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Algorithmic Game Theory: A New Frontier in AI Research

The development of artificial intelligence has grown exponentially in the last two decades, with breakthroughs such as IBM's Watson winning Jeopardy and DeepMind's AlphaGo defeating legendary Go player Lee Sedol in 2016. Now, a new field of research aims to make it possible to apply some of these breakthroughs to strategic environments where players are computer programs, opening up new applications in e-commerce, cybersecurity, economics, and politics. This article introduces the basics of algorithmic game theory and shows how its applications might influence our future lives.

What Is Algorithmic Game Theory?

Algorithmic game theory is a newly emerging field that studies mathematical and computational problems from game theory. For many of these questions, we do not have rigorous mathematical solutions, so algorithmic game theorists develop heuristic algorithms that come reasonably close to an optimal solution. This is especially important for NP-hard games such as matching or scheduling (which are hard to solve exactly but where approximate solutions are acceptable). These sorts of problems arise in many real-world situations including information retrieval (link prediction), content delivery networks (the maximum flow problem), auction mechanisms, finding roommates on sites like Airbnb and StubHub, engineering hiring procedures, and more.

Can it Replace Human Strategic Decision-Making?

Relying on computers to make decisions may sound like a futuristic idea, but it's been happening for quite some time. From Siri to automated trading algorithms, computerized decision-making is quickly becoming commonplace in our everyday lives. But can machines that use algorithms and game theory to make strategic decisions ever truly replace human strategic decision-making? While it's possible this artificial intelligence could surpass humans in certain respects, their inherent limitations mean that we'll still be relying on human

strategic thinking for some time. There are plenty of situations where it makes sense to let a machine take over. It might seem counterintuitive, but an algorithm isn't necessarily better than a human at every task; sometimes they're just better at different tasks. For example, if you need someone to find information about an obscure topic, you're probably better off leaving it up to Google than trying to explain your query in plain English. You'd also be hard-pressed to find anyone who thinks Siri or Alexa would make good doctors or lawyers—but those aren't skills they were designed for anyway!

Where Does It Stand Right Now?

We're already seeing game theory showing up in many aspects of our lives. In several recent tournaments, algorithms have come out on top (check out AlphaGo for one example). Google's DeepMind has even created DeepMind Lab, a gaming platform where developers can build their games and see how advanced AI systems play them. That's part of why we're seeing such huge interest from big tech companies—the sheer number of data points and different strategies that online gaming presents is perfect for teaching machines to make decisions based on probabilities. It doesn't hurt that it makes for a lot of fun, too!

How Close Are We to AGT Becoming Reality?

Algorithmic game theory is already used across several industries, including job recruitment and advertisement. Several startups have already come up with viable business models that use AGT in daily life.

For example, Karma Koin runs a digital currency incentive system for online video games, where gamers earn virtual currency from completing specific objectives within games (e.g., killing an enemy). Those who can reach these goals faster than others receive bonuses (i.e., additional tokens) as an incentive to play more games on

that platform. In reality, game developers reward users not based on their performance but rather as a way to keep them engaged—which translates into more profit for these companies.

How will this impact you?

No matter how much we may want to romanticize gaming and its technology, there are no absolutes. The

reality is that game theory will probably end up as one more option among many others for building real-world applications that can do everything from making smarter financial investments to discovering optimal materials.

And as with all other types of machine learning, it may eventually lead to a metaverse in which computers

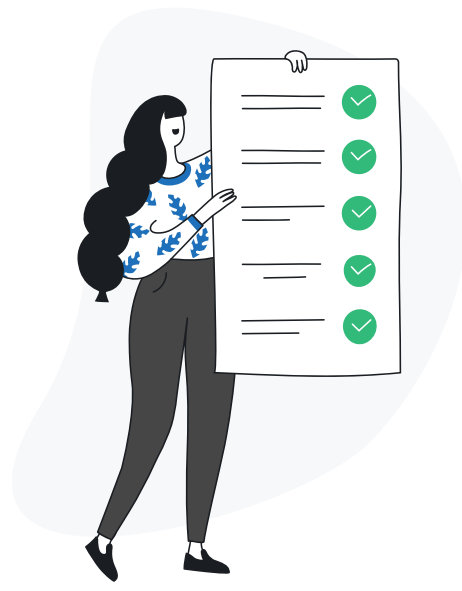
interact with each other through game-like environments—though whether we'll be living in those virtual worlds

anytime soon is another question entirely. But if you're looking for an alternative career path or just hoping to

keep your job marketable, look into algorithmic game theory now while you still have time. If nothing else, you

might even find yourself enjoying games more than ever before. Who knows? Maybe someday everyone will

be able to retire young after creating their idealized realities within them...



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