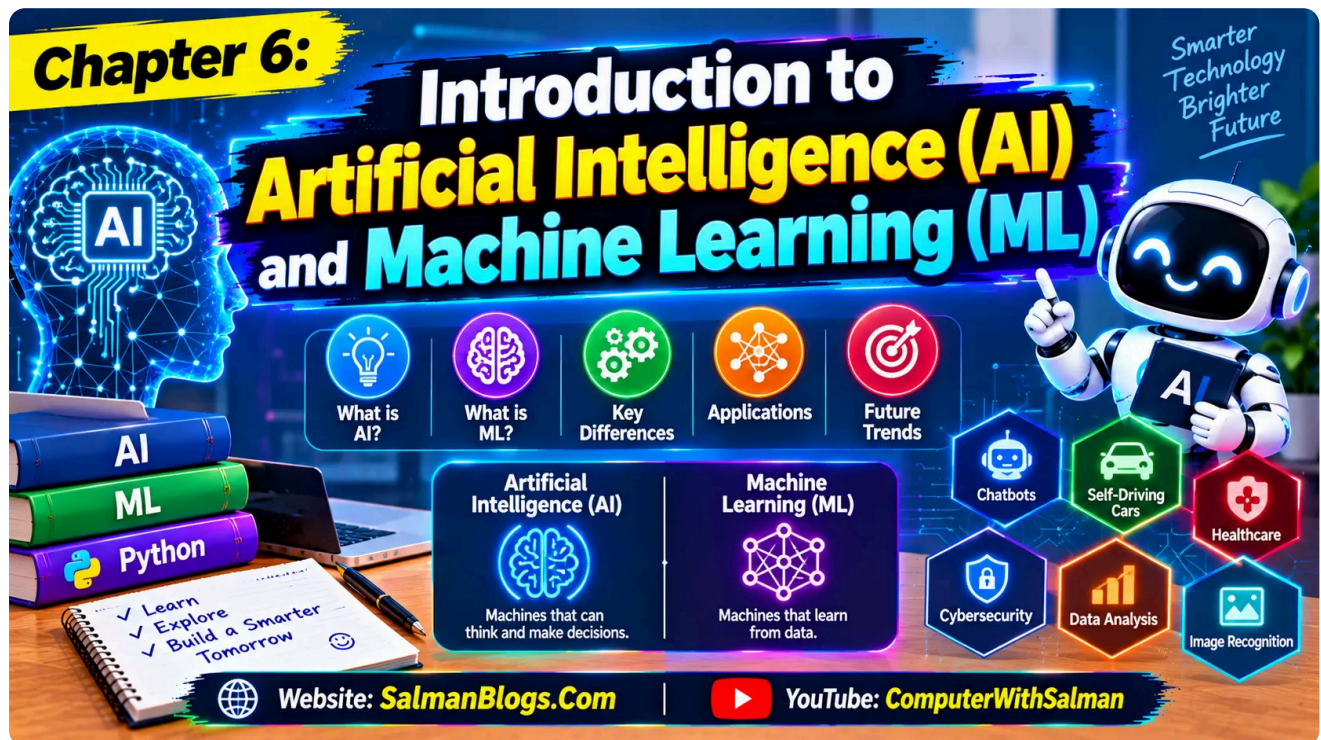


Class 10 Computer Science Chapter 6: Introduction to AI and Machine Learning

Posted in 10 Computer Science



These lecture notes are prepared by **Salman Ahmad**, who is both a **teacher** and a **web developer**. The purpose of this material is to make the topic clear and useful for students of Class 10 Computer Science.

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Artificial Intelligence (AI)

Artificial Intelligence (AI) is a technology that enables computers and machines to perform tasks that normally require human intelligence, such as understanding language, recognizing images, and solving problems.

Examples of AI [Mention any 1 or 2 Examples during writing exam]

- **Google Assistant:** Understands voice commands and responds to users.
- **ChatGPT:** Answers questions, explains topics, and helps users write content.
- **Self-Driving Cars:** Use AI to recognize roads, traffic signs, and other vehicles.
- **YouTube:** Recommends videos based on users' interests.
- **Face Recognition:** Identifies people by analyzing their facial features.
- **Online Chatbots:** Answer customers' questions on websites.
- **Medical Diagnosis:** Helps doctors identify diseases by analyzing medical images and data.
- **Robots:** Use AI to perform tasks such as sorting objects and working in factories.

Machine Learning (ML)

Machine Learning (ML) is a branch of Artificial Intelligence that enables computers to learn from data, identify patterns, and make predictions or decisions without being programmed for every task.

Examples of ML [Mention any 1 or 2 Examples during writing exam]

- **YouTube:** Recommends videos based on users' interests and viewing history.
- **Email Spam Filters:** Learn to identify and separate spam emails from normal emails.
- **Online Shopping:** Recommends products based on users' previous searches and purchases.

- **Netflix:** Recommends movies and shows based on users' viewing habits.

Difference Between Artificial Intelligence (AI) and Machine Learning (ML)

Artificial Intelligence (AI)	Machine Learning (ML)
AI is a technology that enables machines to perform tasks that normally require human intelligence.	ML is a branch of AI that enables machines to learn from data.
It focuses on making machines perform intelligent tasks.	It focuses on learning patterns from data and making predictions.
AI can use different methods, including rules, logic, and machine learning.	ML uses data and algorithms to learn patterns.
AI is the broader field.	ML is a part of AI.
Examples: Google Assistant, ChatGPT, Self-Driving Cars, Face Recognition, Rule-Based Chatbots.	Examples: YouTube Recommendations, Email Spam Filters, Netflix Recommendations, Product Recommendations, Fraud Detection.

Types of Machine Learning

Machine Learning (ML) is a branch of Artificial Intelligence that enables computers to learn from data and make predictions or decisions. It has three main types:

- **Supervised Learning**
- **Unsupervised Learning**
- **Reinforcement Learning:** The computer learns through trial and error by receiving rewards for good actions and penalties for incorrect actions.

Difference Between Supervised and Unsupervised Learning

Supervised and unsupervised learning are two important types of machine learning. The main difference is that supervised learning uses labeled data, while unsupervised learning uses unlabeled data.

Supervised Learning	Unsupervised Learning
It learns from labeled data, where the correct answers are already known.	It learns from unlabeled data, where the correct answers are not provided.
The computer learns by comparing its predictions with the correct answers.	The computer identifies patterns, similarities, and groups in the data on its own.
It is mainly used to predict results or classify information into known categories.	It is mainly used to discover hidden patterns and group similar information.
Example: Teaching a computer using labeled pictures of cats and dogs so it can identify them in new pictures.	Example: Giving a computer pictures of different animals without labels so it can group similar animals together.

Practical Applications of AI/ML

1. Smart Assistants

Smart assistants use AI and ML to understand voice commands, answer questions, and perform different tasks. They help users set alarms, search for information, make calls, send messages, and control smart devices.

Examples: Siri, Google Assistant, and Alexa.

2. Recommendation Systems

Recommendation systems use AI and ML to suggest videos, products, music, movies, and other content based on users' interests, searches, and previous activities. They help users find content they may like.

Examples: YouTube recommends videos, Netflix suggests movies, and Daraz recommends products based on users' interests and activities.

Bias, Privacy, and Responsibility in AI

1. Bias in AI

Bias in AI occurs when an AI system produces unfair results because of the data it learns from.

Example: If an AI system is trained only on English or male voices, it may not work well with Urdu speakers or female voices.

2. Privacy and Data Use

AI systems often use personal information, such as names, locations, and user preferences. This information must be protected from misuse.

Example: An app that tracks a user's location without permission can misuse their personal information.

Best Practices

- Ask users for permission before collecting their data.
- Protect data using encryption.
- Collect only the data that is needed.

3. Responsibility of Humans

Humans are responsible for developing, using, and monitoring AI systems. They must check AI decisions and correct mistakes to prevent harm.

Example: If a facial recognition system identifies the wrong person, developers must investigate the error and improve the system to prevent similar mistakes.

Supervised and Unsupervised Learning Algorithms

1. Linear Regression (Supervised Learning)

Linear Regression is a supervised learning algorithm that predicts future values by finding a straight-line relationship between existing data. It studies how one value changes with another to make predictions.

Example: Predicting a student's exam score based on the number of hours they study. Generally, students who study more hours may achieve higher scores.



Linear Regression (Supervised Learning)



Linear Regression is a **supervised learning algorithm** that predicts future values by finding a straight-line relationship between existing data.



It studies how **one value changes with another** to make predictions.

Example:

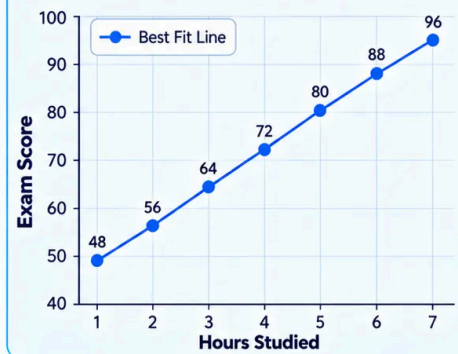
Predicting a student's exam score based on the number of hours they study.

Generally, students who study more hours may achieve higher scores.

Training Data (Labeled Data)

Hours Studied (x)	Exam Score (y)
1	48
2	56
3	64
4	72
5	80
6	88
7	96

Linear Regression Model



Prediction: If a student studies **8 hours**, the model might predict a score of around **104**.



Website: SalmanBlogs.Com



YouTube: ComputerWithSalman



2. Decision Trees (Supervised Learning)

Decision Trees are supervised learning algorithms that make predictions or decisions by following a tree-like structure of questions and conditions.

Example: Predicting whether a student will pass or fail based on their exam preparation and previous marks.

3. K-Means Clustering (Unsupervised Learning)

K-Means Clustering is an unsupervised learning algorithm that groups similar data into different clusters based on their features, without using predefined labels.

Example: Grouping customers based on their shopping habits, such as customers who buy frequently, occasionally, or rarely.

Evaluating Model Performance

Model Performance Evaluation: It is the process of checking how accurately a machine learning model makes predictions.

Confusion Matrix

A confusion matrix is a table used to compare a model's predictions with the actual results. It helps check the performance and quality of a machine learning model by showing its correct and incorrect predictions.

A confusion matrix contains four values:

- **True Positive (TP):** The model correctly predicts a positive result.
- **True Negative (TN):** The model correctly predicts a negative result.

- **False Positive (FP):** The model predicts a positive result, but the actual result is negative.
- **False Negative (FN):** The model predicts a negative result, but the actual result is positive.

Example of a Confusion Matrix

Suppose an AI model predicts whether students will pass or fail an exam. After comparing the predictions with the actual results of 100 students, the following confusion matrix is obtained:

Model Predictions	Actual Results	
	Actual Pass	Actual Fail
Predicted Pass	TP = 40	FP = 10
Predicted Fail	FN = 5	TN = 45

- **TP = 40:** The model correctly predicts that 40 students will pass.
- **TN = 45:** The model correctly predicts that 45 students will fail.
- **FP = 10:** The model predicts that 10 students will pass, but they actually fail.
- **FN = 5:** The model predicts that 5 students will fail, but they actually pass.

Accuracy

Accuracy measures the percentage of all predictions that are correct. It is calculated by dividing the total number of correct predictions by the total number of predictions and multiplying by 100.

Formula:

$$\text{Accuracy} = (\text{TP} + \text{TN}) / (\text{TP} + \text{TN} + \text{FP} + \text{FN}) \times 100$$

Calculation:

$$\text{Accuracy} = (40 + 45) / (40 + 45 + 10 + 5) \times 100$$

$$\text{Accuracy} = 85 / 100 \times 100$$

Accuracy = 85%

Result: The model has an accuracy of 85%, meaning it correctly predicts the results for 85 out of 100 students.

Exercise: Short Answer Questions

1. What is the difference between AI and ML?

Already mentioned in the notes.

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

One real-life example of AI used in Pakistan is a chatbot on a bank's website that answers customers' questions automatically.

3. How does supervised learning work?

Supervised learning works by training a model using labeled data, where the correct answers are already known. The model learns patterns from this data and uses them to make predictions on new data.

4. Define confusion matrix.

A confusion matrix is a table used to compare a machine learning model's predictions with actual results. It helps evaluate the model's performance by showing correct and incorrect predictions through True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN).

5. How can businesses use AI?

Businesses can use AI to answer customer questions through chatbots, recommend products, analyze customer data, detect fraud, and improve decision-making.

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

- **Smart Assistant:** Google Assistant helps users answer questions and perform tasks through voice commands.
- **Recommendation System:** YouTube recommends videos based on users' interests and viewing history.

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

Unsupervised learning uses unlabeled data, which has no predefined labels or correct answers. The computer finds similarities and groups similar data on its own.

Example: Giving a computer pictures of different animals without names. The computer groups similar animals, such as cats and dogs, based on their features.

Exercise: Long Answer Questions

1. Explain supervised and unsupervised learning with suitable examples.

Already mentioned in the notes.

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

a) Confusion Matrix

A confusion matrix is a table used to compare a model's predicted results with the actual results. It helps evaluate the performance and quality of a machine learning model.

It contains four values:

- **True Positive (TP):** The model correctly predicts a positive result.
- **True Negative (TN):** The model correctly predicts a negative result.
- **False Positive (FP):** The model predicts a positive result, but the actual result is negative.
- **False Negative (FN):** The model predicts a negative result, but the actual result is positive.

b) Accuracy

Accuracy measures the percentage of all predictions that are correct. It is calculated by dividing the number of correct predictions by the total number of predictions and multiplying by 100.

Formula:

$$\text{Accuracy} = (\text{TP} + \text{TN}) / (\text{TP} + \text{TN} + \text{FP} + \text{FN}) \times 100$$

c) Precision

Precision measures how many of the positive predictions made by a model are actually positive. It helps determine how reliable the model's positive predictions are.

Formula:

$$\text{Precision} = \text{TP} / (\text{TP} + \text{FP}) \times 100$$

3. Numerical Problem: Confusion Matrix and Accuracy

A model predicts whether students will pass (1) or fail (0). Out of 20 students, the results are:

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

(a) Fill the Confusion Matrix

The confusion matrix is completed by placing the given values according to the predicted and actual results.

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

(b) Calculate Accuracy

Formula:

$$\text{Accuracy} = (\text{TP} + \text{TN}) / (\text{TP} + \text{TN} + \text{FP} + \text{FN}) \times 100$$

Step 1: Substitute the values.

$$\text{Accuracy} = (8 + 6) / (8 + 6 + 4 + 2) \times 100$$

Step 2: Add the values.

$$\text{Accuracy} = 14 / 20 \times 100$$

Step 3: Calculate the percentage.

$$\text{Accuracy} = 0.7 \times 100$$

Final Answer: Accuracy = 70%

Result: The model correctly predicts the results for 14 out of 20 students, giving an accuracy of 70%.

Class 10 Computer Science Chapter 6 MCQs: Introduction to AI and Machine Learning

1. What is Artificial Intelligence (AI)?

- a. A technology that enables machines to perform tasks requiring human intelligence
- b. A method of repairing computer hardware
- c. A type of computer storage
- d. A programming language

Answer: a. A technology that enables machines to perform tasks requiring human intelligence