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?

* Machine learning is a form of artificial intelligence (AI) that teaches computers to think in a similar way to how humans do: Learning and improving upon past experiences.
* It works by exploring data and identifying patterns and involves minimal human intervention.
* Machine Learning in finance helps in portfolio management, algorithmic trading, loan underwriting, and fraud detection.
* General ethical issues in Machine Learning:
* Accuracy
* Bias
* Fairness
* Safety & Security
* Privacy
* Transparency
* Accountability
* Human Control and Decision-making

2. Describe the process of human learning:

i. Under the supervision of experts:

* Human-guided machine learning is a process whereby subject matter experts accelerate the learning process by teaching the technology in real-time.
* For example, if the machine learning model comes across a piece of data it is uncertain about, a human can be asked to weigh in and give feedback.
* Supervised learning is used to train machines so you can develop predictive data models.
* They have multiple applications across all domains and industries.
* It requires expertise to build, scale and update the models.

ii. With the assistance of experts in an indirect manner:

* Indirect guidance is provided through learners actively observing, listening, and engaging with social practices and norms, which serve to furnish models and goals for performance and individuals' learning.
* The exercise of learner agency is a defining quality of guided learning.

iii. Self-education:

* Human learning begins before birth and continues until death because of ongoing interactions between person and environment.
* The nature and processes involved in learning are studied in many fields, including educational psychology, neuropsychology.
* According to Malcom Knowles, self-learning is defined as: “a process by which individuals take the initiative, with or without the assistance of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, and evaluating learning outcomes”.

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

* These are three types of machine learning:
* supervised learning, unsupervised learning, and reinforcement learning.
* Examples:
* Image recognition
* Speech recognition
* Medical diagnosis
* Statistical arbitrage
* Predictive analytics
* Extraction

4. Examine the various forms of machine learning.

* There are 3 types of machine learning
* Supervised learning.
* Unsupervised learning.
* Reinforced learning.

1. Supervised learning:

* Supervised learning is one of the most basic types of machine learning. In this type, the machine learning algorithm is trained on labelled data. Even though the data needs to be labelled accurately for this method to work,
* supervised learning is extremely powerful when used in the right circumstances.
* In supervised learning, the ML algorithm is given a small training dataset to work with. This training dataset is a smaller part of the bigger dataset and serves to give the algorithm a basic idea of the problem, solution, and data points to be dealt with. The training dataset is also very like the final dataset in its characteristics and provides the algorithm with the labelled parameters required for the problem.

1. Unsupervised learning:

* Unsupervised machine learning holds the advantage of being able to work with unlabelled data.
* This means that human labour is not required to make the dataset machine-readable, allowing much larger datasets to be worked on by the program.
* In supervised learning, the labels allow the algorithm to find the exact nature of the relationship between any two data points.

1. Reinforced learning:

* Reinforced learning directly takes inspiration from how human beings learn from data in their lives.
* It features an algorithm that improves upon itself and learns from new situations using a trial-and-error method. Favourable outputs are encouraged or ‘reinforced’,
* and non-favourable outputs are discouraged or ‘punished’.

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.

* 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.
* A well-defined learning problem will have the features like class of tasks,
* the measure of performance to be improved, and the source of experience examples.

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

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

* There are Three types of machine learning algorithms:
* supervised, unsupervised and reinforcement.
* Different technologies in Machine learning:
* Deep Neural Networks (DNN).
* Generative Adversarial Networks.
* Deep Learning.
* Conversational AI or conversational BOTS.
* Machine learning in cybersecurity.
* Machine learning and IoT.
* Augmented reality.
* Automated machine learning.

1. Deep Neural Networks (DNN)

* Deep neural networks are a subset of machine learning algorithms that have been around since the 1950s. DNNs can perform tasks like image recognition, speech recognition, and natural language processing. They consist of multiple hidden layers of neurons where each layer learns a representation of its input data. These representations are then used to make predictions about the output data.

2. Generative Adversarial Networks

* Generative adversarial networks (GANs) are a type of generative model that trains two competing neural networks against each other. One network tries to generate samples that look realistic, while the other evaluates whether those samples come from real data or generated data. GANs have shown great success in generating images and videos. Ans are used to generate new data that resembles the existing data but is in fact totally new we can use GANs to produce new images from existing masterpieces made by renowned artists also known as contemporary AI art they are artists working with the generative models produced masterpieces already you can find out a few of the artists who are using AI and ML for their contemporary art.

We are using the existing data and we are generating new images.

8. Can you explain the various forms of supervised learning? Explain each one with an example application.

* Supervised Learning is the process of making an algorithm to learn to map an input to a particular output. This is achieved using the labelled datasets that you have collected. If the mapping is correct, the algorithm has successfully learned. Else, you make the necessary changes to the algorithm so that it can learn correctly. Supervised Learning algorithms
* can help make predictions for new unseen data that we obtain later in the future.
* Supervised machine learning can be classified into two types of problems, which are given below:
* Classification
* Regression

a) Classification

* Classification algorithms are used to solve the classification problems in which the output variable is categorical, such as "Yes" or No, Male or Female, Red or Blue, etc. The classification algorithms predict the categories present in the dataset. Some real-world examples of classification algorithms are Spam Detection, Email filtering, etc.
* Some popular classification algorithms are given below:
* Random Forest Algorithm
* Decision Tree Algorithm
* Logistic Regression Algorithm
* Support Vector Machine Algorithm

b) Regression

* Regression algorithms are used to solve regression problems in which there is a linear relationship between input and output variables. These are used to predict continuous output variables, such as market trends, weather prediction, etc.
* Some popular Regression algorithms are given below:
* Simple Linear Regression Algorithm
* Multivariate Regression Algorithm
* Decision Tree Algorithm
* Lasso Regression

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

* Major differences between Supervised and Unsupervised Learning
* Supervised Learning:
* Supervised Learning can be used for 2 different types of problems i.e. regression and classification
* Input Data is provided to the model along with the output in the Supervised Learning.
* Output is predicted by the Supervised Learning.
* Labelled data is used to train supervised learning algorithms.
* Accurate results are produced using a supervised learning model.
* Training the model to predict output when a new data is provided is the objective of Supervised Learning.
* Unsupervised Learning:
* Unsupervised Learning can be used for 2 different types of problems i.e. clustering and association.
* Only input data is provided in Unsupervised Learning.
* Hidden patterns in the data can be found using the unsupervised learning model.
* Unlabelled data is used to train unsupervised learning algorithms.
* The accuracy of results produced are less in unsupervised learning models.
* Finding useful insights, hidden patterns from the unknown dataset is the objective of the unsupervised learning.

10. Describe the machine learning process in depth.

* Machine learning is the process of making systems that learn and improve by themselves, by being specifically programmed.
* The goal of machine learning is to design algorithms that automatically help a system gather data and use that data to learn more.
* Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so.
* Machine learning algorithms use historical data as input to predict new output values.

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

MATLAB is one of the most widely used programming languages.

ii. Deep learning applications in healthcare

* As the most advanced artificial intelligence method, deep learning provides a method for computational medicine, so it is a trend to apply deep learning method to biomedical data analysis.
* Heart disease, cancer, and brain tumours are diagnosed using medical imaging procedures such as MRI scans, CT scans, and ECG. As a result,
* deep learning assists doctors in better analysing diseases and providing the best treatment to patients.

iii. Study of the market basket

* Market basket analysis is a data mining technique used by retailers to increase sales by better understanding customer purchasing patterns.
* It involves analysing large data sets, such as purchase history, to reveal product groupings, as well as products that are likely to be purchased together.

iv. Linear regression (simple)

* Simple linear regression is a regression model that estimates the relationship between one independent variable and
* one dependent variable using a straight line. Both variables should be quantitative.

11. Make a comparison between: -

1. Generalization and abstraction

* Abstraction aims at simplifying the description of an entity while generalization looks for common properties among these abstractions.
* Generalizations are clearly important and prevalent in many disciplines of study.

1. Learning that is guided and unsupervised

* Supervised learning algorithms are trained using labelled data. Unsupervised learning algorithms are trained using unlabelled 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.

1. Regression and classification

* The main difference between Regression and Classification algorithms that Regression algorithms are used to predict the continuous values such as price, salary, age, etc. and Classification algorithms are used to predict/Classify the discrete values such as Male or Female, True or False, Spam or Not Spam, etc.