

# Researchers use AI to simulate soccer with inspiration from world's top players

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Dal team first from Canada to make RoboCup finals in more than a decade.  
Credit: Dalhousie University

Artificial Intelligence (AI) is affecting the way we work, learn, shop, and now creating new opportunities for playing and watching our favorite sports.

Using AI and machine learning to mimic the behavior of the likes of Cristiano Ronaldo and Lionel Messi, a team of researchers from the Institute for Big Data Analytics at Dalhousie were recently named as runners up in 2020's largest international AI soccer simulation competition, [RoboCup Japan Open](#). This is the first time a Canadian team has made the finals for more than 10 years.

International robotics competition RoboCup uses soccer simulation to promote robotics and AI research with the research findings used to advance many areas. By 2050, the competition aims to train a team of fully autonomous humanoid robots to win a soccer game against the winner of the most recent World Cup.

## **A new way of using AI**

RoboCup uses a variety of AI and machine learning models to train autonomous 'players' in different positions to collaborate and play together in an intelligent way.

"So, most of our [decision making](#) is based on AI," says Mahtab Sarvmaili, a Ph.D. student in the Faculty of Computer Science. "If you don't use it, the number of decisions is too much. We have to use AI to have a better approach, or better way of playing the game. Now we are trying to make it more similar to the real world, especially by using the reinforcement learning method that's like training the agent without having any actual supervision from humans."

Stan Matwin, Canada Research Chair and director of the Institute for Big Data Analytics adds, "This is a new way of using AI where we use a whole range of AI methods to create a simulation of perception so that the agents or 'players' work autonomously but also learn how to collaborate."

## Addressing bigger issues

While these methods are presenting new ways to play and consume sports particularly during a time where much in person activity is suspended, the team is identifying other ways to use this research to address bigger issues such as cleaning our oceans.

"Mainly what can be extracted from this is how agents or robots can collaborate to achieve a certain goal," explains Amilcar Soares, an assistant professor at Memorial University and former Dalhousie postdoc. "Let's think about the ocean domain. One interesting problem that I see several companies discussing is how we can make autonomous agents collaborate to clean the ocean. So, you could have multiple agents and humans can assign tasks to the agents to collaborate in a way that the final task will clean the ocean or river."

Mahtab echoes that this method of training agents makes them learn behaviors, resulting in them working in the most effective and intelligent way, be that the fastest or by using the least amount of energy. This can also be translated to the future of video games.

"If you consider these very complex games, such as Warcraft, they are not fully autonomous, they are controlled by a central server and the server tells the agent what to do," she says. "What we are doing here is way more complex because we are distributing the decision making and each one of these players acts like a human and thinks about the game. So now, if they learn how to collaborate with one another in this complex environment that is constantly changing, we can apply this model on the other video games and make them more realistic and interesting."

## Value of human experience

AI and Machine Learning may have controlled much of the outcome for the team during the RoboCup competition, but they argue that human experience and knowledge is still essential, and they took some inspiration from the best.

"Nader (Zare, chief architect of the RoboCup team) has developed a [defensive strategy](#) trying to mimic the strategy of Barcelona FC. So, we are trying to get an idea from the [real-world](#) players, and optimize their behavior," says Mahtab. "It's not actually like them, but we want to make our team close to the real human players."

"It's important to point out that during the actual competition we evaluated that it was taking very long for us to make a shot at the goal." Dr. Soares expands. "We checked the threshold for shooting and we saw that it was very low. This was an observation by a human that at some point, even though we had so much data to train, just using the machine it was not perfect, it needed these human interventions to play better."

On the flip side, he argues that humans could learn more about the game from the technology and that this could change the way sports are played and watched forever.

"We could have, for example, a virtual assistant coach that could help the human coach and say the strategy isn't working, why not replace these two players etc." Dr. Soares says. "This could be learned from a platform like that in a way that this decision making can be provided to the coach. I think this could be the future. Even right now it's possible, it's a matter of just modeling properly."

Nader adds, "In real football, we can use knowledge from RoboCup to analyze a real soccer [game](#). We can use this to predict the result of games and to show the benefit of doing certain things with different positions."

Provided by Dalhousie University

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