Tehran2D Team Description Paper

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Abstract. Soccer Simulation 2D is one of the most popular and participated leagues of RoboCup, A yearly competition where soccer is used as a subject for research and challenge. In this paper we will show the research and developments of Tehran2D, by implementing a block algorithm and researching what other teams have been working on.

Keywords: RoboCup · Soccer Simulation 2D · Block

1 Introduction

RoboCup is annual competition since 1997 where the best of artificial intelligence and cutting edge of technology in a battle of robotics. The final goal of the league is to reach human level robotics and artificial intelligence abilities of a human by 2050, and to have a realistic soccer match between robots and humans.

One of the major leagues of this competition, is the RoboCup Soccer 2D Simulation, in which 11 simulated agents (and a coach) from each team play a game of soccer in a top-down, two-dimensional view, where each agent has limited observation of a noisy world.

The team Tehran2D was formed this year, and our current main goal was to catch up on what the other teams are doing by reading other Team Description Papers, and to start by developing a simple algorithm for blocking. As a base for the team, we decided to use the CYRUS 2014 [1][2] release as it already has many basic actions implemented.

2 Related Work

In the recent years, there have been many developments and breakthroughs in Soccer 2D Simulation League, so we decided to study how the three top teams of RoboCup2021 (CYRUS, Helios2021, YuShan) have reached their achievements.

In 2015, YuShan [3] worked on optimizing the kick and block model, and analyzed formations and chain-action and pass chain patterns, while CYRUS [4] worked on defensive decision making and communication between agents to eliminate environmental noise. Helios 2015 and 2016 [5, 7] worked on game analysis via clustering using EMD algorithm. In 2016, the team at CYRUS [6] worked on shooting algorithm using neural networks, and further optimization

of shoot via pattern recognition. YuShan, sadly, did not partake in the RoboCup competition in 2016 and 2017.

Helios2017 [9]worked on improvement of action planning by proposing a pruning method using a clustering algorithm. Meanwhile, CYRUS2017 [8] attempted to predict opponent behaviours using machine learning.

The team at YuShan2018 [10] worked on improving chain action, introducing an inference model to defense and using data-mining to analyze teams. In this year, Helios [14] increased the achievement probability of planned action sequences by improving the knowledge sharing between players. Also Cyrus2018 [11] worked on predicting player's behavior in a multi agent system using neural network.

In 2019, YuShan [15] used data-mining to optimize chain action further and also improve shooting. In this year, Cyrus [16] used an Actor-Critic Reinforcement learning algorithm to improve defensive actions.Also Helios [17] worked on measuring the similarity between teams by using natural language processing and clustering.

In 2021, YuShan [18] used data-mining and analysis to make profiles for each team. Meanwhile Cyrus [19] worked on predicting teammate ball owner's action . Helios [20] worked on putting agents into position based on their characterizations and abilities, and also developed a new analysis tool.

also other note worthy teams such as Persepolis[12, 13], Oxsy[21, 22] and FRA[23, 24] did a lot of contribution to this league and worked on different aspects like marks, blocks and new AI models to work within SS2D.

3   Block

In soccer, blocking is a defensive action that aims to prevent the opponent from shooting and dribbling the ball towards our goal. To achieve this goal, we first find the position where each agent should block, and then select the blocker agent.

To find the block point of an agent , first we calculate the middle point of our goalie and the goalpost further away from our goalie. Then we draw a line between this middle point and the point where the ball is kickable by the opponent. Afterwards, we calculate the projection point of the agent's position on this line. Now we check if the projection point is between the ball and our goal. If not, this agent is disqualified as the blocker.To select between all candidates, we calculate an evaluation metric based on the formula below:

$$eval = alpha * PlayerDistanceFromProjection + beta * PlayerDistanceFromBall$$

Where Alpha and Beta are fine-tuned coefficients.

Then we find the agent with minimum evaluation value and we declare it as the blocker agent. The blocker agent moves towards its projection point and starts intercepting once it reaches the destination.
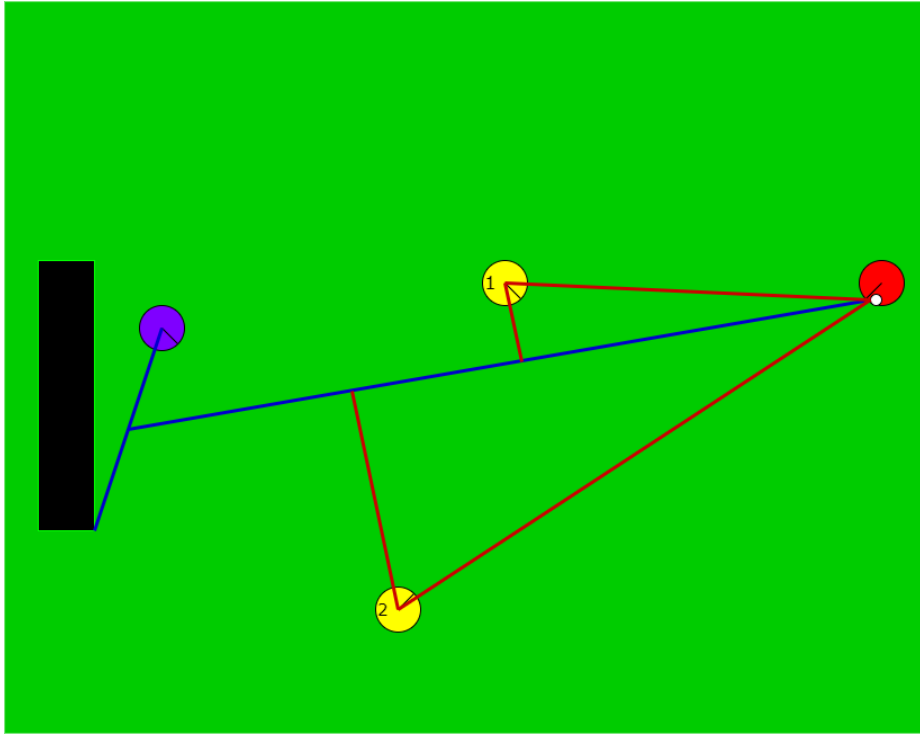
Fig. 1: Player 1 is selected based on the formula, as the length of the red lines
is less for agent 1 than agent 2. The agent will move towards the projection,
and will then start intercepting the ball.

4   Future Work

Tehran2D will begin integrating what we have learnt from reading papers into
our own code base. We will further improve the actions implemented in the base,
and begin using machine learning, specifically Reinforcement Learning to im-
prove decision making. Data-mining and and analytical view of the other teams
could also help improve performance, after establishing solid fundamentals.

References

1. Khayami, R., Zare, N., Karimi, M., Mahor, P., Tekrar, F., Asali, E., Keshavarzi, A.,
   Afshar, A., Asadi, M., Najafi, M.: CYRUS 2D Simulation Team Description Paper
   2014. In: RoboCup 2014 Symposium and Competitions, Brazil, Joao Pessoa, 2014.
2. Akiyama, H., Nakashima, T.: Helios base: An open source package for the robocup
   soccer 2d simulation. In Robot Soccer World Cup 2013 Jun 24 (pp. 528-535).
   Springer, Berlin, Heidelberg.

3. Cheng, Z., Ling, Z., Zhang, G., Jin, W., Yu, T., Zhu, L., Wang, T.: YuShan2015 Team Description Paper for RoboCup2015. In: RoboCup 2015 Symposium and Competitions, China, Hefei, 2015.

4. Zare, N., Karimi, M., Keshavarzi, A., Asali, E., Alipour, H., Aminian, A., Beheshtian, E., Mowla, H., Jafari, H., Khademian, M.J.: CYRUS 2D Simulation Team Description Paper 2015. In: RoboCup 2015 Symposium and Competitions, China, Hefei, 2015.

5. H. Akiyama, T. Nakashima, and S. Mifune, "HELIOS2015 Team Description Paper," pp. 1–6, 2015.

6. Zare, N., Keshavarzi, A., Beheshtian, E., Mowla, H., Jafari, H.: CYRUS 2D Simulation Team Description Paper 2016. In: RoboCup 2016 Symposium and Competitions, Germany, Leipzig, 2016.

7. Akiyama, H., Nakashima, T., Henrio, J, Henn, T., Tanaka, S., Nakade, T., Fukushima, T.: HELIOS2016: Team Description Paper. In: RoboCup 2016 Symposium and Competitions, Germany, Leipzig, 2016.

8. Zare, N., Najimi, A., Sarvmaili, M., Akbarpour, A., NaghipourFar, M., Barahimi, B., Nikanjam, A. : CYRUS 2D Simulation Team Description Paper 2017. In: RoboCup 2016 Symposium and Competitions, Germany, Leipzig, 2016.

9. Akiyama, H., Nakashima, T., Tanaka, S, Fukushima, T.: HELIOS2017: Team Description Paper. In: RoboCup 2017 Symposium and Competitions, Japan, Nagoya, 2017.

10. Cheng, Z., Xie, N., Sun, C., Tan, C., Zhang, K., Wang, L., Zhang, G., She, X., Zheng, X.: YuShan2018 Team Description Paper for RoboCup2018. In: RoboCup 2018 Symposium and Competitions, Canada, Montreal, 2018.

11. Zare, N., Sadeghipour, M., Keshavarzi, A., Sarvmaili, M., Nikanjam, A., Aghayari, R., Firouzkoohi, A., Abolnejad, M., Elahimanesh, S., Akhgari, A.: Cyrus 2D Simulation Team Description Paper 2018. In: RoboCup 2018 Symposium and Competitions, Canada, Montreal, 2018.

12. Noohpisheh, M., Shekarriz, M., Bordbar, A., Liaghat, M., Salimi, A., Borzoo, D., Zarei, A.: Razi Soccer 2D Simulation Team Description Paper 2019. In: RoboCup 2019 Symposium and Competitions: Team Description Papers. Sydney, Australia (2019).

13. Noohpisheh, M., Shekarriz, M., Zaremehrjardi, F., Khademi Ardekani, F., Khorsand, S. A.: Persepolis Soccer 2D Simulation Team Description Paper 2021. In: RoboCup 2021 Symposium and Competitions: Team Description Papers. Worldwide (2021)

14. Akiyama, H., Nakashima, T.: HELIOS2018: RoboCup 2018 Soccer Simulation 2D League Champion.In: RoboCup 2018: Robot Soccer World Cup XVII, pp. 18–22, 2018.

15. Cheng, Z., Xie, N., Zhang, F., et al.: YuShan2019 Team Description Paper for RoboCup2019. In: RoboCup 2019 Symposium and Competitions, Australia, 2019.

16. Zare, N., Sarvmaili, M., Mehrabian, O., Nikanjam, A., Khasteh, S.H., Amini, O., Barahimi, B., Majidi, A., Mostajeran, A.: Cyrus 2D Simulation 2019. In: RoboCup 2019 Symposium and Competitions, Australia, 2019.

17. Akiyama, H., Nakashima, T., Fukushima, T., Suzuki, Y., Ohori, A.: Helios2019: Team description paper. In: RoboCup 2019 Symposium and Competitions, Sydney, Australia (2019).

18. Cheng, Z., Zhang, F., Guang, B., Wang, L. : YuShan2021 Team Description Paper for RoboCup2021. In: RoboCup 2021 Symposium and Competitions, Worldwide (2021).

19. Zare, N., Sayareh, A., Sarvmaili, M., Amini, O., Soares, A., Matwin, S.: CYRUS 2D Soccer Simulation Team Description Paper 2021. In: RoboCup 2021 Symposium and Competitions, Worldwide (2021).
20. Yamaguchi, M., Kuga, R., Omori, H., Fukushima, T., Nakashima, T., Akiyama, H.: Helios2021: Team description paper. In: RoboCup 2021 Symposium and Competitions, Worldwide (2021).
21. Marian, S., Luca, D., Sarac, B., Cotarlea, O.: OXSY 2018 Team Description. In: RoboCup 2018 Symposium and Competitions: Team Description Papers. Montreal, Canada (2018).
22. Marian, S., Luca, D., Sarac, B., Cotarlea, O.: OXSY 2021 Team Description. In: RoboCup 2021 Symposium and Competitions: Team Description Papers. World-Wide (2021).
23. Gabel, T., Sommer, F., Breuer, S., Godehardt, E.: FRA-UNIted–team description 2019. In: RoboCup 2019 Symposium and Competitions: Team Description Papers. Sydney, Australia (2019).
24. Gabel, T., Kloppner, P., Eren, Y., Sommer, F., Breuer, S., Godehardt, E.: FRA-UNIted — Team Description 2021. In: RoboCup 2021 Symposium and Competitions, Worldwide (2021).