1. Explain the term machine learning, and how does it work? Explain two machine learning applications in the business world. What are some of the ethical concerns that machine learning applications could raise?

**Answer : Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. **Machine learning focuses on the development of computer programs** that can access data and use it to learn for themselves.**

**Machine learning uses two types of techniques: supervised learning, which trains a model on known input and output data so that it can predict future outputs, and unsupervised learning, which finds hidden patterns or intrinsic structures in input data.**

**Application of ML :**

1. **Customer Segmentation**
2. **Dynamic Pricing**
3. **Image Classification**
4. **Recommendation Engine**

2. Describe the process of human learning:

i. Under the supervision of experts

**Answer :   
the act of watching a person or activity and making certain that everything is done correctly, safely, etc.: Students are not allowed to handle these chemicals unless they are under the supervision of a teacher.**

ii. With the assistance of experts in an indirect manner

**Answer : If you give someone assistance , you help them do a job or task by doing part of the work for them**

iii. Self-education ;

**Answer : Self-education is the act of acquiring knowledge or a skill without having someone else to teach it to you.**

1. Provide a few examples of various types of machine learning.

Answer :

* **1. Supervised Learning**
* **eg .** predicting house/property price
* predicting stock market price
* **2. Unsupervised Learning :**

**Eg .** grouping customers by purchasing behavior

* **3. Semi Supervised Machine Learning :**
* **Eg . Speech Analysis.**
* **4. Reinforcement Learning**

**Eg. autonomous driving**

1. Examine the various forms of machine learning.

**Answer :**

1. **Supervised Learning**
2. **UnSupervised Learning**
3. **Semi Supervised Learning**
4. **Reinforcement Learning**

5. Can you explain what a well-posed learning problem is? Explain the main characteristics that must be present to identify a learning problem properly.

**Answer :**

**A (machine learning) problem is well-posed if a solution to it exists, if that solution is unique, and if that solution depends on the data / experience but it is not sensitive to (reasonably small) changes in the data / experience.**

1. Is machine learning capable of solving all problems? Give a detailed explanation of your answer.

**While it is undeniable that AI has opened up a wealth of promising opportunities, it has also led to the emergence of a mindset that can be best described as “AI solutionism”. This is the philosophy that, given enough data, machine learning algorithms can solve all of humanity's problems.**

7. What are the various methods and technologies for solving machine learning problems? Any two of them should be defined in detail.

1. **Answer : **Regression : Regression methods fall within the category of supervised ML. They help to predict or explain a particular numerical value based on a set of prior data, for example predicting the price of a property based on previous pricing data for similar properties.****

**The simplest method is linear regression where we use the mathematical equation of the line (y = m \* x + b) to model a data set. We train a linear regression model with many data pairs (x, y) by calculating the position and slope of a line that minimizes the total distance between all of the data points and the line. In other words, we calculate the slope (m) and the y-intercept (b) for a line that best approximates the observations in the data.**

1. ****Classification :****

****Classification is**  supervised ML, classification methods predict or explain a class value. For example, they can help predict whether or not an online customer will buy a product. The output can be yes or no: buyer or not buyer. But classification methods aren’t limited to two classes. For example, a classification method could help to assess whether a given image contains a car or a truck. In this case, the output will be 3 different values: 1) the image contains a car, 2) the image contains a truck, or 3) the image contains neither a car nor a truck.**

**The simplest classification algorithm is logistic regression — which makes it sounds like a regression method, but it’s not. Logistic regression estimates the probability of an occurrence of an event based on one or more inputs.**

1. ****Clustering****
2. ****Dimensionality Reduction****
3. ****Ensemble Methods****
4. ****Neural Nets and Deep Learning****
5. ****Transfer Learning****
6. ****Reinforcement Learning****
7. ****Natural Language Processing****
8. ****Word Embeddings****
9. Can you explain the various forms of supervised learning? Explain each one with an example application.

**Answer : Different Types of Supervised Learning**

**1. Regression**

**2. Classification**

**3. Naive Bayesian Model**

**4. Random Forest Model**

**5. Neural Networks**

**6. Support Vector Machines**

****Regression : Regression methods fall within the category of supervised ML. They help to predict or explain a particular numerical value based on a set of prior data, for example predicting the price of a property based on previous pricing data for similar properties.****

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9. What is the difference between supervised and unsupervised learning? With a sample application in each region, explain the differences.

Answer :

|  |  |
| --- | --- |
| **Supervised Learning** | **Unsupervised Learning** |
| Supervised learning algorithms are trained using labeled data. | Unsupervised learning algorithms are trained using unlabeled data. |
| Supervised learning model takes direct feedback to check if it is predicting correct output or not. | Unsupervised learning model does not take any feedback. |
| Supervised learning model predicts the output. | Unsupervised learning model finds the hidden patterns in data. |
| In supervised learning, input data is provided to the model along with the output. | In unsupervised learning, only input data is provided to the model. |
| The goal of supervised learning is to train the model so that it can predict the output when it is given new data. | The goal of unsupervised learning is to find the hidden patterns and useful insights from the unknown dataset. |
| Supervised learning needs supervision to train the model. | Unsupervised learning does not need any supervision to train the model. |
| Supervised learning can be categorized in ****Classification**** and ****Regression**** problems. | Unsupervised Learning can be classified in ****Clustering**** and ****Associations**** problems. |
| Supervised learning can be used for those cases where we know the input as well as corresponding outputs. | Unsupervised learning can be used for those cases where we have only input data and no corresponding output data. |
| Supervised learning model produces an accurate result. | Unsupervised learning model may give less accurate result as compared to supervised learning. |
| Supervised learning is not close to true Artificial intelligence as in this, we first train the model for each data, and then only it can predict the correct output. | Unsupervised learning is more close to the true Artificial Intelligence as it learns similarly as a child learns daily routine things by his experiences. |
| It includes various algorithms such as Linear Regression, Logistic Regression, Support Vector Machine, Multi-class Classification, Decision tree, Bayesian Logic, etc. | It includes various algorithms such as Clustering, KNN, and Apriori algorithm. |

1. Describe the machine learning process in depth.

a. Make brief notes on any two of the following:

I . MATLAB is one of the most widely used programming languages.

ii. Deep learning applications in healthcare

Answer :

Deep learning is assisting medical professionals and researchers to discover the hidden opportunities in data and to serve the healthcare industry better. Deep learning in healthcare provides doctors the analysis of any disease accurately and helps them treat them better, thus resulting in better medical decisions.

1. Drug discovery

Deep learning in healthcare helps in discovery of medicines and their development. The technology analyzes the patient's medical history and provides the best treatment for them. Moreover, this technology is gaining insights from patient symptoms and tests.

1. Medical imaging

Medical imaging techniques such as MRI scans, CT scans, ECG, are used to diagnose dreadful diseases such as heart disease, cancer, brain tumor. Hence, deep learning helps doctors to analyze the disease better and provide patients with the best treatment.

1. Insurance fraud

Deep learning is used to analyze the medical insurance fraud claims. With predictive analytics, it can predict fraud claims that are likely to happen in the future. Moreover, deep learning helps insurance industry to send out discounts and offers to their target patients.

1. Alzheimer's disease

Alzheimer is one of the significant challenges that medical industry faces. Deep learning technique is used to detect Alzheimer’s disease at an early stage.

1. Genome

Deep learning technique is used to understand a genome and help patients get an idea about disease that might affect them. Deep learning has a promising future in genomics, and also insurance industry

iii. Study of the market basket  
Answer : Market Basket Analysis(MBA) also known as association rule learning or affinity analysis, is a data mining technique that can be used in various fields, such as marketing, bioinformatics, education field, nuclear science etc. ... The existing algorithms work on static data and they do not capture changes in data with time.

iv. Linear regression (simple) :

1. Answer : ****Regression : Regression methods fall within the category of supervised ML. They help to predict or explain a particular numerical value based on a set of prior data, for example predicting the price of a property based on previous pricing data for similar properties.****

**The simplest method is linear regression where we use the mathematical equation of the line (y = m \* x + b) to model a data set. We train a linear regression model with many data pairs (x, y) by calculating the position and slope of a line that minimizes the total distance between all of the data points and the line. In other words, we calculate the slope (m) and the y-intercept (b) for a line that best approximates the observations in the data.**

11. Make a comparison between:-

1. Generalization and abstraction

Answer :

Generalization refers to your model's ability to adapt properly to new, previously unseen data, drawn from the same distribution as the one used to create the model.

abstraction takes several forms in Machine Learning, which are related to either features or instances. The main areas of research that include abstraction in learning includes: Feature selection: hiding irrelevant features. Instance selection: hiding irrelevant instances.

3. Regression and classification

Answer :

|  |  |
| --- | --- |
| **Regression Algorithm** | **Classification Algorithm** |
| In Regression, the output variable must be of continuous nature or real value. | In Classification, the output variable must be a discrete value. |
| The task of the regression algorithm is to map the input value (x) with the continuous output variable(y). | The task of the classification algorithm is to map the input value(x) with the discrete output variable(y). |
| Regression Algorithms are used with continuous data. | Classification Algorithms are used with discrete data. |
| In Regression, we try to find the best fit line, which can predict the output more accurately. | In Classification, we try to find the decision boundary, which can divide the dataset into different classes. |
| Regression algorithms can be used to solve the regression problems such as Weather Prediction, House price prediction, etc. | Classification Algorithms can be used to solve classification problems such as Identification of spam emails, Speech Recognition, Identification of cancer cells, etc. |
| The regression Algorithm can be further divided into Linear and Non-linear Regression. | The Classification algorithms can be divided into Binary Classifier and Multi-class Classifier. |