

A Guide to Machine Learning: Understanding the Fundamentals and Techniques

Machine learning is a subfield of Artificial Intelligence. It focuses on training programs to execute functions that would otherwise be impossible for a computer to perform, such as predicting trends and classifying data. This is achieved through the use of data sets; massive stockpiles of data that an algorithm can learn from. Using this data, algorithms can learn to execute functions without human intervention.

One important differentiation to make is that between AI and machine learning. While the two terms are often used interchangeably, AI refers to creating programs that can think and work like humans and are capable of advanced functions. Machine learning is a specific subset that utilizes algorithms and data sets to do so. While most AI falls under the machine learning category, there are other forms of AI. Another important distinction to make is the difference between AI and human intelligence. AI focuses on the art of prediction – using old data to predict what will happen next and give the desired outcome. However, it differs from human intelligence in that AI struggles with multitasking, common sense and other inherently human thought process. AI also struggles to adapt, unless they receive new and updated data.

Machine learning works on a basic principle; that with enough practice, a program can begin to understand patterns within data. These patterns then inform the outputs, so that a program can realistically guess what might occur when prompted. While these models require immense amounts of data to negate outliers, if enough correct data is present, the model can then predict outcomes. An example of this would be a data set which involves height. It would have numerous variables such as weight, age and gender. It would also provide the height of the person. The program would then analyze the data, and begin to understand that an older, heavier person would generally be taller. If a person was then to input an age, weight and other variables, the program would then be able to output a predicted height.

However, basic algorithms like this are unrefined and would still make mistakes and errors. To negate this and come up with more accurate answers, machine learning models require constant refinement. Eventually, these models will contain a comprehensive set of rules which will give it the ability to perform these tasks at a human like standard. To increase complexity, these models are often layered over one another to create complex and skilled models which can execute various functions. Examples of this can be seen in chatbots and GPT's.

Several different techniques are used to teach the programs to predict. These include Linear Regression and KNN. Both are fundamental techniques which are used to predict outcomes based on the results provided in a data set. Linear Regression is a form of bivariate statistical analysis. It takes two variables from the data set and plots them in the positive quadrant of the cartesian plane. The program then uses a line of best fit to predict one of the variables using a given value of the other. KNN also works using graphing, however it works by classifying data into various classes. The data provided has these classes already entered. The program then plots the data. Theoretically, different classes will be placed in different areas on the graph. Given an unclassified data point, the program would then classify it based on the classes of that points nearest. For example, a data set could have variables of height and age. It would plot these on a graph, and each group would have a class (tall and old, tall and Young, etc.) Given a data point, it would plot this, and then, based on the nearest points, it would give it a class. If the nearest points were all tall and old, it would add that point to the 'tall and old' class.

Machine learning is set to be a pivotal tool of the future. With machines gaining the ability to perform complex tasks, and their role becoming continually more prevalent, machine learning is sure to continue to develop. While AI and machine learning do have several limitations, the principles and techniques are sound and sure to be usefull as humans continue to make new technology.