# A heuristic search algorithm to plan attacks in robotic football

August 27 2020, by Ingrid Fadelli

Photo from a RoboCup game that the researchers participated in. Their robots are on the right side of the pitch. Credit: Khokhlov et al.

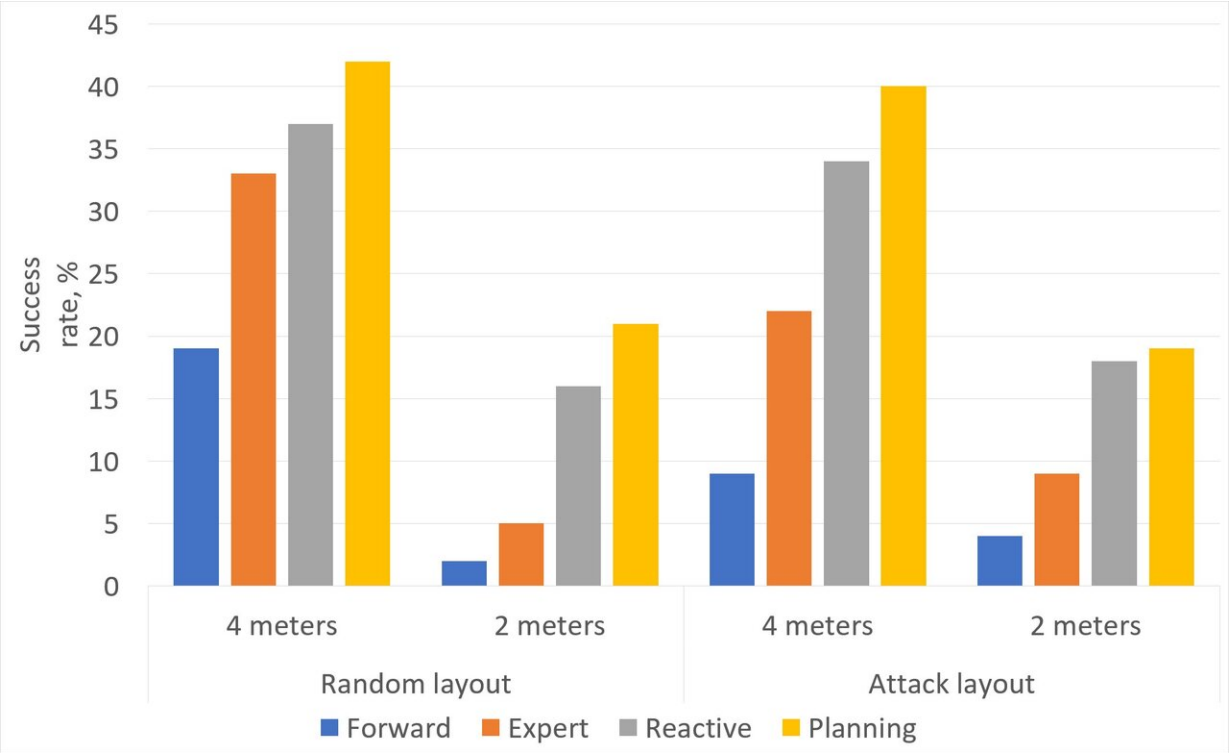
Robots have gradually been making their way into a variety of fields and settings, including sports competitions. Robotic football, or soccer, is an innovative version of soccer in which human players are replaced by robots.

Robotic football/soccer competitions have been around for a few decades, now. First introduced in the 1990s, they are now grouped into a single initiative marked by regular tournaments and leagues, dubbed RoboCup.

The humanoid robots that take part in RoboCup have become increasingly advanced over time, making games more engaging and dynamic. To perform well in these competitions, robots should ideally have a wide range of capabilities, including good locomotion, path planning, localization and interaction skills.

Researchers at Moscow Institute of Physics and Technology have recently developed a technique for planning attacks (i.e., attempts at scoring a goal) in robotic football. This technique, presented in a paper pre-published on arXIv, is based on a computational method known as heuristic search.

The heuristic search algorithm developed by the researchers calculates the trajectories that would allow the ball to travel from a given location on a soccer pitch to the goal of a robot's opposing team. Its calculations are based on a graph that models the game environment and two key search components, known as the cost function and heuristic function.




The researchers' final results summarized in a bar chart. Credit: Khokhlov et al.

"Our research was aimed at solving one of the main tasks in football—scoring a goal as soon as possible," Ivan Khokhlov, one of the researchers who carried out the study, told TechXplore. "The heuristic search-based method we used takes all available information about the game state into account. Moreover, our approach allows robots to plan not only a single kick but the whole attack."

Essentially, the heuristic search algorithm developed by Khokhlov and his colleagues was designed to predict ideal ball trajectories for scoring goals in robotic football based on all available information about the state of a soccer game. The researchers evaluated its performance by comparing it to several baseline techniques in a series of simulation trials.

Remarkably, their algorithm outperformed all the techniques it was compared to, identifying strategies that would allow robots to score goals during robotic soccer games. The initial findings gathered by Khokhlov and his colleagues highlight the algorithm's potential for enhancing the attacks of robots during RoboCup games.

In the future, this recent study could inspire other research teams to develop similar algorithms for improving the performance of robots in other aspects of robotic soccer. So far, the researchers have only tested their algorithm in simulations, but eventually it could also be applied to real humanoid robots, in order to further investigate its potential.

"In our future studies, we plan to test the applicability of reinforcement learning to this algorithm in our specific conditions," Khokhlov said.

**More information:** Khokhlov et al., Planning to score a goal in robotic football with heuristic search. arXiv:2008.00851 [cs.RO]. arxiv.org/abs/2008.00851



Citation: A heuristic search algorithm to plan attacks in robotic football (2020, August 27) retrieved 4 May 2024 from
https://techxplore.com/news/2020-08-heuristic-algorithm-robotic-football.html