

Homework 4 - DA2210

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Contents

| | | |
|----------|---|----------|
| 1 | Is Computer Science Science? | 1 |
| 1.1 | | 1 |
| 1.2 | | 1 |
| 1.3 | | 2 |
| 1.3.1 | | 2 |
| 1.3.2 | | 2 |
| 1.3.3 | | 3 |
| 2 | Can AI algorithms be allowed to make sensitive decisions involving humans? | 4 |
| 2.1 | | 4 |
| 2.2 | | 4 |
| 2.3 | | 5 |
| 2.4 | | 5 |
| 2.4.1 | | 5 |
| 2.4.2 | | 6 |
| 2.4.3 | | 6 |

1 Is Computer Science Science?

1.1

The field of Computer Science has existed since the early 1950's, but there are still disagreements internally in the field whether it really is a pure science. There are many different views on this topic, and there doesn't seem to be a consensus about the answer to this question yet. In his article "Is Computer Science Science", Peter Denning argues that the field meets Francis Bacon's definitions of what a science is, by creating hypotheses and testing them. However, he also raises counterarguments that there has been a lack of testing within the field, which raises concerns about the field's credibility. [3] Denning presents a quite broad definition to what computer science is, in contrast to for example Donald Knuth who defines it as the study of algorithms [1]. This definition makes the field less related to artificially created computers, and more related to natural laws and mathematical principles. Vint Cerf, one of the fathers of the internet, on the other hand argues that software is too unpredictable for us to call Computer Science a pure science [2]. So as we can see the field is not in agreement about this question, which is why we as computer scientists today will have a panel discussion about this precise question, is Computer Science a Science?

1.2

So my first question to the panel is, would you consider computer science a pure science or would you consider it being more of an applied science? And please explain why so?

Would you agree with the statement that computer science isn't a science because it deals with man made objects? Why so?

1.3

1.3.1

I would not consider computer science a science since it deals with man made objects. The hardware that runs the computers, are built by applying other scientific fields such as physics. But how we interact with the computers, with programming languages, are in large part constructed by us. So studying software engineering for example, and making predictions about computer programs could not be considered being scientific in the same way that physics is, since physics in contrast to computer science observes natural laws about the world that are already there before we discover them.

This totally depends on how you define the field of computer science. I would prefer to define it more as Donald Knuth defines computer science, which would be: the study of algorithms and that this is the central core of the subject. If this is the case, then we could argue that algorithms could be proved or disproved whether we have computers or not. We could then argue that computer science should be considered an offshoot of mathematics, and could thus be argued to be a science.

1.3.2

I would argue against computer science being a science in the same sense that Vinton Cerf does [2]. So a very central notion of the scientific method is to create models and make predictions based on those models. And in computer science we are very good at making accurate predictions and measuring the outcomes when it comes to hardware, but not as good at predicting the behaviour of software. Large systems that are built out of smaller subsystems that are dependent on each other are so complex that we generally don't have the ability to reliably predict their behaviour. So I would argue that computer science isn't a science because of the lack of predictability in the systems that we observe.

We may not be able to predict a piece of software exactly, but we can predict

and prove the validity of the algorithmic function of the software, if the algorithm is generalized and abstracted. So if the we observe the algorithm by itself, it can be proven or disproven just like a mathematical theorem can be proven or disproven. So, I think that the argument here is about what the definition of computer science is. If we have a broad definition of computer science, then yes some parts of it is not a science. But if we have a more narrow mathematical definition of it then I would argue that it is a science.

1.3.3

The scientific model is to a large degree about creating models, making predictions based on those models and testing the validity of these predictions. It seems that there has been a lack of testing models and hypotheses in the field of computer science. If the field doesn't seem to follow the scientific method, how can it then be regarded to be a science?

This is an argument against the credibility of the field, and how it has been conducting it's scientific research. So it is more of an attack against the practitioners of computer science and the researchers within the field, but not an argument against if the field itself is a science. If the questions that are asked by computer science can in fact be proven or disproven, then I would argue that is is a scientific field.

2 Can AI algorithms be allowed to make sensitive decisions involving humans?

2.1

Alex Cohlas-Wood discusses a very interesting case where algorithms and AI is incorporated into the legal system. In his article, "Understanding risk assessment instruments in criminal justice", he describes a type of algorithmic tool called risk assessment instruments, or RAI's, that are used to predict the risk of future misbehavior of an individual. Based on the conclusion made by the system, a decision can be made about whether the individual should be incarcerated or not prior to the trial. The hope is that RAI's can bring consistency, accuracy and transparency to judicial decision making. However, there seems to be concerns related to whether these types of systems produce a fair result, or if there are biases embedded in the algorithms. There have been past situations suggesting that racial and gender based biases have occurred in making judicial decisions using these kind of systems. The author thus points to the importance of transparency in what data is used to train the algorithms, to see whether the algorithms is making biased decisions against individuals on trial. [4]

2.2

Artificial Intelligence (AI) is being implemented in the products and systems that we use more and more every day. It is being used in everything from making consumer recommendations, steering autonomous vehicles, making decisions on the stock market and in many other areas. The support we get from algorithms in these areas are often beneficial to us. But what about making sensitive decisions about individuals that can effect their lives? How about deciding the right candidate for a position, or whether an individual should be sentenced in a trial? There are some evidence suggesting that biases based on group identity can sometimes be embedded within these systems, and without our own knowledge [4]. So in light of all this, we get

to the question that we will discuss in this seminar, which is if AI algorithms can be allowed to make sensitive decisions involving humans?

2.3

Could you discuss where the line is regarding if an algorithm is biased or not in making decisions?

Do you think that companies and institutions should be forced to be transparent with their algorithms so that we can ensure their degree of fairness?

2.4

2.4.1

I want to stress that I think that it should be legal to make sensitive decisions involving humans, I think that banning technology and innovation is usually not a good path. That being said, I'm not sure whether it is always appropriate. I think that the reason to do it is that it would in fact get rid of our biases that we have and make more accurate decisions. So to use an example, let's look at Amazons hiring algorithm[5]. If the algorithm picked the best candidates for the position based on their experiences and competences as individuals, then I would say that the algorithm is successful. This would be independent of what groups of people are represented in the outcome. However, if it makes decision based on group identity and not individual capacities, then I would say the algorithm is biased.

As a counterargument I would say that it is too difficult for us to know whether the right candidates have been picked or not. We can have an idea if the candidates were appropriate or not, but the AI algorithms are too complex for us to grasp, so the decisions they make can't be accurately evaluated by us.

2.4.2

I would argue that it in some sense would be more appropriate to use algorithms to make decisions about people, than to use people. Since we are tribal in our nature, we are inherently biased in some sense, whether we want to be or not. Using algorithms could let us break free from those biases.

I think that this is a misunderstanding. The algorithms doesn't make decisions out of thin air. The decisions that they make are based on data, and we produce that data. Because of this, the algorithm is perhaps going to make more consistent judgements than we do, however the biases are still going to be there since it is embedded in the data.

2.4.3

There are problems with making sensitive decisions about individuals using algorithms, but we can regulate the use of algorithms to the extent that these problems are mitigated. Using regulations we could force companies and institutions to be transparent with their algorithms by law, and thus we would find out if there were biases embedded.

First of all, it is too complex to regulate this. There are too many laws regarding copyrights and so on that are already in place to create these new regulations appropriately. Second of all, the justice system is yet too uneducated regarding technology that we couldn't judge the fairness of the algorithms even if the right degree of transparency already was in place.

References

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