

Facing the ball carrier in AI World cup soccer

“What are the best positioning methods for a defender to face the attacking opponent who carries the ball?”

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Background

The AI world cup environment is a virtual environment where two teams with five robots each play a soccer match. The purpose of this environment is to offer participants an accessible way to develop and explore new architectures, strategies and techniques.

Research questions

The main research question “What are the best positioning methods for a defender to face the attacking opponent who carries the ball?” can be divided into three sub questions:

- On which factors should we decide which player should oppose the ball carrier?
- How could we decide where to position a defender to hinder shot access to the uncovered regions of the goal?
- How could we decide where to position a defender to hinder passing possibilities to the opponents team members?

The last sub question can be answered by using the results of related research [2].

Methodology

Marking strategies: man marking and zonal marking. A full defense is needed to evaluate the two marking strategies.

Covering the goal: Comparing two different algorithms: A rule based algorithm and the DDPG[1] Reinforcement Learning algorithm

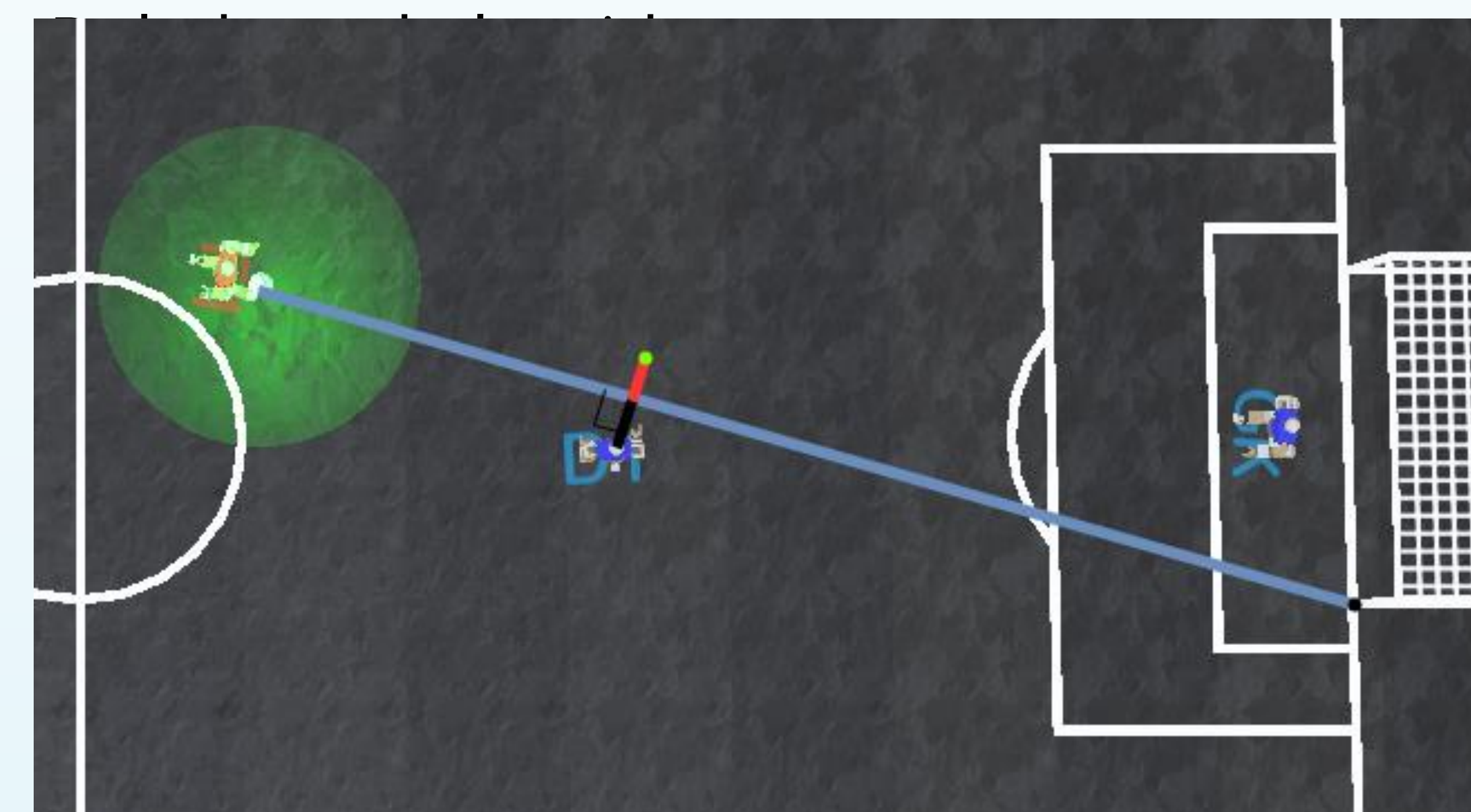


Figure 1: Rule based positioning of the defender. The green point is the target position of the defender. This position is half the width of a robot from the line that has to be covered. In this way, the ball can not be shot past the defender in the direction of the goalpost the defender is covering.

Extending the rule-based algorithm to include teamwork with the keeper:



Figure 2: Rule based teamwork between the defender and the goalkeeper. When the defender is covering the far corner, the keeper moves over to the side that is not covered by the defender, so together they cover the whole goal.

DDPG Reinforcement Learning: Training the defender to block the shot by rewarding the defender when it gets closer to the ball and when he successfully blocks a shot from the attacker

References

- [1] M. Hausknecht and P. Stone, “Deep reinforcement learning in parameterized actionspace,” arXiv preprint arXiv:1511.04143, 2015.
- [2] T. van den Hurk, “Ai soccer: covering an opponent not in possession of the ball,” Tech.Rep. CSE3000-G40-, Delft University of Technology, Fac. EEMCS, 2021

Results

	Run 1	Run 2	Run 3	Mean
Rule-based	7	5	7	6.3
DDPG	11	12	14	12.3

Table 1: Amount of goals conceded out of 100 shots aimed at a random low position of the goal

	Goals conceded
Without teamwork	43
With teamwork	28

Table 2: Amount of shots aimed at one of the top corners conceded out of 100 shots

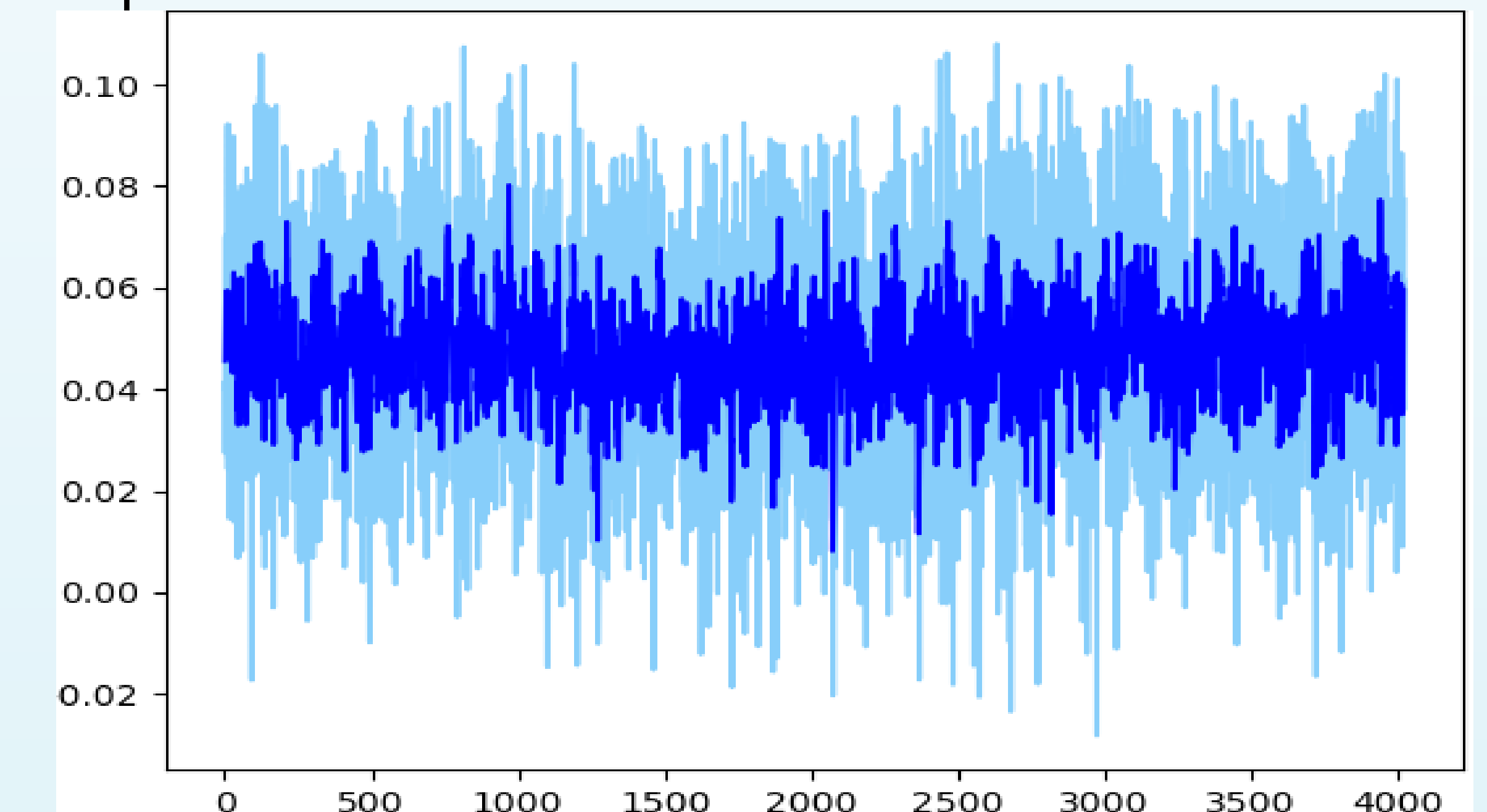


Figure 3: DDPG training. Dark blue: Average reward of all episode. Light blue: Total reward per episode

Conclusion

When covering the goal with the defender, the DDPG algorithm failed to learn a better way of covering the goal than the rule-based solution proposed in this research. The addition of teamwork between the defender proved to be a significant improvement.