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Autonomous robot soccer matches

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Abstract

The Dutch Nao Team develops fully autonomous soccer behaviors for bipedal robots. In the process of doing so, several fields of artificial intelligence have been explored such as: behavior representations, sound recognition, visual search algorithms and motion models. To showcase the latest developments a penalty shoot-out will be demonstrated.

1 Introduction

Emulating human behaviour and motion is not an easy task. In an effort to incentivize research in these areas, RoboCup offers various platforms at which teams compete, one of which is robot soccer. Using robots, a team is required to program them in such a way that they will autonomously play a match, usually in a five versus five format. One of these teams is the Dutch Nao Team (DNT), consisting of a collaboration between the Universiteit van Amsterdam, Universiteit Maastricht and previously the Technische Universiteit Delft. To reach the goal of playing autonomous soccer with a robot, several main topics of artificial intelligence and robotics have to be combined such as: behavior representations, sound recognition, visual search algorithms and motion models.

2 RoboCup & Standard Platform League

The RoboCup was originally founded in 1997, and has the goal to win with a fully autonomous humanoid robot soccer team against the 2050 FIFA world champion. In order to accomplish this goal, RoboCup has divided itself in multiple leagues, each of which has a different research focus. In the Standard Platform League (SPL), in which DNT participates since 2010, contestants play with identical robots (hence the Standard Platform), which means that the team with the best algorithms in theory wins. The robots used in this league are the bipedal NAO robots as can be seen in Figure 1.



Figure 1: NAO robots in a game at the RoboCup Leizig 2016.

3 The demonstration

The demonstration will feature a display of one attacker versus a goalkeeper on a smaller field, who will try to autonomously score in the goalkeepers goal. Except for the field size, the demonstration will follow the RoboCup SPL rules of next year's competition in Nagoya, Japan. This includes a ground surface of 6 mm high artificial grass, which is a big difference in respect to previous years' flat carpet field. This means that our team has to demonstrate their latest developments in the walking engine. The demonstration requires an area of at least three by six metres. Another challenge is natural lighting conditions; currently a team of honours students is improving the ball-detection algorithm to cope with dynamic lighting (in 2016 the first games outdoor were played).

4 Showcased work

The demonstration showcases work from several publications and theses¹. It includes, but is not limited to:

- automatic whistle detection [1] to start matches;
- localization [3] supported by a visual compass that updates over time [4];
- robot detection based on Haar-like features [5].

For a more detailed overview of the team's work, we refer to the latest team qualification document [2]. In the 2016 competition the team had the best result so far, it became ex-aequo second in the first-round and was later eliminated in a shoot-out of the play-in round².

5 Conclusion

The demonstration allows to show the challenges, research and application of several fields of artificial intelligence behind the RoboCup initiative, which will be explained in more detail by one of the keynote speakers.

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¹<http://dutchnaoteam.nl/publications/>

²<https://www.youtube.com/watch?v=kQl1MMRLfMI>