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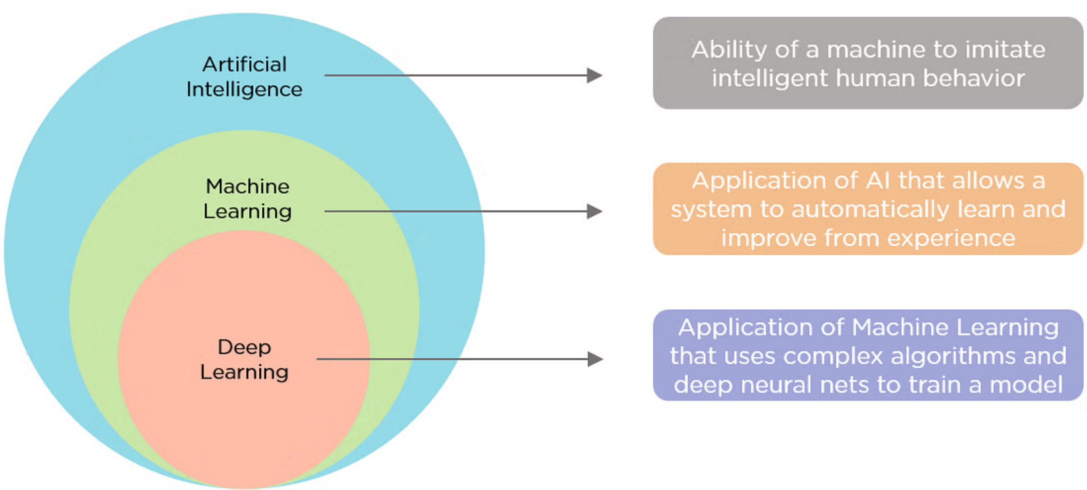
Final Exam Portfolio

Module 1: Introduction to AI

Module 1 consisted of learning the basics of AI and what it is. Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think, learn, and make decisions. These systems are designed to perform tasks that typically require human intelligence, such as problem-solving, reasoning, learning, understanding language, perception, and decision-making.

I also learned about the basic subsets within AI like machine learning and deep learning. Machine Learning is a subset of Artificial Intelligence (AI) that allows systems to learn from data and improve their performance over time without the need for explicit programming. Instead of following rule-based instructions, machine learning algorithms discover patterns in data to create predictions or judgments. Deep Learning is a subclass of Machine Learning that uses neural networks with numerous layers (hence the name "deep") to replicate how the human brain analyzes data. These layers automatically extract and learn complex features from raw input data, making deep learning ideal for massive, unstructured datasets such as photos, audio, and text.

Another important thing I was introduced to is Supervised learning which trains algorithms using labeled input/output data. Unsupervised learning which trains algorithms with no labeled data, and Reinforcement learning where algorithms takes actions to maximize cumulative reward.



Module 2: Intro to AI - The Big Issues

In module 2 we dug deeper into the roots and history of AI. One big thing that really intrigued in this module was learning about Shakey the robot. Shakey the Robot was a groundbreaking achievement in artificial intelligence (AI) and robotics, created between 1966 and 1972 at Stanford Research Institute (now SRI International). It was the first general-purpose robot capable of deciding on its actions depending on its surroundings, combining AI, robotics, and planning capabilities. Shakey's development was a huge step forward in the fields of artificial intelligence and robotics. Shakey's autonomy allows it to perceive, plan, and perform tasks independently, unlike previous robots that required manual control. Shakey integrated numerous AI approaches, including: Computer vision is the ability to recognize objects and their environment using cameras and sensors. Natural Language Processing: Instructions were interpreted using simple English commands. Pathfinding and Planning: Algorithms are used to navigate and plan actions. Shakey used the STRIPS (Stanford Research Institute Problem Solver) planning method to divide activities into smaller, more manageable actions and sequences. This was a groundbreaking development in AI planning systems. The system used a video camera, bump sensors, and a laser rangefinder to interact with its surroundings.

Module 3: Games, Prelude to AI

Module 3 was very fun, I learned about decision theory which is a topic of research that investigates the ideas and strategies for making rational judgments in the face of uncertainty. It uses mathematics, statistics, economics, psychology, and philosophy to assess choices and prospective results. Decision theory provides a framework for examining how individuals, organizations, or systems should make decisions to attain their goals. Prospect theory, Bayesian probability, Markov decision process, and game theory are also some terms that stood out to me in this module.

I was very intrigued by AlphaGo and AlphaZero. DeepMind Technologies (a subsidiary of Alphabet Inc.) created AlphaGo, an advanced artificial intelligence computer designed to play the board game Go to superhuman levels. It rose to prominence after defeating world-class human Go players, demonstrating AI's ability to solve complicated problems. DeepMind Technologies developed AlphaZero, an advanced artificial intelligence system, as the next generation of their AlphaGo project. It is a general-purpose reinforcement learning system capable of mastering games such as chess, shogi (Japanese chess), and Go without the need for past knowledge or human input. Instead, AlphaZero learns solely through self-play.

Module 4: Games Change Everything

Module 4 went deeper into how games modernized AI with similar terms learned in the previous module and expanded on new terms. Virtual Reality (VR) technology produces an immersive digital environment that completely replaces the real world. Users interact with and explore the simulated environment via VR headsets and other sensory devices. Key features: VR provides a fully immersive experience, replacing the real world with a computer-generated 3D scene. Headset Display: Devices such as the Oculus Quest, HTC Vive, and PlayStation VR employ head-mounted displays to mimic a virtual environment. Motion tracking uses sensors to track head, hand, and body motions, allowing for natural interaction with the virtual environment. Auditory feedback: Spatial audio improves immersion by simulating real-world soundscapes. Augmented Reality (AR) adds digital content (e.g. photographs, text, 3D objects) to the real world, complementing rather than replacing it. Key features: Real-World Integration: AR combines digital and real-world aspects. Devices include smartphones, tablets, and augmented reality glasses such as Microsoft HoloLens or Magic Leap. Interactive Elements: Users can interact with virtual objects that appear in the real environment. Mobility: AR applications frequently use GPS and camera technologies to provide location-based experiences. Mixed Reality (MR) combines VR and AR, enabling digital things to interact with the real environment. Examples include programs that allow virtual items to be anchored to real-world surfaces and manipulated in physical spaces (such as Microsoft HoloLens). Extended Reality (XR) refers to all immersive technologies such as VR, AR, and MR.

Module 5: Machine Learning - The Data

Machine learning the data is the process of using data to train machine learning (ML) models so that they can spot patterns, make predictions, or classify information. In essence, machine learning algorithms "learn" from data by detecting underlying correlations within it. The quality and quantity of data have a substantial impact on the model's performance and accuracy. Machine learning data can be organized (e.g., rows and columns in tables), unstructured (e.g., photos, text, or videos), or semi-structured (e.g., JSON files or sensor logs). The process of machine learning the data consists of numerous stages: Data collection entails gathering useful and representative data from various sources, such as databases, sensors, or the internet. Data Preprocessing: Cleaning the data to remove missing values, outliers, and inconsistencies, followed by normalization, scaling, or encoding to prepare it for training. This process also includes feature engineering, which selects or derives key attributes to improve model performance. Data Splitting: Separating the dataset into training, validation, and test sets. The training set helps the model learn patterns, the validation set fine-tunes parameters, and the test set assesses performance on previously unseen data. Model Training is the process of feeding training data into an algorithm (such as Decision Trees or Neural Networks) and using it to detect patterns or rules. Evaluation entails assessing the model's performance on validation and test datasets using measures such as accuracy, precision, recall, and mean squared error. Machine learning highlights the need of data quality, representativeness, and ethical issues, as biased or inadequate data can result in incorrect predictions or unforeseen consequences. This approach lays the groundwork for successful machine learning applications in industries such as healthcare, finance, and technology.

Module 6 Machine Learning - The Pipeline

A machine learning pipeline is an organized series of stages that automate the process of creating, training, evaluating, and deploying machine learning models. It provides a framework for managing workflow, ensuring consistency, repeatability, and scalability across the project. The pipeline begins with data collection, which gathers relevant information from a variety of sources such as databases, APIs, sensors, and web scraping. The quality and quantity of this data are critical since any errors or missing information can result in poor model performance.

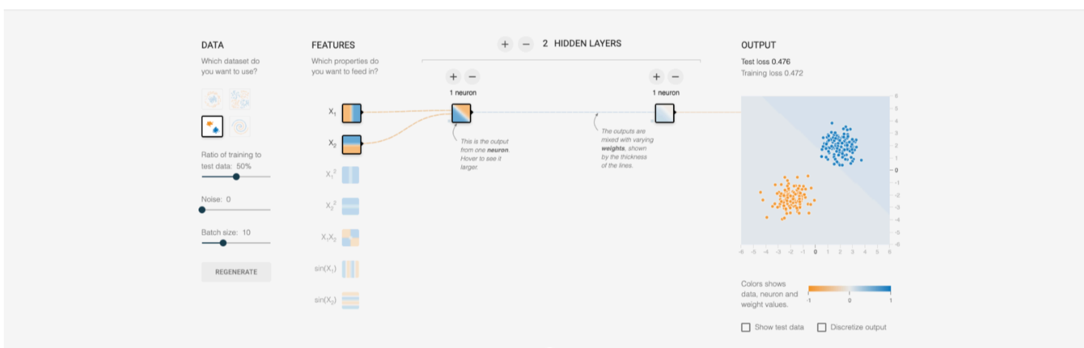
Preprocessing occurs after data has been acquired. This process comprises cleaning and translating the data into an analysis-ready format. Missing value handling, duplication removal, numerical feature normalization or scaling, and categorical data encoding are among the tasks done. Feature extraction or selection may also be performed to ensure that only the most relevant features are used in training. Proper preprocessing guarantees that the data is of good quality and suitable for machine learning techniques.

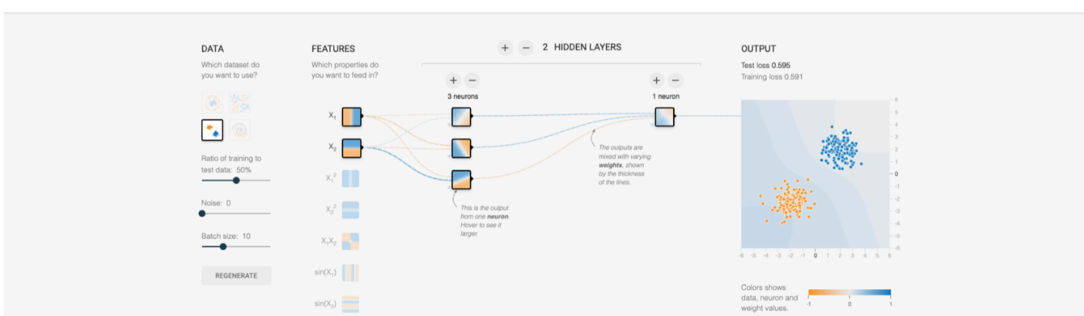
The next step is model training, which involves feeding the cleaned data into a machine learning algorithm to discover patterns and understand correlations between the characteristics and the target variable. During training, the algorithm modifies its parameters to enhance its predictions. The model's performance is then evaluated against a separate validation or test dataset. This evaluation stage guarantees that the model generalizes properly to new data and identifies problems such as overfitting or underfitting. Performance indicators including as accuracy, precision, recall, and F1 score are commonly used to evaluate the model's efficacy.

If the model's performance is inadequate, optimization approaches such as hyperparameter tuning or cross-validation are used to enhance it. This iterative approach may include modifying the model, selecting other characteristics, or improving its design. Once an acceptable model has been developed, it is deployed in a production setting where it can make real-time predictions and automate decisions. Following deployment, the model is constantly monitored to ensure that it retains good performance. This involves looking for issues like data drift, which may necessitate retraining the model to react to new patterns in the data.

Module 7 Deep Learning Neural Networks

Module 7 definitely one the most challenging in my opinion we were introduced to Deep learning and learning & neural networks. Deep learning is a form of machine learning that employs neural networks to simulate complicated patterns in data. Deep learning is fundamentally based on artificial neural networks, which are inspired by the structure and function of the human brain. These networks are made up of layers of interconnected nodes, or "neurons," which process information using weighted connections. A basic neural network typically consists of three layers: the input layer, hidden layers, and output layer. The raw data is fed into the input layer, which then passes it through one or more concealed layers. Each hidden layer processes data by applying mathematical functions to weighted inputs, resulting in increasingly abstract representations. Finally, the output layer computes predictions or classifications. A basic neural network typically consists of three layers: the input layer, hidden layers, and output layer. The raw data is fed into the input layer, which then passes it through one or more concealed layers. Each hidden layer processes data by applying mathematical functions to weighted inputs, resulting in increasingly abstract representations. Finally, the output layer makes predictions or classifications using the learned features.





Module 8: Deep Learning - Real Learning Good Analytics

Deep learning and big data analytics are two interconnected fields that have considerably increased the capabilities of artificial intelligence. Deep learning is a form of machine learning that use neural networks with multiple layers to model complicated patterns in huge datasets. These neural networks are made up of layers of interconnected nodes, or neurons, which execute computations on input data. Deep learning's power comes from its capacity to automatically learn hierarchical features from raw data, reducing the need for manual feature extraction. This makes deep learning especially useful for applications like picture and speech recognition, natural language processing, and autonomous driving.

Big data analytics, on the other hand, is the process of analyzing massive amounts of organized and unstructured data to find patterns, trends, and insights. Big data's immense scale and complexity necessitate specialized tools and technologies for storage, processing, and analysis, such as distributed computing frameworks like Hadoop and Spark. These tools let firms to process and analyze data on a large scale, providing useful insights for decision-making, predictive modeling, and business intelligence.

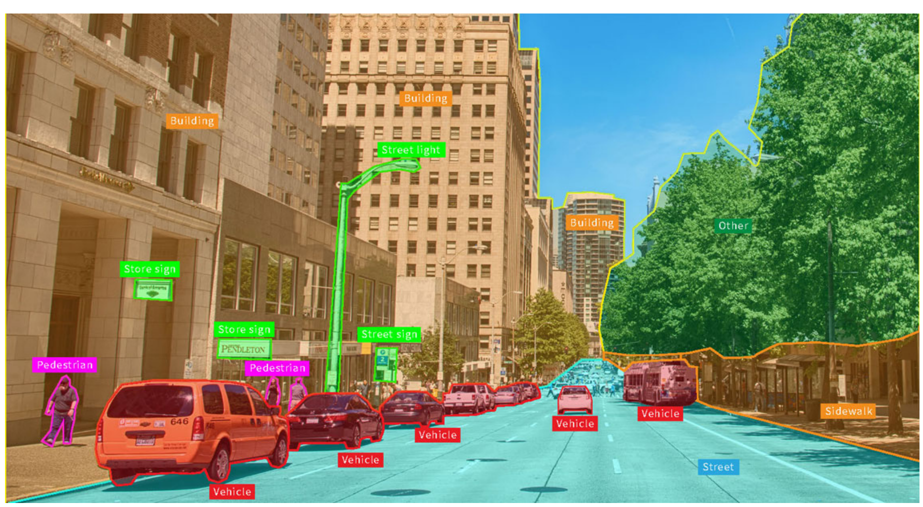
Deep learning and big data analytics work well together, creating a tremendous synergy. Deep learning models excel at learning from large and diverse datasets provided by big data systems, increasing the accuracy and efficacy of predictions and decisions. As big data grows in size and complexity, deep learning is a crucial tool for realizing its full potential, enabling better, data-driven insights across a variety of industries, including healthcare, finance, and beyond.

Module 9: Computer Vision - Image Processing

Module 9 and 10 were hands down my favorite module, computer vision and image processing is one of the things that interest me the most in the field of AI. Learning about the photo process was extremely fun. The Ansel Adams puzzle we did led me into digging deeper into his work and I very impressed. From there things progressed into facial processing which is also a very interesting technology. Computer vision is a branch of artificial intelligence (AI) that allows computers to interpret and analyze visual information from their surroundings in the same way that people do. It entails creating algorithms and models that enable robots to process, analyze, and make judgments using photos, videos, and other visual data. Computer vision aims to emulate human visual perception by performing tasks such as object detection, image classification, motion tracking, and scene interpretation.

Module 10: Computer Vision - Image Understanding

Computer vision image understanding is allowing machines to interpret and make sense of image content, moving beyond basic image processing to comprehend higher-level concepts, objects, and relationships in a visual scene. It entails extracting meaningful information from a picture, which could include identifying items, comprehending spatial relationships, recognizing scenes, or even deciphering the intent behind visual inputs. Object Detection: Identifying and finding items in an image. For example, identifying faces in photographs or automobiles in a street scene. It recognizes both what is in the image and where each object is positioned. Semantic segmentation is the process of classifying each pixel in an image into a preset category. For example, distinguishing between pixels representing the sky, road, and car in a street scene. Instance Segmentation: Instance segmentation, like semantic segmentation, distinguishes unique items even when they are in the same category. For example, recognize numerous people in a crowd and distinguish each one individually. Scene Understanding is the process of analyzing a scene's greater context or significance. It entails recognizing the context shown in a picture (e.g., a park, office, or beach), comprehending activities or events occurring in that setting, and anticipating potential interactions. Visual Question Answering (VQA): This job combines computer vision and natural language processing, in which a model is given an image and a question about it and responds based on the visual content.



Module 11: Natural Language Processing - Basics

Natural Language Processing (NLP) is a subfield of artificial intelligence (AI) that aims to help robots understand, interpret, and synthesize human language. The purpose of natural language processing (NLP) is to bridge the gap between human communication and computer understanding by allowing machines to process and analyze massive volumes of natural language input, including text and audio. Basic tasks in natural language processing include: Tokenization: This procedure divides text into smaller components, such as words or sentences. Tokenization is frequently the first step in most NLP jobs, as it helps structure the text for further analysis. Part-of-Speech Tagging: This work entails determining the grammatical components of a sentence, such as nouns, verbs, adjectives, and so on. Understanding the role of each word in a phrase is critical for doing more advanced NLP tasks. Named Entity Recognition (NER) is the process of identifying and classifying named entities in text, such as the names of persons, organizations, locations, and dates. For example, in the sentence "Apple was founded by Steve Jobs in Cupertino," NER would distinguish between "Apple" as a company, "Steve Jobs" as a person, and "Cupertino" as a location. Sentiment analysis is the process of determining whether a piece of text expresses a good, negative, or neutral sentiment. It is frequently used to analyze customer reviews, social media remarks, and other types of feedback. Machine Translation entails translating text from one language to another. Google Translate and other translation services that use NLP models to help with cross-language communication are popular examples. Text Summarization: NLP models can be used to create short summaries of lengthier texts, maintaining just the most significant information while removing redundant or unnecessary content. This is handy for digesting news items, research papers, and long reports.

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