

Computer Science in Modern Technology

Introduction to the Applications of CS

CS1 was a great introduction to the field of computer science and gave me a good idea of what computer science is all about, as well as the applications and challenges in the near future. The two lectures I found most interesting were Professor Adnan Darwiche's lecture on artificial intelligence and Professor Sriram Sankararaman's lecture on computational biology.

In Professor Darwiche's lecture, he introduced the field of artificial intelligence and how important computer science is in order to making AI possible. I found the topic of machine learning and natural language processing intriguing for many reasons.

As for machine learning, I was impressed by simply the concept, where a machine could "learn" how to recognize and predict many things, such as classifying objects and predicting models. The various graphics of the numbers as an example of the data set used for machine learning gives me an idea of how the concept of machine learning works. Also, the topic interests me because of how relatable it is with the human brain, using the concept of neural networks to create complicated relationships and develop a model used in the program created. Professor Darwiche went over the various branches of machine learning, such as supervised, unsupervised, and reinforcement learning, which shows how complex the topic has become over the past few years, since machine learning is still a relatively new idea within computer science.

Natural language processing is interesting to me mainly because of how computers can become interactive with humans and because of how relevant and useful it is for machines to understand humans better, bettering our daily lives through more and more interactive technology. I am currently taking an intro to linguistics class, so the topic of natural language

processing is intriguing to me, where the idea of two different topics, linguistics and computer science, can be brought together to create a sophisticated idea beneficial to modern technology. Specifically, the different types of ambiguities(syntactic, semantic, and pragmatic) are ideas covered in my linguistics class, so I have a better idea of the challenges that would arise while working with natural language processing. Not surprisingly, machine learning is used in the modern approach of perfecting natural language processing.

From Professor Darwiche's Lecture, I have come to appreciate the sophistication of computer science which has a multitude of branches, most of which are connected to another topic outside of computer science, like natural language processing. The fact that machine learning is used within natural language processing shows how important every branch of computer science is and how interconnected every topic is to the point that they rely on each other in order to reach their maximum potential.

In Professor Sankararaman's lecture, he discusses an application of computer science and how it can be utilized to revolutionize the field of biology, specifically regarding genes and bioinformatics. He goes into detail about the current tactics used to process gene codes and the issues we run into now, ranging from long algorithm run times to large memory requirements.

My views on computer science changed after listening to this lecture, mainly by the fact that every algorithm can be bettered to run more efficiently, and every complex problem today has a better solution. There are countless challenges within every idea of computer science, and as these issues arise, solutions are found over time and often change the whole field of computer science and revolutionize the world. Also, machine learning is used in computational biology, which shows how important and widely used machine learning is nowadays in the field of computer science.

The Future of Cars

One of the emerging technologies today closely related to computer science is building an autonomous car. Tesla, an electric vehicle company, has worked with this idea for the past several years now, and has made good progress in the idea of auto pilot on highways and straight roads. Google has also made significant progress. Creating this technology requires a significant amount of computer science, specifically in manipulating data for the car to operate safely.

For example, the Franklin Institute describes the general process of how the cars works, where “software/control algorithms are needed to reliably capture the data from sensors and connectivity and make decisions on steering, braking, speed, and route guidance” (Gupton). Although a lot of these aspects have to do with hardware, just having hardware alone will not get the car very far. It is the computer science behind the hardware that allows it to perform as it should and allow the car to run autonomously.

In the end, autonomous cars are a relatively new technology that has not been thoroughly explored yet, and soon, with the help of an expanding source of computer science knowledge and algorithms, may turn all cars into fully autonomous cars that will not even need a steering wheel. Currently, many cars have the basic ability to detect other cars, while more advanced cars have an autopilot function that allows it to drive on simple paths with clear road markings. However, getting beyond that barrier to driving anywhere, with or without road markings, is the ultimate challenge.

A huge challenge that engineers are running into is night driving, where detecting objects is harder and more prone to error, which is not what people want when they are in a car. Recognizing stops signs, pedestrians, bicycles, and other entities is a great challenge that

computer science is capable of solving. An article from the University of Virginia describes how machine learning is a large part of the whole project, where engineers are “manually training the autonomous system to recognize and operate safely in a range of scenarios, including unusual situations, such as a car ahead suddenly veering across three lanes, or an anomaly like a boulder suddenly rolling off a cliff onto the road” (Samarrai). Developing a way for the car to detect these situations is a difficult task that needs to be dealt with for autonomous cars to be safe and feel safe for the user. Safety is probably the largest issue that needs to be dealt with, and the more complex the safety system, developed by the software, the safer the vehicle.

Having the ability to be fully autonomous also comes with needing the ability to drive without any guidance from the ground, such as road markings, since not all places have road markings, or even roads. Science Daily explains a possible solution that has been developed in the Massachusetts Institute of Technology, specifically MIT's Computer Science and Artificial Intelligence Laboratory, where they developed a new framework that “allows self-driving cars to drive on roads they've never been on before without 3D maps.” They developed MapLite, a program that combines simple GPS data with various sensors to detect road conditions, successfully maneuvering the autonomous car on unpaved country roads in Devens, Massachusetts, and “reliably [detecting] the road more than 100 feet in advance” (Massachusetts Institute of Technology, CSAIL). Progress is being made at this moment and new ways to detect entities are being found to further develop the software of the car.

Today, the main issue is that people are not willing to sit in autonomous cars due to the fear of getting in an accident, since the proper set of technology is not completely reliable at this point. A lot of work still must be done regarding detecting various situations as described above, as well as developing new and better algorithms to make autonomous cars more accessible and

reliable for the public to trust and use. At Stanford University, Stephen Zepf, the executive director of the Center for Automotive Research, describes “when the car behaves as it should, stopping fully and waiting for pedestrians to cross, all goes smoothly. When the car inches forward as the pedestrian enters the street, confusion ensues--the walker might stop and start, pass behind the car, or make an otherwise unpredictable move” (Sacks). In other words, the cars need to know how people move, another job where machine learning comes in.

I think that this technology will be extremely important in the future and will revolutionize transportation in many ways. Uber, the company that allows people to go places by having others drive for them, is trying to work with autonomous cars in order to transform their business. Autonomous cars will be the main mode of transportation since that would mean that people do not need to drive and can spend their time doing more meaningful tasks. Also, autonomous cars can change transportation entirely, and with enough autonomous cars on the road, it may make cars safer than they are now if the autonomous cars are all linked to each other, transmitting and sharing data in real time, as opposed to people driving cars individually which always comes with the risk of human errors on the road which can lead to accidents.

Citations

Darwiche, A. (2018). Artificial Intelligence (AI) [Lecture Slides].

Gupton, N. (2018). The Science of Self-Driving Cars [Technical Report]. Retrieved from

<https://www.fi.edu/science-of-selfdriving-cars>

Massachusetts Institute of Technology, CSAIL (2018, May 17). Self-driving cars for country roads [News]. Retrieved from

www.sciencedaily.com/releases/2018/05/180507074237.htm

Sacks, M. (2018, March 20). Traveling in the age of driverless cars [Technical Report].

Retrieved from <https://engineering.stanford.edu/magazine/article/traveling-age-driverless-cars>

Samarrai, F. (2018, March 18). Teaching Cars to ‘Think’ for an Autonomous Future [Technical

Report]. Retrieved from <https://news.virginia.edu/content/teaching-cars-think-autonomous-future>

Sankararaman, S. (2018). Computational Biology [Lecture Slides].