Presenting ideas about self-driving cars

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1 Scripts

Self-driving, as an innovative technology has continuously shocked the world, aiming to help the vehicle moving safely with little or no human input[1]. According to SAE International, there are five levels of automation as listed below① . [1]

① Here "below" means the chart is on the slide.

Before diving into the topic, it is always exciting to check the history. Originally, this term is quite deceptive for actually there is an actual person responsible for driving through a transmitting antenna sending signals. It was not until 1980s machine-learning technique was finally introduced to self-driving cars. The car was really slow for the computer processor cannot be responsible for the performing huge matrix's multiplications. Since then, training cars with enormous data set became a trend[3].

Scientists all around the world has been longing for artificial intelligence, the intelligence demonstrated by machines [1]. Among the subfields, machine learning is gaining increasing attention. One of the most amazing ways to do this is deep learning. In short, deep learning abstracts any real-world problems to a function. By building up and layers, together with weights and biases between layers, we may use this tool to solve all kinds of functions[2]. Concretely, a self-driving problem may be simplified to this: the input is all sensors, and output is the direction and acceleration to adjust.

On GitHub, there is a simulator that can simulate a driving of a car. You may train your model by driving manually, with the technique of back propagation, the machine can always minimize the error rate so called as cost function according to calculus.

Compared to human drivers, it is less likely to make an error, according to Waymo Safety Report[5]. But what is more important is the ethic problem behind. There are two moto cyclers falling simultaneously ahead of the road and it is too late to press brake. One with a helmet on and another do not. Which one shall the AI bump into [4]? There are more similar problems like this.

Although artificial intelligence plays a major part in self-driving cars, there are many auxiliary tools designed by humans to enhance it make even more complicated decisions. For example, it may predict where the person is going to and what is his intention. But it is not always correct due to not fully covered training set and weird real-word scenarios. Sometimes flawed algorithms can make it more severe. Earlier this year, Xiaoppeng auto driving car bumped into a still object at 80km/h without any deceleration. The reason it happened is that it used doppler effect to track the environment, and the difference between two objects is so large that the camera fails to link the two pictures together.

The toughest part is that today's AI is facing more than massive problems to solve. For example, no one can actually tell what the weights and biases in a network really means, and sometimes adding some random noises on the original picture significantly improves the confidence, and the adaption of scenes is also a challenge, meaning that once the scene has slightly changed, the training will be starting from zero.

In conclusion, there will be many breakthroughs before AI gains its real intelligence. There is no wonder that in face of the debate between optimistic and pessimistic about the development of AI, one of the most famous experts said that it deserves hundreds of Nobel's Prizes before we need to actually consider these problems.

2 Fun facts

We discovered many fun videos telling us what AI is, and the machanism behind it.

This video shows the machanism behind self-driving cars, which is really cool.

This video made by 3Blue1Brown tells me what how is AI trained, which grow my interest in learning calculus.

And we found this paper, making it more fun to organize my ideas.

In the future, I will work harder to understand these new terms.

3 References

1 . Wikipedia Self-driving car Definition

2 . 3Blue1Brown What is neroun network

3 . Welch Lab Self driving cars

4 . Veritasium Why You Should Want Driverless Cars On Roads Now

5 . Waymo Safety Report