will be able to:

- Define artificial intelligence (AI), and machine learning (ML).
- Differentiate between AI, and ML, understanding their unique characteristics and applications.
- Understand the concept of supervised learning and its application to teach systems to make predictions.
- Comprehend unsupervised learning, used for clustering and pattern recognition.
- Understand different algorithms and choose relevant algorithms based on specific business problems. This includes simple linear regression.
- Familiarity with key model performance metrics accuracy.
- Understand where AI and ML are applied in daily life, business, and education.
- Discuss bias, privacy, and responsibility when using AI.

Subjective Type Questions

Long Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

Introduction

Q. How can you define AI and ML? Give brief defines?

Ans: In the present digital era, technology is not just about machines, it is about smart systems that can think, learn, and help us in making better decisions. This chapter introduces the exciting fields of Artificial Intelligence (AI), and Machine Learning (ML). These are powerful technologies behind many commonly used things such as voice assistants like google assistant, ChatGPT, video recommendations on YouTube, and even predicting the weather. Understanding these fields helps you see how computers are becoming more intelligent and helpful in solving real-life problems.

In this chapter, Students will explore how data is used to train machines to recognize patterns, make predictions, and group information just like a human brain, but more quickly and accurately. How these technologies are shaping the future and how they can play a part in this paradigm shift.

6.1**Overview of AI and ML**

Q.1. Why AI is used now a days? Also define artificial intelligence (AI) and machine learning (ML)?

Ans: Why use AI:

In the modern world, huge amounts of data are being collected every second. This

is where AI and ML come in. These technologies learn from data and help machines think, decide, and improve but faster and more consistently.

Definition of AI:

AI is the ability of a machine or computer program to perform tasks that normally require human thinking and ability. AI means teaching machines to do tasks that usually require human intelligence such as understanding speech, recognizing images, or making decisions.

Real life examples of AI use:

- Urdu speech-to-text apps used in educational institutes including schools
- Chatbots used by banks like HBL and JazzCash for customer support
- Traffic control systems in big cities such as one introduced by Safe City Authority in Lahore.

Definition of Machine Learning:

Machine Learning (ML) is a method where computers learn from past data to predict or decide something. Machine Learning is a part of AI. It means training a machine to learn from data and make decisions on its own without being programmed every time.

Real life examples of ML use:

- Netflix or YouTube recommend videos based on watching history of users.
- A weather app uses past temperatures to predict weather for next day.

Q.2. Differentiate between artificial intelligence (AI) and Machine Learning (ML)?

Ans:

Feature	AI	ML
Definition	Making machines smart enough to copy human behaviour	Teaching machines to learn from data and improve decision making
Main Goal	To perform smart task like human did	To make predications or decision making based on data.
Data Need	Sometimes it needs data to act smartly	Always needs data to learn and made important decisions.
Human Like behaviour	It speaks, see and understand things like humans.	No it does not show human behaviour. It just learn pattern.
Real life examples	Chatbots on many mobile apps, virtual assistants, robots etc	Apps that predict weather. Apps that predict stock exchange trends etc

- Think of AI as the brain, and ML as the experience that teaches brain how to improve.
- AI is the broader concept of machines acting smart, while ML is when machines learn from data to make predictions or decisions.

6.2

Machine Learning Types

Q.3. Explain machine learning type? Also give examples of each.

Ans:

Machines can also learn in two main ways, i.e., Supervised Learning and Unsupervised Learning.

Supervised Learning:

Definition:

Supervised learning is when the machine is trained using labeled data, where both instance and correct output are provided. In supervised learning, the machine is given data with correct answers (labels). It learns by comparing its own guesses with the correct answers and its learning improves over time.

Example 1: Suppose you are training a machine to predict whether a fruit is an apple or a mango. You show the machine many Apples and Mangoes and label it as that:

- "This is an Apple"
- "This is a Mango"

The computer learns from these examples. Later, it can predict with high accuracy when shown a picture of apple and mangoes such pictures.

Example 2: A system can be trained based on marks and attendance of students to predict who might fail.

Un-supervised Learning:

Definition:

Unsupervised learning is when the machine finds patterns or groups in unlabeled data without being told what the correct answer is. In unsupervised learning, the machine is given only data without any labels. It has to find patterns or group similar things by itself.

Example 1: This helps the store in marketing products in a better way, even without knowing the exact customer types.

Example 2: A school wants to divide students into study groups. The system checks their interests and subjects and forms groups just based on similarities and without knowing which group is "best".

Q.4. Differentiate between supervised and unsupervised learning?

Ans:

Feature	Supervised Learning	Unsupervised Learning
Labelled Data?	Yes machine is told the correct answers	No machine finds patterns on its own
Main Task	Predict or classify	Group or cluster similar data
Example	Predict student results using marks and study hours	Group customers based on shopping behaviour
Uses in School	Identify students who need help	Make automatic student groups for projects

TIDBIT

Think of **Supervised Learning** as learning with a teacher, and **Unsupervised Learning** as exploring on your own.

REMEMBER

1. **Supervised Learning** uses labeled data to **predict or classify**.
2. **Unsupervised Learning** uses unlabeled data to **find hidden patterns**.
3. Both are used in schools, businesses, apps, and government systems in Pakistan. If the system is learning from examples with correct answers, it is supervised. If it is grouping without given answers, it is unsupervised.

6.3

Practical Application of AI / ML

Q.5. Explain practical applications of AI and ML Smart Assistants and Recommendations:

Ans:

Now that you understand what AI and ML are, and how machines learn, now it is time to explore where these technologies are being used around us. We use these technologies everyday seamlessly.

Smart Assistants and Recommendations:

AI powers many smart tools and apps that help make our lives easier.

Smart Assistants:

Smart assistants like Google Assistant, Siri, use AI to understand voice commands, translate languages, set reminders, and answer questions.

Example:

If you set an alarm to Google Assistant in Urdu, it will set an alarm using speech recognition and natural language processing techniques, both powered by AI.

Recommendation systems:

These systems suggest what you might like, based on your past activities.

Examples:

- YouTube recommends videos after you watch a few clips.
- Daraz suggests clothes based on your browsing history.
- Instagram shows videos similar to what you have watched before. These apps use ML to analyze what you like and improve their suggestions over time.

TIDBIT

If the app makes suggestions, understands your voice, answers you, or learns your habits.

Q.6. Explain practical applications of AI and ML Business Use Cases Using Customer Analysis and Chatbots:**Ans:**

AI helps businesses understand customers, answer questions, and improve their services.

Customer Analysis:

Companies collect data about customers to find:

- Which product is best to sell?

Example:

A grocery delivery app like Cheetay uses ML to suggest items you often buy, and predicts which items are needed in which city.

Chatbots and Automated Help:

Many Pakistani banks, telecoms, and e-commerce sites now use chatbots which are smart systems that can answer questions without needing a human agent. These chatbots use AI to understand typed questions and respond automatically.

DO YOU KNOW

AI helps businesses work faster, save money, and keep customers happy using the power of data.

Q.7. Explain practical applications of AI and ML Bias, Privacy and Responsibility**Ans:**

While AI are powerful, they must be used responsibly.

Bias in AI:

Sometimes, machines learn unfair patterns from the data they are trained on. This is called bias. For example, if an AI system is trained only on English or male voices, it may not work well with Urdu speakers or female voices.

Privacy and Data Use:

AI systems often use personal data (like name, location, or choices) which raises privacy concerns. For example, if an app tracks your movements or listens to your microphone without permission, it can be misused.

Best Practice:

- Ask for user permission
- Protect data using encryption
- Do not collect more than needed

Responsibility of Humans:

Humans must use AI wisely as it is just a tool. If an AI powered system makes a wrong decision, the responsibility lies with the humans who created or used it.

Example:

If a facial recognition system wrongly accuses system should be fixed and detect.

REMEMBER

Always use diverse and balanced data to reduce bias.

REMEMBER

- AI is used in smart assistants, shopping apps, and chatbots.
- Businesses use them for customer service and sales analysis.
- We must always consider ethics: fairness, privacy, and responsibility.

6.4

Supervised and Unsupervised Algorithms

Q.8. Define and explain supervised and unsupervised algorithms?

Ans:

Data science uses various algorithms to find patterns, make predictions, or analyze large data. Choosing the right algorithm depends on the type of data and the kind of problem you are trying to solve. These algorithms help organizations solve real-world problems such as predicting exam results, grouping customers for better marketing and identifying patterns in fraud or health data. Some common data science algorithms are:

Linear Regression:

Predicts future values based on a straight-line relationship (e.g., predicting student scores from study hours).

Decision Trees:

Uses a tree-like model to make decisions based on yes/no questions (e.g., predicting if a customer will buy or not).

K-Means (Clustering):

Groups similar items together (e.g., grouping students with similar interests).

TIDBIT

Think of an algorithm like a recipe in the kitchen. It tells the computer what ingredients (data) to use and what steps to follow to get the final dish (prediction or group).

Q.9. What is Linear regression? Explain with the help of example?

Ans: Simple Linear Regression algorithm helps us predict a value based on the relationship between two things. Linear regression predicting sales, temperature, or student performance based on past data are among the few use cases of linear regression.

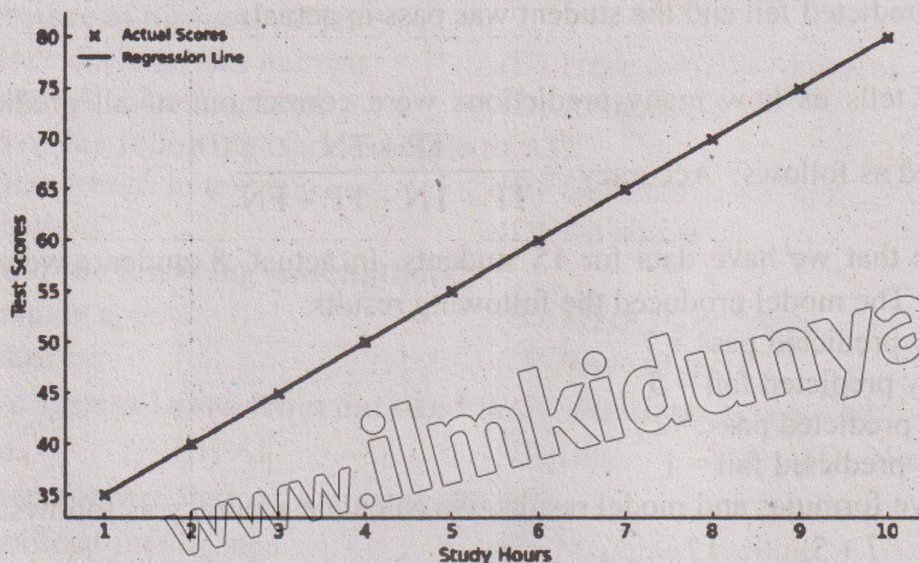
Example: A teacher wants to predict how well students will perform in a test based on the number of hours they studied. Here, study hours is taken as Input (X) while test score is used as Output (Y). Linear regression finds a line that best fits the data and helps predict marks if students studied for, say, 6 hours.

Scenario: A teacher wants to predict student test scores based on their study hours using data provided in Table 6.5. Linear Regression draws a best-fit straight line to predict future values as shown in Figure 6.1. In this graph, blue dots are actual student scores while blue line shows the predicted trend. If a student studies for 6.5 hours, the model can predict their score using the line.

Table 6.5: Student Data

Study Hours	Test Scores
01	35
02	40
03	45
04	50
05	55
06	60
07	65
08	70
09	75
10	80

Table 6.5: Study Hours vs Test Score



Linear Regression: Study Hours vs Test Score

DO YOU KNOW

- Simple linear regression uses just one independent variable (input) to predict one outcome. However, in real life, outcomes usually depend on many things.
- Multiple linear regression helps the computer understand more complex patterns and improve prediction accuracy.

6.5

Evaluating Model Performance

Q.10. What is Evaluating Model Performance? Also explain Confusion Matrix and Accuracy?

Ans:

Once a ML model is trained, then we are required to measure the performance of the model. This helps in deciding if the model is accurate and reliable. We will explore four important performance metrics with simple definitions and examples.

Confusion Matrix:

A confusion matrix is a simple table that shows how many predictions/classifications were correct or incorrect. Table 6.6 shows a simple confusion matrix considering whether a student will pass or fail (classification problem). The confusion matrix helps in understand whether a model is making classification or prediction mistakes and helps in calculating the accuracy (an important measure) of the model.

	Predicted: pass	Predicted: fail
Actual: pass	True Positive (TP)	False Negative (FN)
Actual: fail	False Positive (FP)	True Negative (TN)

- TP = Model predicted pass, and the student was pass in actual as well.
- TN = Model predicted fail and the student failed in actual as well.
- FP = Model predicted pass, but the student failed in actual.
- FN = Model predicted fail and the student was pass in actual.

Accuracy:

Accuracy (A) tells us how many predictions were correct out of all predictions made. It is calculated as follows:
$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

Example:

Let us assume that we have data for 15 students. In actual, 8 students were pass while 7 failed. The model produced the following results:

TP = Correctly predicted pass = 7

TN = Correctly predicted fail = 5

FP = Wrongly predicted pass = 2

FN = Wrongly predicted fail = 1

Using the above formulas and model results, we calculate accuracy as follows:

$$\text{Accuracy} = \frac{7 + 5}{7 + 5 + 2 + 1} = \frac{12}{15} = 0.80 \text{ or } 80\%$$

Objective Type Questions

Additional MCQ's

Multiple Choice Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

Introduction

1. **Today's technology is not about machine, it is about:**
(A) Electronic systems (B) Electric system
(C) Smart system (D) All above
2. **ML stands for:**
(A) Machine Living (B) Machine learning
(C) Machine Lesson (D) Machine Lose
3. **Siri & Alexa is a:**
(A) AI (B) Google Assistant
(C) Robot (D) Voice Assistant
4. **ChatGPT is a:**
(A) AI chatbot (B) Google Assistant (C) Voice Assistant (D) Robot

6.1

Overview of AI and ML

5. **AI means:**
(A) Translate text to human voice (B) Teach machine to do task
(C) Both a, b (D) None of them
6. **AI and ML helps in:**
(A) Manage Big Data (B) Improve Transportation
(C) Provide health service (D) All above
7. **As compare to humans AI is:**
(A) Make decision like humans (B) Have think like humans
(C) Faster & more consistent (D) All above
8. **Which of the following is an example of AI?**
(A) Urdu speech to text app (B) Gestures to text app
(C) Chatbots (D) All above
9. **Which of the following use chatbots?**
(A) Gaming apps (B) Track record apps
(C) JazzCash (D) None of them
10. **When a system Learn from data and make decisions, it is called:**
(A) ML (B) AI (C) DL (D) None of them
11. **Weather app predictions are examples of?**
(A) Artificial Intelligence (B) Machine Learning
(C) Satellite computing (D) Smart system

12. **Main goal of AI:**
 (A) Make predictions (B) Help customers
 (C) Perform smart task (D) Store data
13. **Which of the following always need data?**
 (A) AI (B) ML (C) Chatbots (D) Google
14. **Which of the following application of AI?**
 (A) Hiring (B) Speech & understand
 (C) Conversion (D) None of them

6.2

Machine Learning Types

15. **How many types of machine learning?**
 (A) 1 (B) 2 (C) 3 (D) 4
16. **Who Compare its own results with correct results?**
 (A) Supervised learning (B) Machine learning
 (C) Un-supervised learning (D) AI
17. **Give data without any label?**
 (A) Supervised learning (B) Machine learning
 (C) Chatbots (D) Un-supervised learning
18. **Which of the following provide high accuracy?**
 (A) SL (B) USL (C) AI (D) ML
19. **When grouped or unlabeled data is arrived, we used?**
 (A) Supervised learning (B) Un-Supervised learning
 (C) Machine learning (D) All above
20. **Which of the following help to market product in better way?**
 (A) SL (B) ML (C) AI (D) USL

6.3

Practical Applications of AI/ML

21. **Schools, Business app used:**
 (A) Supervised learning (B) Un-supervised learning
 (C) Both a, b (D) None of them
22. **Which of the following is not an example of Smart system?**
 (A) Siri (B) Google assistant
 (C) IoT (D) None of them
23. **NLP is an example of:**
 (A) AI (B) ML (C) DL (D) SL
24. **Which applications use ML?**
 (A) YouTube (B) Instagram (C) Daraz (D) All above
25. **Which AI feature is used to help customer service?**
 (A) ML (B) Chatbots (C) IoT (D) None of them
26. **Machine learning unfair pattern is called:**
 (A) Wrong Analysis (B) Incomplete data
 (C) Bias in AI (D) Chatbot error

27. Which of the following reduce Bias?
 (A) Good network speed (B) Better quality feature of AI app
 (C) Diverse & balanced data (D) None of them
28. Why business organizations are used AI?
 (A) Keep track record of employee (B) Sales Analysis
 (C) Customer service centers (D) Above all

6.4

Supervised and Unsupervised Algorithms

29. Choosing algorithm depends upon:
 (A) Data type (B) Pattern Recognition
 (C) Abstract (D) Decomposition
30. How many types of data science algorithm?
 (A) 1 (B) 2 (C) 3 (D) 4
31. Which of the following is used to make decision?
 (A) Linear regression (B) Decision Trees
 (C) Clustering (D) None of them
32. Data Science Algorithms are used to:
 (A) Control systems (B) Computer updation
 (C) Fraud or health data (D) All above
33. Linear Regression use _____ to show relationship between two things:
 (A) Variables (B) Graphs (C) Patterns (D) Formulas
34. In linear regression graph, x-axis shows:
 (A) input (B) output (C) origin (D) Results
35. In linear regression graph, y-axis shows:
 (A) input (B) output (C) patterns (D) line
36. Which type of regression is used to understand complex patterns?
 (A) Simple (B) Linear (C) Parallel (D) Multiple
37. A type of variables used in regression:
 (A) 2 (B) 3 (C) 4 (D) 6

6.5

Evaluating Model Performance

38. Which shows how many predictions are correct?
 (A) Accuracy (B) Confusion Matrix
 (C) Both a, b (D) None of them
39. Confusion Matrix used _____ parameters:
 (A) 1 (B) 2 (C) 3 (D) 4
40. Model predicted Pass, and the student was pass in actual as well:
 (A) TP (B) TN (C) FP (D) FN

Answers

- | | | | | | | |
|------|------|-------|-------|-------|-------|-------|
| 1. C | 2. B | 3. D | 4. A | 5. B | 6. D | 7. C |
| 8. D | 9. C | 10. A | 11. B | 12. C | 13. B | 14. B |

- | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|
| 15. B | 16. A | 17. D | 18. A | 19. B | 20. D | 21. C |
| 22. D | 23. B | 24. D | 25. B | 26. C | 27. C | 28. D |
| 29. A | 30. C | 31. B | 32. C | 33. B | 34. A | 35. B |
| 36. D | 37. A | 38. B | 39. D | 40. A | | |

Additional Short Question's

Short Answer Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

Introduction

1. Name two fields of modern era used in every technology.

Ans: The existing fields of today's modern era are:

- Artificial Intelligence
- Machine Learning

2. Name the fields in which AI and ML are used now a days.

Ans: These are powerful technologies behind many commonly used things such as:

- Voice assistants like google assistant
- ChatGPT
- video recommendations on YouTube
- predicting the weather

3. Why AI and ML are important for us?

Ans: Understanding these fields helps you see how computers are becoming more intelligent and helpful in solving real-life problems. These technologies are shaping the future and they can play a part in this paradigm shift.

6.1

Overview of Ai and ML

4. How could you define AI? Give one example.

Ans: AI is the ability of a machine or computer program to perform tasks that normally require human thinking and ability. AI means teaching machines to do tasks that usually require human intelligence such as understanding speech, recognizing images, or making decisions.

Example: Chatbots used by banks like HBL and JazzCash for customer support

6.2

Machine Learning Types

5. Why machine learning is important? Give example.

Ans: Machine Learning (ML) is a method where computers learn from past data to predict or decide something. Machine Learning is a part of AI. It means training a machine to learn from data and make decisions on its own without being programmed every time.

Example: Netflix or YouTube recommend videos based on watching history of users.

6. What is supervised learning? Give one example.

Ans: Supervised learning is when the machine is trained using labeled data, where both instance and correct output are provided. In supervised learning, the machine is given data with correct answers (labels).

Example: A system can be trained based on marks and attendance of students to predict who might fail.

7. What is unsupervised learning? Give one example.

Ans: Unsupervised learning is when the machine finds patterns or groups in unlabeled data without being told what the correct answer is. In unsupervised learning, the machine is given only data without any labels.

Example: This helps the store in marketing products in a better way, even without knowing the exact customer types

6.3

Practical Applications of AI/ML

8. What do you understand by smart assistant? Give an example.

Ans: Smart assistants like Google Assistant, Siri, use AI to understand voice commands, translate languages, set reminders, and answer questions.

Example:

If you set an alarm to Google Assistant in Urdu, it will set an alarm using speech recognition and natural language processing techniques, both powered by AI.

9. What is recommendation system? Give an example.

Ans: These systems suggest what you might like, based on your past activities.

Examples:

- YouTube recommends videos after you watch a few clips.
- Daraz suggests clothes based on your browsing history.

10. What is customer analysis?

Ans: Companies collect data about customers to find:

- Which product is best to sell?

Example:

A grocery delivery app like Cheetay uses ML to suggest items you often buy, and predicts which items are needed in which city.

11. How many fields in real life who used chatbots and why?

Ans: Many Pakistani banks, telecoms, and e-commerce sites now use chatbots which are smart systems that can answer questions without needing a human agent. These chatbots use AI to understand typed questions and respond automatically.

12. What problem exist due to biase?

Ans: Sometimes, machines learn unfair patterns from the data they are trained on. This is called bias. For example, if an AI system is trained only on English or male voices, it may not work well with Urdu speakers or female voices.

13. What are the best practices to protect data?

Ans:

- Ask for user permission
- Protect data using encryption
- Do not collect more than needed

14. Describe the responsibility of human when use AI?

Ans: Humans must use AI wisely as it is just a tool. If an AI powered system makes a wrong decision, the responsibility lies with the humans who created or used it.

Example:

If a facial recognition system wrongly accuses system should be fixed and detect.

6.4

Supervised and Unsupervised Algorithms

15. Define S.L and U.S.L algorithms.

Ans: Data science uses various algorithms to find patterns, make predictions, or analyze large data. Choosing the right algorithm depends on the type of data and the kind of problem you are trying to solve.

16. Why to choose right algorithm is important?

Ans: These algorithms help organizations solve real-world problems such as predicting exam results, grouping customers for better marketing and identifying patterns in fraud or health data

17. Name some common data science algorithms. Also define them.

Ans: Some common data science algorithms are:

Linear Regression:

Predicts future values based on a straight-line relationship (e.g., predicting student scores from study hours).

Decision Trees:

Uses a tree-like model to make decisions based on yes/no questions (e.g., predicting if a customer will buy or not).

K-Means (Clustering):

Groups similar items together (e.g., grouping students with similar interests).

18. What are the uses of linear regression?

Ans: Linear regression predicting sales, temperature, or student performance based on past data are among the few use cases of linear regression.

19. What is dependent and independent variables?

Ans: A type of variable which is written in x - axis of linear regression graph is called independent variable. A type of variable which is written in y - axis of linear regression graph is called dependent variable.

Example: In a cricket match analysis graph, over are written in x - axis so they are independent variable and runs are written y - axis so they are dependent variables.

20. What is simple linear and multiple linear regression?

Ans:

- Simple linear regression uses just one independent variable (input) to predict one outcome. However, in real life, outcomes usually depend on many things.
- Multiple linear regression helps the computer understand more complex patterns and improve prediction accuracy.

21. Define Confusion matrix.

Ans: A confusion matrix is a simple table that shows how many predictions/classifications were correct or incorrect. The confusion matrix helps in understand whether a model is making classification or prediction mistakes and helps in calculating the accuracy (an important measure) of the model.

22. Describe the parameters of confusion matrix.

Ans:

- TP = Model predicted pass, and the student was pass in actual as well.
- TN = Model predicted fail and the student failed in actual as well.
- FP = Model predicted pass, but the student failed in actual.
- FN = Model predicted fail and the student was pass in actual.

23. Define Accuracy.

Ans: Accuracy (A) tells us how many predictions were correct out of all predictions

made. It is calculated as follows:
$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FP} + \text{FN}}$$

Exercise Questions (Solved)

Multiple Choice Questions

1. **What is Artificial Intelligence (AI)?**
 - (a) Solving math problems by hand
 - (b) Machines performing tasks like humans
 - (c) Sending emails using a computer
 - (d) Watching videos online
2. **Which of the following is an example of AI?**
 - (a) A chatbot replying to your questions
 - (b) Using a whiteboard
 - (c) A TV remote
 - (d) Typing on a keyboard
3. **What is Machine Learning (ML)?**
 - (a) Teaching humans to use machines
 - (b) Teaching machines to learn from data like human
 - (c) Learning computer hardware basics
 - (d) A machine without internet
4. **Which app recommends videos using ML?**
 - (a) Google Maps
 - (b) Microsoft Paint
 - (c) YouTube
 - (d) Windows Media Player
5. **In supervised learning, the data is:**
 - (a) Unorganized
 - (b) Without any answers
 - (c) Labeled with correct answers
 - (d) Only text-based
6. **Which of the following is an example of unsupervised learning?**
 - (a) Predicting student marks
 - (b) Identifying spam emails
 - (c) Marking quizzes
 - (d) Grouping students by interest without labels

7. Google Assistant is an example of:
 - (a) A game app
 - (b) A word processor
 - (c) A smart assistant using AI
 - (d) A calculator
8. AI is mostly used for:
 - (a) Handwriting notes
 - (b) Making phone calls
 - (c) Charging phones
 - (d) Smart decision making and automation
9. A chatbot on JazzCash is an example of:
 - (a) Cloud computing
 - (b) Data visualization
 - (c) AI in business
 - (d) Unsupervised learning

Answers

- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (b) | 2. (a) | 3. (b) | 4. (c) | 5. (c) |
| 6. (d) | 7. (c) | 8. (d) | 9. (c) | |

Short Questions

1. What is the difference between AI and ML?

Ans:

Feature	AI	ML
Definition	Making machines smart enough to copy human behaviour	Teaching machines to learn from data and improve decision making
Main Goal	To perform smart task like human did	To make predications or decision making based on data.

2. Give one real-life example of AI used in Pakistan.

Ans: Real life examples of AI use: Chatbots used by banks like HBL and JazzCash for customer support.

3. How does supervised learning work?

Ans: In supervised learning, the machine is given data with correct answers (labels). It learns by comparing its own guesses with the correct answers and its learning improves over time.

Example: A system can be trained based on marks and attendance of students to predict who might fail.

4. Define confusion matrix.

Ans: A confusion matrix is a simple table that shows how many predictions/classifications were correct or incorrect. The confusion matrix helps in understand whether a model is making classification or prediction mistakes and helps in calculating the accuracy (an important measure) of the model.

5. How can businesses use AI?

Ans: Chatbots and Automated Help:

Many Pakistani banks, telecoms, and e-commerce sites now use chatbots which are smart systems that can answer questions without needing a human agent. These chatbots use AI to understand typed questions and respond automatically.

6. Give one example each of a smart assistant and a recommendation system.

Ans: Smart Assistants:

Smart assistants like Google Assistant, Siri, use AI to understand voice commands, translate languages, set reminders, and answer questions.

Example: If you set an alarm to Google Assistant in Urdu, it will set an alarm using speech recognition and natural language processing techniques, both powered by AI.

7. What kind of data is used in unsupervised learning?

Ans: In unsupervised learning, the machine is given only data without any labels. It has to find patterns or group similar things by itself.

Example 1: This helps the store in marketing products in a better way, even without knowing the exact customer types.

Long Questions

1. Explain supervised and unsupervised learning with suitable examples.

Ans: For Answer See Q No. 3.

2. Explain how model performance is evaluated in machine learning using the following metrics:

- a) Confusion Matrix b) Accuracy

Ans: For Answer See Q No. 10.

3. A model predicts if students will pass (1) or fail (0). Out of 20 students:

- True Positives (TP) = 8
- True Negatives (TN) = 6
- False Positives (FP) = 4
- False Negatives (FN) = 2

You are required to (a) fill the confusion matrix, and (b) calculate accuracy.

Ans: First we calculate the accuracy using formula:

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

Given Data:

- True Positives (TP) = 8
- True Negatives (TN) = 6
- False Positives (FP) = 4
- False Negatives (FN) = 2

Accuracy:

$$\text{Accuracy} = \frac{8 + 6}{8 + 6 + 4 + 2} = \frac{14}{20} = 0.70 \text{ or } 70\%$$

Confusion Matrix

	Predicted: Pass (1)	Predicted: Fail (0)
Actual: Pass (1)	TP = 8	FN = 2
Actual: Fail (0)	FP = 4	TN = 6