1. What does one mean by the term "machine learning"?

Machine learning is a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy.

Machine Learning is the field of study that gives computers the capability to learn without being explicitly programmed. ML is one of the most exciting technologies that one would have ever come across. As it is evident from the name, it gives the computer that makes it more similar to humans: The ability to learn. Machine learning is actively being used today, perhaps in many more places than one would expect.

2.Can you think of 4 distinct types of issues where it shines?

There are limitless applications of machine learning and there are a lot of machine learning algorithms are available to learn. They are available in every form from simple to highly complex. Top 10 Uses of machine learning are as follows:

Image Recognition

The image recognition is one of the most common uses of machine learning applications. It can also be referred to as a digital image and for these images, the measurement describes the output of every pixel in an image. The face recognition is also one of the great features that have been developed by machine learning only. It helps to recognize the face and send the notifications related to that to people.

Voice Recognition

Machine learning (ML) also helps in developing the application for voice recognition. It also referred to as virtual personal assistants (VPA). It will help you to find the information when asked over the voice. After your question, that assistant will look out for the data or the information that has been asked by you and collect the required information to provide you with the best answer. There are many devices available in today’s world of Machine learning for voice recognition that is Amazon echo and googles home is the smart speakers. There is one mobile app called Google allo and smartphones are Samsung S8 and Bixby.

Predictions

It helps in building the applications that predict the price of cab or travel for a particular duration and congestion of traffic where can be found. While booking the cab and the app estimates the approximate price of the trip that is done by the uses of machine learning only. When do we use GPS service to check the route from source to destination, the app will show us the various ways to go and check the traffic on that moment for the lesser number of vehicles and where the congestion of traffic is more that is done or retrieved by the uses of machine learning application.

Videos Surveillance

It helps to detect the crime or any miss happening that is going to happen before it happens. It helps in tracking the unusual behavior of people like napping on benches and standing still from a long time, stumbling etc. and it will create an automatic alert to the guards or people who all are posted there and they can help to avoid any issues or problems.

Social Media Platform

Social Media is being used for providing better news feed and advertisement as per the user’s interest is mainly done through the uses of machine learning only. There are many examples like friend suggestions, page suggestions for Facebook, songs, and videos suggestion on YouTube. It mainly works on the straightforward concept on the basis of the user’s experience, with which they are getting connected and visit the profiles or websites very often, suggestions are providing to the user accordingly. It also provides the technique to extract useful information from images and videos

Spam and Malware

Email clients use a number of spam filtering and these spam filters are continuously getting updated and these are mainly done by the uses of machine learning. Rule-based, multi-layer and tree induction are some of the techniques that are provided by machine learning. Similarly, a number of malware are detected and these are detected mainly by the system security programs that are mainly helped by machine learning only.

Customer Support

Most of the reputed companies or many websites provide the option to chat with a customer support representative. So, after asking any query by the customer, it is not compulsory that the answer is given by the human only, sometimes the answers are given by the chatbot which extracts the information from the website and provides the answer to customers. Now they are better and understand the queries quickly and faster and also provides a good result by giving appropriate result and it is done by the uses of machine learning only.

Search Engine

There are search engines available while searching to provide the best results to customers. There are many machine learning algorithms created for searching the particular user query like for google. Whatever the page is being opened by the users for a particular topic frequently that will remain at the top of the page for a long time.

Applications/Companies

There are many applications and companies that used machine learning for doing their day to day process as it is being more accurate and precise than manual interventions. These companies are Netflix, facebook, google maps, Gmail, Google search etc.

Fraud and Preference

It is being used by the companies to keep track of money laundering like Paypal. It uses the set of tools to help them to check or compare the millions of transactions and make secure transactions.

3.What is a labeled training set, and how does it work?

Labeled training data is used in supervised learning. It enables ML models to learn the characteristics associated with specific labels, which can be used to classify newer data points.

The training set is used to train the algorithm, and then you use the trained model on the test set to predict the response variable values that are already known. The final step is to compare the predicted responses against the actual (observed) responses to see how close they are.

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4.What are the two most important tasks that are supervised?

The two most common supervised tasks are regression and classification.

5.Can you think of four examples of unsupervised tasks?

Common unsupervised tasks include clustering, visualization, dimensionality reduction, and association rule learning.

6.State the machine learning model that would be best to make a robot walk through various unfamiliar terrains?

The best Machine Learning algorithm to allow a robot to walk in unknown terrain is Reinforced Learning, where the robot can learn from response of the terrain to optimize itself.

7.Which algorithm will you use to divide your customers into different groups?

Clustering algorithm is a technique that assists customer segmentation which is a process of classifying similar customers into the same segment. Clustering algorithm helps to better understand customers, in terms of both static demographics and dynamic behaviors.

8.Will you consider the problem of spam detection to be a supervised or unsupervised learning problem?

Spam detection is a supervised machine learning problem. This means you must provide your machine learning model with a set of examples of spam and ham messages and let it find the relevant patterns that separate the two different categories.

9.What is the concept of an online learning system?

In computer science, online machine learning is a method of machine learning in which data becomes available in a sequential order and is used to update the best predictor for future data at each step, as opposed to batch learning techniques which generate the best predictor by learning on the entire training data set .

10.What is out-of-core learning, and how does it differ from core learning?

Out-of-core learning refers to the machine learning algorithms working with data that cannot fit into a single machine's memory but can easily fit into some data storage, such as a local hard disk or web repository.

Core ML applies a machine learning algorithm to a set of training data to create a model. You use a model to make predictions based on new input data. Models can accomplish a wide variety of tasks that would be difficult or impractical to write in code.

11.What kind of learning algorithm makes predictions using a similarity measure?

Learning algorithm that relies on a similarity measure to make predictions is instance-based algorithm.

12.What's the difference between a model parameter and a hyperparameter in a learning algorithm?

Model Parameters: These are the parameters in the model that must be determined using the training data set. These are the fitted parameters. Hyperparameters: These are adjustable parameters that must be tuned in order to obtain a model with optimal performance.

model parameters are estimated from data automatically and model hyperparameters are set manually and are used in processes to help estimate model parameters. Model hyperparameters are often referred to as parameters because they are the parts of the machine learning that must be set manually and tuned.

13.What are the criteria that model-based learning algorithms look for? What is the most popular method they use to achieve success? What method do they use to make predictions?

The goal for a model-based algorithm is to be able to generalize to new examples. To do this, model based algorithms search for optimal values for the model's parameters, often called theta . This searching, or "learning", is what machine learning is all about.

Model-based system learn by minimizing a cost function that measures how bad the system is at making predicitons on new data, plus a penalty for model complexity if the model is regularized. To make a prediction, a new instance's features are fed into a hypothesis function which uses the minimized theta found by repeatedly running the cost function.

14.Can you name four of the most important Machine Learning challenges?

* Not gathering enough data, or sampling noise. Sampling noise means we'll have non-representative data as a result of chance.
* Using a dataset that is not representative of the cases you want to generalize to. This is called sampling bias. For example, if you want to train an algorithm with "cat videos", and all your videos are from YouTube, you're actually training an algorithm to learn about "YouTube cat videos."
* Your dataset is full of missing values, outliers, and noise (poor measurments).
* The features in your dataset are irrelevant. Garbage in, garbage out.
  + Feature selection - choose the most relevant features from your dataset
  + Feature extraction - combine features in your dataset to generate a new, more useful feature
* When your model performs well on the training data, but not on test data, you've over fit your model. Models that suffer from overfitting do not generalize well to new examples. Overfitting happens when the model is too complex relative to the amount and noisiness of the data.
* Try simplyfying the model by reducing the number of features in the data or constraining the parameters by reducing the degrees of freedom.
* Gather more training data.
* Reduce noise in the training data by fixing errors and removing outliers.

When your model is too simple to learn the underlying structure of the data you've underfit your model.

* Select a more powerful model with more parameters
* Use feature engineering to feed better features to the model
* Reduce the constraints of the model (increase degrees of freedom, reduce regularization parameter, etc.)

15.What happens if the model performs well on the training data but fails to generalize the results to new situations? Can you think of three different options?

This is a case where the model is overfitting the training data. To couteract overfitting, we can reduce the complexity of the model by removing features or constraining the parameters. We could gather more data. Finally we can reduce noisiness in the data by fixing errors and removing outliers.

16.What exactly is a test set, and why would you need one?

When we want to know how well our model generalizes to new cases we prefer to use a test set instead of actually deploying the system. To build the test set we split the training data (50-50, 60-40, 80-20 are common splits) into a training set and test set. Our model is training with the training set. Then we use the model to run predictions on the test set. Our error rate on the test set is called the generalization error or out-of-sample error. This error tells us how well our model performs on examples it has never seen before.

If the training error is low, but the generalization error is high, it means we're overfitting our model.

17.What is a validation set's purpose?

Let's say we have a linear model and we want to perform some hyperparameter tuning to reduce the generalization error. One way to do this 100 different models with 100 different hyperparameter values using the training set and finding the generalization error with the test set. You find the best hyperparameter value gives you 5% generalization error.

So you launch the model into production and find you're seeing 15% generalization error. This isn't going as expected. What happened?

The problem is that for each iteration of hyperparameter tuning, you measured the generalization error then updated the model using the same test set. In other words, your produced the best generalization error for the test set. The test set no longer represents cases the model hasn't seen before.

A common solution to this problem is to have a second holdout set called the validation set. You train multiple models with various hyperparameters using the training set, you select the model and hyperparameters that perform best on the validation set, and when you are happy about your model you run a single final test against the test set to get an estimate of the generalization error.

18.What precisely is the train-dev kit, when will you need it, how do you put it to use?

A training data set is a data set of examples used during the learning process and is used to fit the parameters (e.g., weights) of, for example, a classifier.

The goal of dev-set is to rank the models in term of their accuracy and helps us decide which model to proceed further with. Using Dev set we rank all our models in terms of their accuracy and pick the best performing model.

19.What could go wrong if you use the test set to tune hyperparameters?

The model will not generalize well to unseen data because it overfits the test set. Tuning model hyper-parameters to a test set means that the hyper-parameters may overfit to that test set. If the same test set is used to estimate performance, it will produce an overestimate.