Assignment 1 – A Comparison of Computer Science Disciplines

Artificial Intelligence (AI) is a very popular topic as of recent years for many reasons including LLM's such as Chat-GPT as well as Deepfake content. AI is a very broad topic, including other areas within Computer Science such as Machine Learning (ML), Deep Learning (DL), and Data Mining (DM). Although AI uses Data Science for projects and ideas, the two topics are different. Data Science focuses on understanding the data presented, through a variety of means, including ML models, or DL findings, and applies knowledge from a variety of disciplines. AI and Data Science work together to create a variety of interesting projects and tools such as COVID-19 Prediction. This project falls under the realm of Machine Learning.

Machine Learning is the process of Data Retrieval, Model Creation (via an algorithm), and Model Evaluation. Two popular types of ML algorithms are Supervised and Unsupervised. Supervised algorithms use data that is presented to try to predict missing/new data based on patterns recognized within the given dataset. COVID-19 Prediction is an example of Supervised learning. Given data on patients with COVID-19, we would like to predict whether a given patient also has the same disease. Unsupervised algorithms on the other hand, try to find relationships within the data, such as clusters which represent data that are seen to correlate together. The idea of trying to find relationships within the data present is mainly attributed to DL.

Deep Learning looks at the given data and tries to understand the data on a deep and complex level. To this end, most DL algorithms are Neural Networks or very closely resemble Neural Networks. NN such as CNN (Convolutional Neural Networks) or ANN (Artificial Neural Networks) mimic neurons within the brain by transmitting information (numerical) through a series of layers possibly accompanied by filters to achieve a desired goal. One such example of a DL project is Image Recognition, where the model created tries to determine the presented object within an image. The reason behind the neuron structure is because of the design of the algorithms involved compared to those within ML. ML algorithms provide a model, typically a polynomial function, to perform the given task. DL algorithms instead work towards analyzing relationships and present data that gets passed through a series of functions ultimately achieving a conclusion.

Data Mining is like DL and ML because it looks at data and wants to find patterns/correlations in said data. The biggest difference is that Data Mining looks at very large datasets, typically contained within databases, which then get processed through algorithms and models that are then used to produce results. An example of a Data Mining project is a Recommendation System. By analyzing data from a large quantity of users, a service provider like Netflix can provide similar movies to watch.

1. A Comprehensive Review of the Covid-19 Pandemic and the Role of IoT, Drones, AI, Blockchain, and 5G in Managing Its Impact – Vinay Chamola - 2020
2. Alignment-Free Sequence Comparison: A Systematic Survey From a Machine Learning Perspective – Katrin Sophie Bohnsack - 2023
3. An Efficient k-Means Clustering Algorithm: Analysis and Implementation – Tapas Kanungo - 2002
4. Can AI Help in Screening Viral and COVID-19 Pneumonia? - Muhammad E. H. Chowdhury - 2020
5. Deep Residual Learning for Image Recognition – Kaiming He - 2016
6. Digital Twin: Enabling Technologies, Challenges, and Open Research – Aidan Fuller – 2020
7. Going Deeper with Convolutions – Christian Szegedy – 2015
8. ImageNet: A Large-Scale Hierarchical Image Database – Jia Deng – 2009
9. Multimodal Representation Learning: Advances, Trends, and Challenges – Su-Fang Zhang - 2019