Neural Network

1st Session

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1 Introduction

1.1 Computational Neuroscience vs Neural Network

In computational neuroscience, biology is important and we need to understand the functionality of brain first and then we should try to make models that mimic the functionality that brain has to solve our problems, whereas, in neural network, the focus is on helping artificial intelligence and to build models that solve problems more and more efficiently, even more so than human brain. Also the models do not have to mimic human brain's functionality

1.2 About Our Brain

Our brain is a computation system. The input of this system is received by various means, such as sight and hearing and smelling and so on. After receiving the data, the neural networks in our brain perform some computation and transform the raw data, into something that we can infer insights from and by this processed data, we can interact with our surrounding world.

Natural intelligence is as old as humanity, but artificial intelligence is also fairly old. [1] Primarily, artificial intelligence aimed to mimic natural intelligence and its goal was to have a system that behaves similar to human brain.

[1] The creation of artificial dates back to when computer science first became a thing. They are nearly as old.

1.3 What does the term "smart" mean?

The term "smart" is a tricky one, since it does not have a clear mathematical definition. It's more of an abstract concept that conveys intelligence. Smart can have different definitions; one might say: a system which can take correct decisions by itself is smart, while other might say: a system which can learn from its surroundings to be able to behave correctly in future is smart. and so on.
the popular definition is that, imagine we have a sample of something smart that everyone witnesses its smartness, like human brain, each system that is as similar to this sample, is considered to be smart. This is that Turing's [2]test demonstrated.
However, this definition is not complete and is sort of an old fashion one, because human intelligent might not be as smart as we can be and that's what has happened with neural networks, there are models that can solve problems, better and faster than humans brain.

1.4 Classic vs Modern AI

There are two main approaches when we talk about AI. It's necessary for us to know the differences to understand what this course is really about.

[2] Turing coined the term artificial intelligence for the first time. You might hear Turing's name more on subjects like computational logic or theory of computation, but nearly all fields in computer science are more or less effected by his work.

1.4.1 What is classic AI?

At first AI was considered to be achieved by designing algorithms that could perform better than or equal to human brain. This approach highly depended on the intelligence of the algorithm designer himself, the smarter he was, the better the algorithm that he could make. The algorithm designer had to predict the in and out of a situation that the AI algorithm would probably face and later he had to implement how the algorithm would react to those certain cases. [1]

1.4.2 How does the modern AI work?

Modern AI take a different approach, the way it works is that, it tries to replicate human intelligence by replicating how works under the hood, which is neural networks. Shortly after Turing, some scientists tried simulating brain's mechanisms. For example: they tried to make a single neuron using logical gates. Then if we connect several artificial neurons together, we'll have a digital circuit that for every input,or set of input, given; generates the wanted output. So it will totally work as human brain. The only problem would be to find the Turing machine. [2]

At first, neuroscience was not that advanced and there was not much info about human brain. In the meantime, computation power was limited back then, but as it went on and on, bigger achievements and successes were accomplished for neural networks.

Even simple neural networks work way better than classic AI algorithms and that gave scientists the illusion that they were so close to reach complete human intelligence, but as it went further, they faces more and more obstacles and difficulties. As a result, neural networks went into a winter[3]

1.5 Will AI take over us?

Thanks to neural networks, in the form of deep learning that we see nowadays, since 2012, the latest AI spring has started and it is still going on since AI is a trend everywhere and thousands of researchers are working on this niche worldwide. In practice, we have models and algorithms is neural networks that solve problems which 10 years ago, no one would believe that they would be solved today and thought it would take three to four decades for us to solve them. This has caused the age old fear of AI to be felt not that much of a fiction anymore.

1.5.1 Who should be afraid of AI?

Think of what physicians do, they examine the patient and recognize some symptoms and based on that, they prescribe some medicine. This is a pattern recognition system that a neural network or classic AI algorithm can do easily. Think of drivers as another example, the same thing goes on for them since what they are doing is just making decisions. and so on. Even programmers are threatened. This makes it somewhat as frightening as those horror movies that you would watch for fun on Saturday nights to get your mind distracted.

It is predictable that every AI equivalent of any system would be preferred to its human counterpart since it doesn't need raised it doesn't get tired it doesn't get outdated, doesn't demand leaves and so on.

Briefly speaking, you can get replaced by AI if your job is kind of a pattern recognition.

1.5.2 What happened in the industrial revolution

Invention of mechanical machines which were able to transform potential energy of fuels to kinetic energy caused this revolution, which caused the shift from using physical power of the workers to using their mental power. This laid of lots of people and made many workers useless and as a result, jobless.

Nowadays, by the development of AI, even people's mind is not important and won't come in handy. Although this solution is more of a mystery. If our physical power is not important and our mental power is not important them what is important about us?

1.5.3 Is there any good point in it?

Back in time, people had to focus on their needs and nearly all of their time would be spent on making food, finding water, making shelter and so on. This phenomena made their minds free of a lot of mental issues that we face these days because we have a lot more time to think and clearly, thinking causes much more conflicts. Looking at AI positively, same thing might happen when AI replaces us on our mental jobs. This can allegedly give us more room and time to think of other things than work, but we cannot say for sure.

[1] Once IBM implemented an AI algorithm that beat the best chess player at that time.

[2] In theory of computation there is a theorem which demonstrates that, a computable system is a system which guarantees generating output when taking an input.

[3] This means that for a couple of decades, they were not that much of a trend and few scientists were working on them.

1.5.4 How to escape this massacre?

If we want to have a brighter future, it's the best time to enter such field and to have such knowledge and profession that cannot be easily replaced by AI. I'm talking about being an artificial intelligence specialist.

Lastly, since AI is evolving with a very fast pace, our knowledge will be outdated so soon. previously people would learn one skill and would make a living out of it for the rest of their lives, but that's not the case anymore. We as computer science students should learn the most important skill which is learning how to learn.