**Deep Learning vs Machine Learning**

Let us first get an overview of Machine Learning, Deep Learning and their connection to AI.



The above figure is a good representation of the hierarchy of these three terms. Let us define them in more detail.

**Artificial Intelligence:** It is the quality of a man-made system that enables it to perform tasks that normally requires human levels of intelligence. These include tasks such as Visual Perception, Speech Recognition, Decision Making etc

**Machine Learning:** It is the field of study combining mathematics, statistics and computational sciences to allow computers to learn based on provided data. It is a subset of Artificial Intelligence and in essence allows the computer to make decisions based on its inferences of input data instead of being explicitly programmed.

**Deep Learning:** It is a subset of Machine Learning which uses a multi-layered approach to applying ML models on data. Each successive layer provides its own interpretation to the data and combined, they are able to handle high levels of complexity in both the data and task at hand. The multi-layered architecture that is used in deep learning is called the Artificial Neural Network.

With the figure and the definitions established, we can now look at a comparison between ML and DL

In ML and DL, data is king. Data collection is a long and less glamorous step in the ML/DL pipeline. By applying a mathematical model to the data, complex relationships are understood which allow for the system to make intelligent predictions about the future.

Both ML and DL follow a similar process flow. With a few key differences:



In traditional Machine Learning, the data must be broken down into individual features. These hand-crafted features are fed into the model and we get a prediction as an output. However, hand-crafting features is a time-consuming process that involves a lot of statistical knowledge and expertise in data science.

With the advent of Deep Learning and multi-layered Artificial Neural Networks, feature selection can now be handled by the model itself. By feeding it numerical representation of raw data (Images, Video, Audio etc), the multi-layered architecture allows for the model to determine the highest-contributing features and uses them to make successful predictions, without any human crafted features. This drastically shortened project timelines and human intervention in the preliminary stages. A small caveat is that DL models required larger volumes of data to train than traditional ML models.

A question might arise, why couldn’t deep learning have been used from the start? Isn’t it more efficient in every way to traditional Machine Learning?

The answer to that is that only over the last decade have we advanced enough in the technological front to make deep learning practically viable. The most significant advances are as follows

**Abundance of Data:** Over the last decade, we have seen an increased abundance of multimodal data(Text, Video, Audio, Tables etc). The large amount of publicly accessible datasets allow for people to train their DL models a lot more efficiently.

**Democratization of Models/Algorithms:** With a largely open-sourced community of Deep Learning Practitioners, progress and innovation have been expedited due to the sharing of models and learning algorithms.

**Cheaper Compute:** Owing to the reducing costs of high-powered compute resources, deep learning is much more accessible and viable to practitioners. Deep Learning makes use of multi-layered Neural Networks which require significantly higher compute resources than traditional machine learning methods. With many of the top Deep Learning frameworks being optimized to run on GPUs, the era of affordable computing has made deep learning accessible to a much wider group.

While these three factors were also instrumental in the rise of traditional machine learning, their improvement and advancement is similarly instrumental in the rise of Deep Learning.