A Paradox, Induction, and Research Basics - DA2210

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Contents

1 Achilles and the Tortoise

In this paradox, there is a race between Achilles and a tortoise. In the conditions for the race it is stated that the tortoise will have a substantial head start over Achilles, although Achilles will have substantially greater speed[1]. Let's say for the purposes of this illustration that the head start is 100 meters, and that the speed of Achilles is doubled compared to the tortoise's. Zeno uses these two statements as his premises to build his logical argument. From these, he derives the argument that when Achilles has reached 100 meters, the tortoise will have traveled a total of 150 meters. When Achilles has travelled an additional 50 meters, the tortoise will have travelled 175 meters in total. And every time Achilles will advance to reach the current point of the tortoise, it will during this time have travelled even further, and thus reach a new point that Achilles have to race to. From these arguments, Zeno derives a conclusion that Achilles will never reach the turtle [1]. This is clearly a paradox since we can prove the conclusion to be false by conducting an experiment in reality, and observe that the faster moving contender will eventually reach the slower one.

2 When does induction work?

In my opinion, the most convincing argument to explain the Raven Paradox is the Carnap Approach. The explanation consists of the argument that the observation of a non black non raven object constitutes evidence that all ravens are black, in two ways. First of all, by stating that the information that this object being observed isn't a raven, totally removes the chance of this object being a counterexample. Furthermore, it reduces the probability that unobserved objects are going to be ravens, and thereby reducing that we are going to find counterexamples. According to this line of reasoning, non raven objects that are non black doesn't tell us anything about the color of ravens, but it reduces the number of counterexamples to the statement "All ravens are black". [2] According to me, this proves the validity of induction

in theory, although we could still argue against the practicality to observe objects that are non raven and non black to prove that ravens are black.

Another example that shows the flaw of induction is an example derived by George Polya. In this example, we want to prove that all horses have the same color. In the base case, we state that in a group with 1 horse, all horses have the same color. Furthermore, we assume that a in a group with n horses, all of them have the same color. We then take a look at a group with n+1 horses. We can start by removing one horse from this group and conclude that the remaining group of n horses have the same color, since this was assumed in the induction hypothesis. We then remove another horse from this group, and conclude that the n number of horses have the same color, although this group will contain the horse that was removed in the earlier example, and thus we prove that this horse too has the same color as the others. It is thus proved that all horses have the same color, but this is clearly not the truth. [3]

3 Research Basics

Walliman talks about eight different techniques of obtaining new information through research, one of them being comparison. In this method, different phenomena are compared and evaluated against each other to gain a deeper understanding. An example where this type of research is conducted is this paper from 2013, where different types of machine learning methods in classification are compared [4].

Another technique that Walliman presents is explain. This method is more descriptive and often attempts to move beyond collecting facts, and look at the contextual and societal elements that could be involved. An example of this method applied in computer science research is this paper from 2021 where the challenges, problems and potential solutions of privacy-preserving machine learning is being described [5].

Finally I would argue that the most obvious approach raised by Walliman that applies to computer science is positivism. Since computer science very much is grounded in the reality of physics, math and such disciplines, I would argue that positivism have to be applied in computer science to some degree since it builds on objectivity. I would argue that philosophies such as relativism becomes more applicable when you move into more subjective parts of computer science such as interaction design and similar disciplines.

References

[1] *Zeno's paradoxes*. Available: https://en.wikipedia.org/wiki/Zeno%27s_paradoxes

[2] *Raven paradox*. Available: https://en.wikipedia.org/wiki/Raven_paradox

[3] *All horses are the same color*. Available: https://en.wikipedia.org/wiki/All_horses_are_the_same_color

[4] M. Khondoker, R. Dobson, C. Skirrow et al. *A comparison of machine learning methods for classification using simulation with multiple real data examples from mental health studies*. PubMed, September 18 2013. Available: https://journals.sagepub.com/doi/full/10.1177/0962280213502437

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