Discussion About Artificial Intelligence’s Advantages and Disadvantages Compete with Natural Intelligence

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ABSTRACT Artificial intelligence and natural intelligence both have their own advantages and disadvantages. This article discusses the situations where artificial intelligence outcompetes natural intelligence, and where natural intelligence outcompetes natural intelligence, by modeling the scene of predation. Via adjusting variables in the model, different circumstances can be simulated and different outcomes can be verified. The results coincident well with the most wildly-accepted theory about the origin of natural intelligence, and can reasonably infer about artificial intelligence’s limits under current technology and algorithms.

1. INTRODUCTION
In the past decades, artificial intelligence has grown rapidly. It accomplished things that we can never imagine before, like beating the world champion in a chess game. However, there are still numerous things, which are super easy for human beings, that we consider impossible for artificial intelligence to achieve. So, what makes such big difference between artificial intelligence and natural intelligence? And, what, actually, is the difference? To answer the first question, we have to have a clear view of how artificial intelligence works and how our brains work; and more complicated researches must be conducted in order to answer the second one.

First, a brief introduction of the origin of artificial intelligence will be made, which will serve the purpose to illustrate how today’s AI works. The story goes back to the year 1936, when Turing first came up with the idea of an abstract model of a machine, which was later named “The Turing Machine". The Turing Machine can do three things: read the information from a type, write or remove a 0 or 1 on the paper, and move the type whether left or right. Turing considered the model as an “universal machine" because he thought it was able to complete any kind of work that could be written in a mathematical language. He was right, and that made him the father of all computers. The system was all made of 0 and 1, which is called the binary system and is still applied in computers today. Computer science was developed rapidly, but artificial intelligence would never exist if biologists didn’t discover that the neurons in our brain fired electronic signals. The discover led to a burst of enthusiasms which was believed that computers could completely simulate the brain’s function and human beings were able to create robots that were just as clever as people themselves. The reason was simple: when a neuron receives a signal, whether it fires or not, and that exactly correlates our comprehension to the binary system, which is successfully employed in computers. Of course, those scientists failed. Later researches have proved that our brain works in a way that is far more complex, and the signals fired by neurons are more likely to be mechanic instead of electronic, which creates huge difference between signals. Despite the hopeless facts that were provided by researchers, computer scientists were still optimistic, and for sure, they didn’t make any progress in the field, until the 21st century.

Things are different in the new era, when software technic grows in a shocking speed. Because of
the number of running speed of the CPU being astronomical, possibility emerges from mission impossible. On the other hand, biology steps forward in a faster pace, and computer scientists are convinced to give up the idea that creates an artificial intelligence which is as clever as human beings. Instead of that, they come up with new ideas, and that’s when neuron network and deep learning take the stage. Scientist have long been puzzled by how to “teach” computers, and this time, they make them “learn” on their own. The neuron network is simply a lot of neurons, each has its own variables and functions. Working together, they give an output to particular input. The neuron network is like a black box, which means scientist have no idea what each variable should be, but in fact, that doesn’t matter. The running speed of computers are so advanced that they can adjust variables in the neuron network on their own based on huge amount of labeled data. Moreover, if the outcomes aren’t as good as expected, just retrain the network. Through the neuron network and deep learning process, the AI can do complex tasks such as NLP, image detection, and video analysis. Some of the tasks require heavy labor, and some of them are even not be capable to do by humans. So, it won’t be surprising to find that artificial intelligence plays a very important role in today’s society.

While AI has its own advantages, its disadvantages are just as obvious as ever. For instance, most of people can recognize a movie star even if they have only had a glance at his or her new movie on TV. However, thousands of pictures from different perspectives of that star are needed if you want to train an AI to recognize him or her. The function of human brain is known as one-shot learning, whereas the AI’s is known as deep learning. We see from the example that our brains work in a more flexible way, and that has something to do with the origin of natural intelligence. The most famous aspect of the origin of human intelligence is that our evolution happened because of the last ice age. In most situations, creatures evolve by natural selection. The cost of intelligence is so high that in most situations natural selection won’t give you that. However, natural selections take generations to occur, and it may not work well in extreme climate like the ice age. Professor Steen has an interesting view about natural selection: he considers it just as the function of deep learning, where huge datasets are required to make improvements. “In the ice age,” according to Professor Steen, “functions which works in your parents’ time may not work in yours, and that’s when intelligence outcompete natural selection and the cost pays off.

The question is clear from here. The competition between artificial intelligence and natural intelligence is actually a competition between deep learning method and one-shot learning method. Both advantages and disadvantages of the two methods are obvious; however, it still need to dig deeper into the conditions that influence the performance. In order to do that, a praxiological model is made and different variables are set inside the model.

2. THE PREDATION MODEL

The first model that is made to solve the problem was simple. It simulates a predation so it likes a game. In the model, there is a predator, a prey, and n paths, each with a weight. Each time, the prey chooses the path which weighs the most on its side, and so does the predator. When the prey gets caught, game overs.
But, the influence of intelligence, interactions must be involved, which means the weights of the paths should change according to the actions the prey and the predator take each time. In order to avoid randomness in the experiment to ensure the outcome is correct, formulas for changing the weight each time are calculated, and as the “degree” of intelligence must be shown clearly, the parameter $p_{\text{prey}}$ and $p_{\text{pred}}$, which stand for how much the prey’s and the predator’s next move will be influenced by the former performance, range from 0 to 1.

```cpp
for (int i=x; i<=y; i++)
{
    if (i==x)
    {
        a[i].w_prey = a[i-1].w_prey + (1-2*p)/n;
        a[i].w_pred = a[i-1].w_pred + 1/k;
    }
    else
    {
        a[i].w_prey = a[i-1].w_prey + (2*p-1)/n;
        a[i].w_pred = a[i-1].w_pred - 1/k;
    }
    if (a[i].w_prey > prey_max) {prey_max = a[i].w_prey; prey_next = i;}
    if (a[i].w_pred > pred_max) {pred_max = a[i].w_pred; pred_next = i;}
}
```

Figure 2. The formula in the C++ window

To be honest, the first version of the predation model is a complete failure. First, randomness is unignorable in real world. Even natural selection happens because of random mutations in DNA. To remove the extreme situations, the program must be run for multiple times and the relative outcomes must be collected in order to make sure that doesn’t seem to go extreme. Also, by adding randomness, whether the algorithm used is proper can be examined, because an outcome which proves to be unstable is more likely to go wrong. Then, the behavior mode should not always be the same for both preys and predators. It was considered to be a side effect to avoid randomness, which makes both the prey and predator extra predictable. And, as the model works as a double-blind game, unchanged behavior mode means that select completely in random will be the best solution and there’s nothing to do with intelligence. Finally, as predators are often superior in intelligence and less in number in real situation, a model of zero-sum game shouldn’t be used. If the model is designed to put the prey and the predator in equal situations, it must have failed in simulate real predation.
Another problem which is also worth-mentioning is a so called “Traversal Trap”. When this occurs under specific set of parameters, the prey always maintains its choice, and the predator goes through all possibilities and the outcome is always n, which is the number of totally routes available.

Based on the failure of the alpha version, changes must be made. To make the simulation seems more like a real situation, variable behavior modes are added to the prey and preference is used instead of exact weight of each route. Also, randomness is added, which means the prey’s choice is no longer determined by its preference, but influenced instead. To further improve the changeability of the prey, multiple preys are introduced, which means the preys will have more than one chances before they die out: the preys’ preference changes every time a prey is caught or when no prey is caught in t turns (consider t as a period). In conclusion, the preys are given a behavior mode, a total number, and a period at the beginning. There are three designed behavior models in all: none, slight, and strong, each of those has different degree of influence on the random function which decides the final choice of preys each turn. On the other hand, there are also changes made for the predator-a new way to measure its intelligence level. The predator is given a k, which means he will look back in the last k steps taken by the prey to decide its next move. The larger k is, a larger dataset is involved to determine the outcome, thus the predator behaves more like deep learning; in contrast, a smaller k means the predator behaves in a more “one-shot-learning” way. The function of determining the movement is simple majority, which means the predator will always take the route that is visited the most often by the preys in the last k rounds of the game. In the beta version, it shows that under what circumstances a small k will do better and under what circumstances a large k will do better by adjusting the behavior mode of the preys, the period which the preys change their preference, the number of routes available, and the total number of preys; and, correlate these parameters with real meanings to find out the advantages and disadvantages of artificial and natural intelligence. The result is quite the same as predicted:
Figure 4. The results when the behavior mode is none

Figure 5. The results when the behavior mode is slight
Figure 6. The results when the behavior mode is strong

Take a set of outcomes which the behavior mode is set differently as an example. It is predicted that preys with a small \( t \) will be harder to catch and predators with a large \( k \) will take less steps to catch all the preys, and those points that do not correlate with this trend is noisy. From the plots above, a fact can be found that the first two pictures contain the most “noisy” points and the last two pictures contains the least. So, it can be concluded that the outcome will be less noisy if the preference of the prey is stronger. And as the behavior mode measures how predictable the prey is and the number of noisy points measures the side effect caused by randomness, it can be known that when the prey is more predictable, randomness has less influence on the creature. Likewise, other conclusions can be drawn from the plots.

3. THE STANDARD MODEL

After all the works above have been done and with all the results that have been collected, more samples were tested; and almost by accident, a plot was made that is almost completely regular, which leaded to a new thought. Through testing datasets, making plots, and analyzing the outcomes, finally the standard model was found, in which not a single point is noisy, all the points are arranged in a perfectly regular way. The dataset is “\( n=15, m=43, c=\text{strong} \)”. The standard model means far more than it looks to. With the standard model, the relationship between any two parameters can be determined by keeping other parameters unchanged, and that should cover all the situations in real hunting scene.

Professor Steen also gave a suggestion about the model. He mentioned that the benefit brought by a higher \( k \) seemed to have a linear relationship with \( k \), because higher intelligence always brings more benefits. But in real situations, intelligence is “expensive”, when the benefits of intelligence don’t match with its cost, creatures stop evolving their brains, just as human did. He suggested that another parameter for the cost of intelligence should be added, which is in proportion to \( k \), and see if it can get a quadratic outcome that indicates an extremely high intelligence is not worthy. The suggestion is interesting and reasonable, but I haven’t had time for that.

4. CONCLUSION

From the experiment, it can be known that artificial intelligence specializes at particular fields. When the task is highly repetitive and is not very complex, artificial intelligence outcompetes human being by its efficiency and accuracy. Whereas the true value of intelligence glows when the environment changes rapidly and tasks require highly complexity of critical thinking. A human can do anything an artificial intelligence does, just as we can do all the calculations instead of using a calculator. But the mechanism of computers makes artificial intelligence a lot faster when doing tasks in a certain order and unchanged methods. However, bio scientists still have difficulties understanding the function of our brain. The only
thing they can tell is that the brain is a more precise machine which works with more complex physical and chemical functions than a chip in the CPU. So, before mystery of our brain is solved, or new technology and algorithm are employed, “The only thing we have is still stupid AI,” according to professor Steen.

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