IoT Devices and ML Applications

Jack Landers, January 9, 2022

Internet of Things

Internet of Things devices are technologies that are connected to a network which bonds and monitors them altogether. This can be applied in instances such as smart homes, industrial engineering, and many others to improve overall automation. This is key for improving our everyday lives, by reducing the tasks that consumers have to perform. However, the devices alone cannot function at any level of automation without the enabling of Machine Learning. This is where software learns from inputs to predict and or manage outputs.

The term Internet of Things encases a wide range of technologies that are connected from varying distances. For short range, primary technologies include wireless sensor networks (WSN), bluetooth and wireless fidelity (Wifi), which are both especially familiar as our mobile phones are reliant on them, as well as Zigbee. On top of this, the internet and speech can control systems wirelessly on a much broader scale with Global System for Mobile Communicating (GSM), which is a digital mobile network which connects mobile devices to an array of connected orbiting satellites.

All Internet of Things technologies are built with four main components which are a main circuit board which connects them, a microchip that processes data, a transmitter that outputs data, and a receiver for input data. To improve the software which manages theses devices, we use Artificial Intelligence (AI) systems, programs which learn like we do, in order to develop themselves. As this learning system improves it is called Machine Learning, and if so complex, is even Deep Learning.

Machine learning

Together, these self-improvement systems all use one of three types of learning: Supervised, Reinforced, or Unsupervised learning. Supervised learning tells the machine what the inputs are so that it can learn from the inputs to predict similar ones in the future. Reinforcement learning is only supervised in that there is an additional system to reward the system when successful replicating how a human supervisor would, so that it can naturally select the best techniques to manage input data over iterations. Finally, unsupervised learning inputs sets of data that the machine learns to group by identifying similarities from inputs.

These are applied in so many different fields because of the variety machine learning systems can be designed for, applicable to almost all systems in a range of ways. The most familiar of which would be spam prediction systems in our emails which filter what we receive, but occasionally, misinterpreting a message that is important which might be an inconvenience that we can all relate to. But so many other systems use machine learning, like social media algorithms which learn what kinds of media we want to consume next, judged on factors such as view time and engagement frequency. Product recommendations work in similar ways, developing data on what we might want to purchase next and selling this to advertisers. There is also sentiment analysis, which judges users' emotions and opinions, animal behavior, heart failure prediction, linguistics, image recognition, banking economic predictions, all of these rely on machine learning softwares.

The Cost

Because of how applicable these systems are to Internet of Things devices, governments find use of them for managing countries and security on a global scale, through data collection, border surveillance and other concealed cases. We have now become so dependent on the Internet of Things devices that their polluting components are inevitably in excess, with the world generating 53.6 million metric tons of e-waste. This problem only worsens as well, as each year we produce 2.5 million metric tons more of e-waste than the year previous. To counter this, we need companies to rely less on stronger glues that make the tech harder to recycle, and for producers like Amazon, with massive amounts of digital traffic to their sites, to develop features that make recycling locations easily accessible and known to all consumers. With such a threat to our environment that companies have no financial incentive to counter, there is a bleak future ahead for our world if consumers cannot act to make a difference.

Overall, while the Internet of Things and Machine Learning are a hugely significant technological progression, the pollution they produce is such an irreversible threat to our already deteriorating environment and mental health, where we must start to ask ourselves the existential question, is this rapid development truly worth the convenience it brings?