Homework 2

David Östling
dostl@kth.se
DA2210

September 27, 2021

Achilles and the Tortoise

For the purpose of this task we define a paradox as follows:

"a paradox can be defined as an unacceptable conclusion derived by apparently acceptable reasoning from apparently acceptable premises." [1]

Now, to determine our own resolution on how the Achilles and the Tortoise paradox is structured, let's look at the following quote from Aristotle himself; *"In a race, the quickest runner can never overtake the slowest, since the pursuer must first reach the point whence the pursued started, so that the slower must always hold a lead."* [2]. I do believe that the unacceptable conclusion here is the statement *"the quickest runner can never overtake the slowest"* combined with *"the slower must always hold a lead"* as it is rather illogical when you think about it. The apparently acceptable reasoning here is the part where *"the pursuer must first reach the point whence the pursued started"* thus forming the paradox.

When does induction work?

a) I find that the *"Standard Bayesian Solution"* [3] is the most convincing as it is logical and makes a lot of sense. The initial thought when hearing the paradox is that seeing a green apple won't provide any evidence that all ravens are black. However this solution builds upon just that; as the evidence that this provides for the confirmation that all ravens are black is so small it is often assumed to provide no evidence at all. However, according to the solution this is not true, it does provide, albeit very little, evidence that all ravens are black. The thing that makes this conclusion so convincing (according to me) is the weight of evidence calculation [3].

b) The goodman's paradox *(or the "grue" paradox)* is pretty similar to the raven paradox however this one supposes that all emeralds that have been observed are green and hence argues inductively that all emeralds are indeed green [4]. If we then suppose that all emeralds are *"grue"* (green until a certain point in time where it becomes blue). The thing to note here is that the induction supports that all emeralds are grue just as well as if all emeralds are green.

Another example where induction might lead to wrongful answers would be the *"all horses are the same color"* paradox [5]. It is proved by mathematical induction, if you picture a base case where a lone horse resides within a group. Then all horses (one horse) in that group must have the same color to begin with. If we then start with the induction and hereby assume that n horses always share the same color and then create a group of n+1 horses we can do the following:

-Exclude one horse and focus only on the remaining n horses which are all the same color.

-Exclude another horse (not the same as the first one) and focus only on the remaining n horses which are all the same color.

-Continue on like this and the horses will always have the same color, thus we have proven the inductive paradox (because in reality, all horses are not the same color).

Research basics

a) We can begin by using both the *comparison- and the correlation method* [6] to compare the *P vs NP problem* [7]. If we simply check the similarities and differences between the *P and NP* we can learn a lot and thus obtain new knowledge about the problem. We will now state the key differences below:

-*P* is a set of problems that can be solved in polynomial time by using a deterministic turing machine [7].

-*NP* is a set of decision problems *(problems that can be answered by saying yes or no)* that can be solved in nondeterministic polynomial time by using a nondeterministic turing machine [7].

Now by simply understanding the above we know that both *P and NP* are solvable in polynomial time *(they correlate here)* and it is the type of Turing machine that decides what set of problems *P or NP* corresponds to. Now we know a little bit more about the *P vs NP problem*!

Another example would be *Dijkstra's algorithm* and we can learn more about it by using the *describe- and the explain method* [6] and thus answer the question why we would use *Dijkstra's algorithm*? As the algorithm describes a way of finding the shortest way possible to transverse between the nodes of a given graph [8] there spawns a lot of reasons to use the algorithm. An example of this would be route planning [8] but practically anything that involves efficient graph transversion could benefit from applying the algorithm.

b) I believe that the only approaches that really apply in computer science would be the *positivism- and the postmodernism* approaches [6]. *Positivism* is based around the fact that the world we live in is real and that we can find out about the realities present in this world. This can be truly linked to computer science problems because of the following quote: *"Knowledge is derived using scientific method and based on sensory experience gained through experiments or comparative analysis"* [6]. We can simply use the same examples as in a) *(P vs NP and Dijkstra's algorithm)* as the knowledge of the P vs NP problem comes from a lot of experiments and comparative analyses [7], the same goes for *Dijkstra's algorithm* [8].

References

[1] Sainsbury, R. M. (2009). Paradoxes. Cambridge University Press.

[2] Wikipedia (2021) "Zeno's paradoxes" Available: https://en.wikipedia.org/wiki/Zeno

[3] Wikipedia (2021) "Raven paradox" Available: https://en.wikipedia.org/wiki/Ravenparadox

[4] Colman, A. (2008). A Dictionary of Psychology. : Oxford University Press. Retrieved 24 Sep. 2021, Available: https://www.oxfordreference.com/view/10.1093/acref/9780199534067.001.0001/acref-9780199534067

[5] Łukowski P. (2010) Paradoxes of Wrong Intuition. In: Paradoxes. Trends in Logic, vol 31. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-1476-22

[6] Walliman, N. (2018). Research methods: The basics.

[7] Cook, S. (2006). The P versus NP problem. The millennium prize problems.

[8] Fan, D., Shi, P. (2010, August). Improvement of Dijkstra's algorithm and its application in route planning. In 2010 seventh international conference on fuzzy systems and knowledge discovery (Vol. 4, pp. 1901-1904). IEEE.