Warthog Robotics
Team Description Paper 2013

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Abstract. This paper describes the Warthog Robotics 2D soccer simulation team. The team was runner-up at the Brazilian Robotics Competition (CBR) 2011 and, previously under the name of GEARSIM, won the CBR 2009 and the Latin American Robotics Competition (LARC) 2010. In this paper is presented the current team research focus, which has been designed and implemented within this last year.

1 Introduction

The Warthog Robotics 2D soccer simulation team is a branch of the Warthog Robotics Team [1], which was created in 2011, after the merge of two previous robotics groups, GEAR and USPDroids, both competitors at the Brazilian Robotics Competition during several years. Besides the 2D simulation league, the team also participates in two other categories of the Robocup, the 3D simulation league and the SSL.

Our approach to the simulation 2D league is the research of decision making in dynamic multi-agent systems. Based on the uncertainty and the subjective character of each simulation 2D game, and on [2], [3], [4], [6], [7], we have chosen a fuzzy system technique to determine the team formation, merging both previous works [6], [7], so that both behavior and positioning of each agents were affected. This method will be presented further on this paper.

The Warthog 2D Team is based on Agent2D base source code [5], due its nice and clear implementation of the low-level layer, and its easiness in developing intelligent approaches in the high-level layer.

2 Fuzzy System Formation Chooser

In our previous works, fuzzy systems were implemented on the coach, and they could alter either the positioning of the agents [7], or its behavior [6]. In this new approach, the coach uses both fuzzy systems, blends them and generate a new formation which affect both positioning and behavior, changing completely the attitude of the agents, creating a whole new dynamics to the game.

This new fuzzy system has four inputs and two outputs. These parameters are, respectively:

- Time - Number of game cycles (Figure 1);
- Successful Attacks - Value in percentage (%) (Figure 2);
- Successful Defenses - Value in percentage (%) (Figure 3);
- Ball position – Value of the *X* coordinate, where the value 0 is the minimum value, and 105 the maximum value (Figure 4);
- Stress Level – Represents the behavior to be adopted (Figure 5);
- Tactical Formation – Represents the position to be adopted (Figure 6).

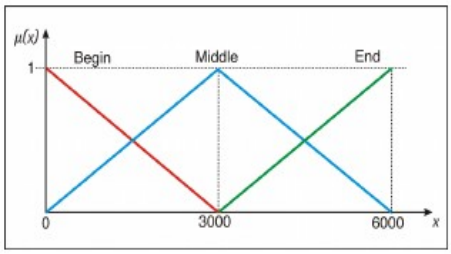

Fig. 1 – Total game time [6].

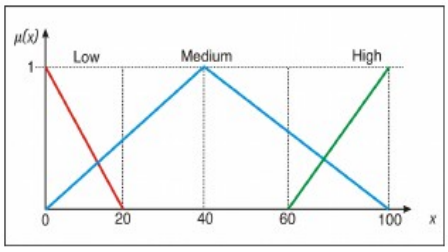

Fig. 2 – % Successful Attacks [6].

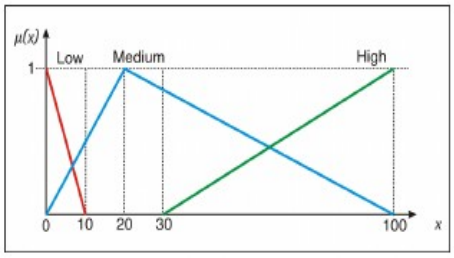

Fig. 3 – % Successful Defenses [6].

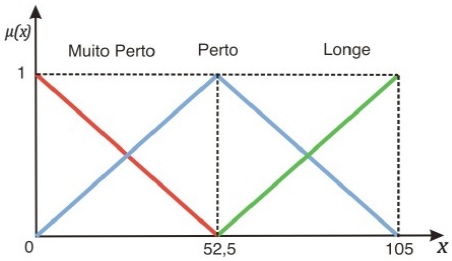

Fig. 4 – Ball Position [7]*.

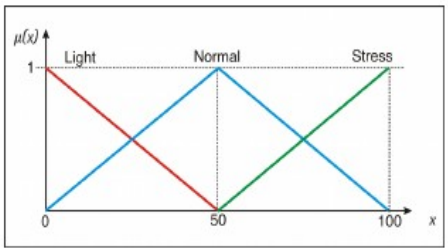

Fig. 5 – Stress Level [6].

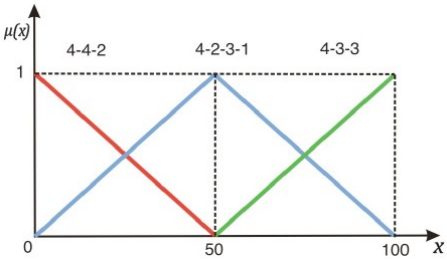

Fig. 6 – Tactical Formations [7].

*some parameters are not in English:
”Muito perto” stands for “Too close”;
“Perto” stands for “close”;
“Longe” stands for “Far away”.

Due to the mathematical complexity of calculating this new fuzzy system and the limitation of time to perform calculations between each game cycle, we have decided to calculate each fuzzy system separately, and the merge the two results.

Comparing with the previous works, instead of having only three behaviors with one positioning, or three different positioning with only one behavior, there are nine possible combinations of formations, as represent on table 1.

Behavior\Formation	4-4-2	4-2-3-1	4-3-3
Stressed	442_S	4231_S	433_S
Normal	442_N	4231_N	433_N
Light	442_L	4231_L	433_L

Table 1 – Possible combinations of formations.

It is interesting to point out that both fuzzy systems shares one input (time), and they are influenced by each other. When the formation chosen is the offensive (433), the team tends to attack more, make more shots at goal. This affects the percentage of successful attacks, which affects the choice of the behavior. With more attacks, the behavior chosen tends to be light, which prioritizes a more prudent behavior, with less wrong passes. This generates a more defensive behavior, which causes the ball position (*x* coordinate) to be smaller, influencing the choice of the formation.

3 Updates and Corrections

Updates at the source code were made after the issues that occurred at the RoboCup in Mexico (2012). The previous team version had for dependency the *librcsc3.1.1*, and despite all the help from Luis and Fernando from *FCPortugal2D*, the code did not work at all, so an emergency version was developed. This version had lots of bugs and reduced functionality, which led to bad results in the competition.

The effort of *Warthog Robotics Team* during the end of 2012 and the beginning of 2013 was to adjust and update the previous code, which was based in *librcsc3.1.1*, to the newest *librcsc* available (*librcsc4.1.0*). Also the team went through personnel changes, which required deep modifications in the team management, and training of new students to support and encourage the development of the simulation 2d category and carry on the previous work.

4 Conclusion and Future Plans

This paper briefly describes the Warthog Robotics 2D Simulation Team, its current efforts and research areas. We have merged two previous researches in a new fuzzy system that affects both behavior and positioning of the agents. Tests and improvements are still being performed, since the amount of coding needed to implement all the new behaviors were considerably high, but the preliminary results are quite satisfactory.

Our plans for the future includes some reinforcement learning techniques applied to the goalie, and a swarm approach for the agents navigation.

References

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