

## Overview of ML

### **Define ML in your own words.**

Machine learning in a nutshell is pattern recognition. Data is taken from the past, whether its labeled or not, and then based on the type of learning problem, a model will recognize patterns in a particular way through a portion of the data designated as training. Then use those patterns to formulate a strategy to predict on an unseen portion of the data set whether its testing and/or validation.

### **In a paragraph, summarize the importance of data, pattern recognition, and accuracy in machine learning.**

Today, data is being collected everywhere and from pretty much everything. While the problems risen from the collection of data do point towards storage and engineering solutions, value of the data itself can be extracted through the form of analytical techniques such as predictive ones like machine learning. The machine learning models themselves work off the idea of pattern recognition. Pattern recognitions is important because there could be insights not easily foreseen by humans that the model might detect and those patterns then could be leveraged in a predictive way to understand the future extents to the pattern, saving lots of money and mitigating risk. Along with pattern recognition, accuracy in machine learning is also important. As with the positive aspects of predictive analytics using machine learning, there can be negatives, if the model is overfit to the data it might not generalize well to new and incoming datasets, and so the accuracy of a model should take this into account. Metrics, let alone accuracy, are very important for machine learning, they allow us to measure how well a model is performing and we can tweak models with respect to certain metrics, such as accuracy, to tune them so that they can predict better in the future.

### **Describe the relationship between AI and ML.**

I like to think of artificial intelligence as the larger software system. Artificial intelligence employs techniques from subfields such as natural language processing, computer vision, machine learning, and more. AI is an autonomous system which collects data through inputs, processes that input data with respect to a model behind the scenes, acting as a thought engine, and then making predictions on the data so that an action can be performed. Machine learning on the other hand, is one such technique that an artificial intelligence can employ. For example, in the popular show Silicon Valley, there was an application which used image detection to determine if a food item was a hot dog or not. This is an example of what could be considered artificial intelligence. The app itself allowed the user to hover over an image, a snapshot of the image fed back into a thought engine, probably a convolutional neural net which predicted whether or not the new image was a hot dog based on the patterns of images it had been trained on, then with that prediction it sent it back to the front-end of the application, allowing the user to see whether or not what they hovered over was a hot dog or not.

**List at least 2 examples of modern machine learning applications and explain why this application could not be built with traditional programming.**

One application of machine learning is in the detection of fraudulent transactions. An online store for a given company has a ton of data involving their transaction history with the customers. Majority of records are probably good, as in they did not result in a charge back or fraudulent claim whereas a minority are fraudulent. The challenge is, how can companies predict if a transaction is fraudulent ahead of time prior to the negative side effects? Traditional programming cannot fix this issue alone as it is more operative. An artificial intelligence can so long as a component of it employs machine learning, because pattern recognition is needed. The AI could dictate an action to then put an order on hold or block an order from going through, but only thereafter once the order has been placed and it has been ran through the engine of pattern recognition, machine learning.

Another application of machine learning is in real-time big data processing. Most of the data in the world comes in an unstructured form and is being read in from all kinds of devices. Real-time as in the data is entering into a system from a continuous and constant flow of input from a device. For example, sensors on a space station detecting heat waves in celestial bodies far away. The sensor is always on and collecting data. That constant flow of data presents challenges that cannot be met by traditional programming techniques. The data cannot all be stored and it also cannot be available at the same time. To handle issues like this big data technologies such as Apache Spark Streaming are used to chunk the data at given discrete interval and iterative machine learning techniques can then be used to aggregate insights between the current window and previous windows of data that were provided.

**In a paragraph define the terms observations, feature, quantitative data, and qualitative data, and discuss their importance in machine learning.**

The terms observations, feature, quantitative, and qualitative data are often used in analytics contexts such as machine learning. Relative to a .csv, an observation is considered as a row, instance, or example of the data, whereas a feature is considered as a column, attribute, or predictor. Quantitative data is that which is numerical and/or continuous representable by something that is numerical and not categorical. Qualitative data is that which is categorical and/or representable by a factor. The importance of all of these is apparent since they describe the make up of the data and can prescribe the task for the given learning problem.

**Write a paragraph describe your personal interest in machine learning and whether/how you would like to learn more about ML for personal projects and/or professional application.**

I am excited to take machine learning because I'm interested in software development and the orchestration of components in a larger system such as artificial intelligence. I would like to learn more about it primarily through exploration of projects so that I can learn how to apply it to build more interactive experiences for users of the stuff that I make. Ideally, I'd like to be able to employ aspects of machine learning on the back-end of my applications so that pattern recognition can be used in a recommender system type way for my clients.