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Context to the nugget

Kartik speaks about how AI has moved from being expert systems (where humans input a certain set of rules that machines follow) to machine learning systems (where human expose the machine to tonnes of data with the relevant input and output parameters) and how that leads to situations where the machines often come up with actions that are beyond our comprehension. He also takes the example of US Constitution and the Code of Hammurabi to make the distinction between the two types of systems and the trade-offs therein.

Transcription

Deepak Jayaraman (DJ): And moving to another game like chess you talk extensively about the game Alpha as well and specifically you refer to a particular game where a 37th move got everybody puzzled and in that context you also talk about the notion of predictability resilience paradox so talk to our listeners about, what's this paradox and what does this mean in terms of how we think about, AI systems and what does it mean and what is the implication for various stake holders here?

Kartik Hosanagar (KH): So the story I mention in the book is about, there's system Googles deep mind division created called Alpha Go and it was all over the news so most of your listeners have likely heard of it but just to set context 'Go' is the strategy game like chess but far more complex than chess there's many more moves that one could explore and so it's hard to conquer 'Go' with just brute computational power unlike chess which you can conquer with brute computational part and so 'Go' was this one game where humans were beating machines for quite some time but that changed with 'Alpha Go' which beat the world go champion Lee Sedol and I describe one particular game in which go made a move which was very unexpected that game was you know going like any other game for a while it seem like 'Alpha Go' had an advantage over Lee Sedol who was a world champion but then all of a sudden Alphago made a move which was the move no. 37 which stumped a lot of people and I recollect the European Go champion saying this is not a human move and in fact Lee Sedol had to step out of the room, come back and he slowed down and he was trying to make sense of the move and initially some people even thought that's a poor move, a bad move and it turned out that it was a brilliant move and it's not a move that humans would make and some people called it a move from an alternative dimension so it kind of brings up this question of, where is this ability to go beyond human kinds of moves coming in and I used that to set up this idea that I refer to as predictability resilience paradox which is a paradox I mention in the context of designing algorithms and I make the case that it's hard to build and algorithm that is simultaneously highly predictable and highly resilient and so let me clarify what I mean by that, so if you wanted to build an AI system to do something amazing like drive a car or diagnose diseases there's many ways in which to build that sort of system. It used to be the case that the old way of doing this was that you interviewed experts, let's say I want to build a system to diagnose diseases I would interview lots of

doctors over several hours and ask them what are the rules they use to diagnose a disease or what are the rules they use to interpret an x-ray image or whatever it is and they give me the rules and I code those rules, it turns out you can build reasonably good AI systems with that but they ultimately cannot match human intelligence they are subpar as far as humans are concerned that's because we have a lot of knowledge that we don't even know we have, so it's hard to even share that knowledge or share the rules associated with that. For example if I asked you Deepak give me the rules to identify your mother's face in a photograph, you can give me bunch of the rules like the shape of her eye, the colour of her eye, the shape of her nose, hair and so on but I code all those rules that software will fail with the very first photograph I give it, because that's a lot of knowledge you have which you are not even able to express, you are not even aware of that knowledge and so the question is this, is there a better way to build AI? And the better way to build AI over the last 10-15 years has turned out to be machine learning which is the idea that instead of asking experts for rules let's observe them in action, let's collect that data and ask the machine to find patterns. So instead of asking doctors to give us the rules for diagnosing diseases we observe maybe a million or a crore patients coming in to hospitals and we observe what were their complaints? What were their symptoms? What were their clinical markers? And what was the final diagnosis by the doctor? And we give that data to a statistical system or to a machine that observes that pattern and learns how to diagnose disease. And that's how now we are building systems that can match humans in terms of diagnosis, we are building systems that can drive cars on their own because nobody has to give the system every rule it has to follow it just observes thousands or hundred thousand of people driving and learns how to drive with that but the flip side of this is this systems are highly capable they can beat humans they match humans they are highly resilient as well when they face a new situation they might fail but they immediately learn from that, they use the data and they improve and so that highly resilient but then they are not highly predictable the old rule based systems the expert systems where highly predictable because they followed a fixed set of rules. You could say what it will do under any scenario because you program those rules but these new systems while they are more resilient, they are not highly predictable because you didn't code the rules so it's all based on the data and how its learning...

DJ: That's the 37th move I guess

KH: That's the 37th move and sometimes the data might not even be data on human moves so 'Alpha Go' use was trained on moves made by go champions in the past but it also played millions of games on its own through simulations and against itself so its generating its own data and it's trying crazy moves and seeing what happens and it's learning that here's the crazy move no human has tried but it seems to work so I am going to use it next time.

DJ: How should we think about the trade-off of predictability versus resilience and you also in that context talk about the contrast between the US constitution and the code of Hammurabi?

KH: So, I kind of bring up question in this book which is called a human guide to machine intelligence and in the book, I bring up this question should we go with predictability? Should we prefer resilience over predictability? What is it? How do we make the trade off? And the contrast I bring up is that, one analogy for that is, if you look at rule systems that humans have used one of the oldest rule system we know of the society has used is the code of Hammurabi which we all have read about in history books when we were in middle school or high school and the code of Hammurabi obviously has some of these very famous maxims like eye for an eye things like that and it's very precise set of rules which in modern times actually seems sometimes cruel things like eye for an eye but even out-dated because there are certain rules for what happens when your neighbour doesn't maintain their dam well and the water flows over from their field to your field and so on and which is relevant to a lot of us today and the point being that the code of Hammurabi follows the fix set of

rules, its highly predictable but it's not resilient because as times changed and human civilisation changed it couldn't adapt and be relevant then, the US constitution interestingly is again a set of rules that is used to governed in the US, it's one of the oldest constitutions that are still being used today and the reason it's still successful and still being used today is because a constitution is not fixed set of rules, the constitution allows for new cases to set a president for the constitution to be amended for new situations to arise and to set a president for supreme court for the constitution itself and so on and so it adapts and that has allowed it to survive longer and so clearly if you want a AI system to function in the long run then you need to allow it to adapt as the environment is changing and so that's why we are moving in the direction of ML over predictable expert systems even though these systems are bit unpredictable, they can actually deliver they can perform well and they can adapt and so that's one of the trends that I think will stay that we will see this switch towards machine learning but the question arises OK! We want machine learning because it's highly resilient but how do we build some checks and balances to make sure it doesn't go out of control and I am sure we will talk about that in a bit.

Reflections from Deepak Jayaraman

DJ: Kartik speaking about codifying your mother's face reminds me of a nugget from my conversation with Indranil Chakraborty (IC) on the podcast a few weeks back. Indranil is an expert in business storytelling and he speaks about the asymmetry between what we have in our head and what we end up communicating using a very interesting experiment conducted by Elizabeth Newton in 1990s.

IC: *"Tap a tune on the table you are a musician so I think you will get it and I am going to ask you to tell me what is the song that I just tapped. Let's start. You give me some genre or? It's a very popular English song and you learnt it in your earlier days in school. Come on you didn't get it its Jingle bell, Jingle bell. Now what just happened the reason I got it is because the tune was in my head and when the tune is in my head that sound is like Jingle bell for me when the tune is not in your head that sound is like noise"*

DJ: I guess, there is so much that is hard-coded in the human mind that is hard to transfer to a machine. But at the same time, given the processing power of systems we are on, we don't want to limit the machines to the limits of what the human mind can process.

The key would be for us to have the checks and balances for situations that might be beyond our comprehension and possibly develop the tolerance for the occasional 37th move type outcome which might not make sense for us but might be the right thing to do given the tonnes of data the machine has processed.

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End of nugget transcription

Nugget from Indranil Chakraborty that is referenced: [Curse of Knowledge](#).

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Kartik Hosanagar - Nuggets

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About Deepak Jayaraman

Deepak seeks to unlock human potential of senior executive's / leadership teams by working with them as an Executive Coach / Sounding Board / Transition Advisor. You can know more about his work [here](#).

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