Overview of ML

Machine learning takes advantage of concepts from statistics and probability, as well as artificial intelligence and computer science, to solve problems that traditional algorithms cannot. Standard algorithms know the output of a program given a specified number of inputs. However, in instances where we don't see this output beforehand, we can train computers to recognize patterns in data and predict a corresponding result.

Importance of Data, Pattern Recognition, and Accuracy

As we collect our data, we must work with data owners to transform raw data in an organized manner of what is most important to learn from the data. The quality and size of our data allow our machine-learning algorithms to recognize patterns and come close to an accurate output. We can represent this data frame as a vector or matrix, for example, in which each row gives an example of previous values for each attribute defined in the columns. However, we must continue to revise our model until the statistics tell us that our machine-learning algorithm reflects an accurate prediction higher than a predetermined baseline.

Relationship Between AI and ML

Artificial intelligence is the process of developing a computer to simulate human cognitive abilities, such as problem-solving. Machine learning differs from traditional programming because it requires mathematics and statistics to recognize patterns in data and accurately predict an output. Therefore, machine learning is a branch of artificial intelligence since the computer determines the result.

Modern Machine Learning Applications

Image recognition is one famous example of a modern machine-learning application in which a model is built to classify various objects in an image. This type of application is not feasible with traditional programming due to the overall scale and complexity. In a conventional context, programmers would require manual effort to label hundreds of thousands of images or more. Even if we could classify all this data and write a traditional algorithm, could this traditional approach classify the same objects if it's light or dark outside? What about if another object might be blocking the one we are trying to detect?

Natural language processing is another modern machine learning approach that is used to understand human languages better to translate text or program virtual assistant applications to respond to human queries with a precise, easy-to-understand answer. Similar to image recognition, the scale and complexity of this application make it impractical to achieve with traditional programming accurately. On top of this, certain words or phrases used in various languages might have different meanings depending on how they are used in a sentence. It is only possible to manually program a computer to understand every possible interpretation of every word or phrase of a language with machine learning.

Machine Learning Terms

Several terms are essential to know when developing machine learning applications. An **observation** refers to a sample data point within a row of a data set. A **feature** represents a specific column of the corresponding data set. When we discuss **quantitative data**, we are referring to one or more numeric features in our data set. On the other hand, **qualitative data** are features that can only have a specific set of values. When we want to make a prediction based on a series of quantitative or qualitative observations from a given feature, that feature becomes a target variable we use to predict future observations. All other features become predictors.

Personal Interest in ML

My interest in machine learning comes from a fascination with wanting to understand how its various applications work behind the scenes, such as recommendations from video and audio streaming services, self-driving cars, and virtual assistant software. Learning more about ML can allow me to replicate modern machine learning applications within personal projects, such as implementing my recommendation algorithm built around the application. In a professional setting, ML can predict the consumer's product use or provide valuable business insights to influence company decisions. Therefore, it is a helpful skill set to have as a software engineer.