UT Austin Villa: A Machine Learning Approach for Kicking and Passing

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Over the past several years the RoboCup 3D simulation league has been evolving from a competition dominated by good walking and dribbling skills to one in which multiagent kicking and passing behavior is increasingly important. This presentation will give an overview of the UT Austin Villa team's approach, incorporating machine learning, to the following topics necessary for kicking and passing the ball to teammates.

• How to approach and kick the ball to different targets
To successfully pass the ball to teammates an agent needs to be able to approach and accurately kick the ball to different positions on the field. The UT Austin Villa team accomplishes this by using the CMA-ES algorithm and overlapping layered learning [1] methodologies to optimize kicks for different distances.

• Where to kick the ball
Ideally an agent wants to kick the ball to a teammate, into the opponent's goal, or move it to another advantageous position on the field. UT Austin Villa computes a scoring function for different potential targets to kick the ball to and then chooses the target with the highest score.

• When to kick the ball
When approaching the ball an agent must decide if there is enough time to attempt a kick so that opponents will not get to the ball first or block the kick. The UT Austin Villa team trains a logistic regression classifier to determine when there is enough time to kick the ball.

• How to have teammates move to receive a pass
For a teammate to receive a pass the teammate needs to know where to position itself to collect the ball after it is kicked. UT Austin Villa has the player kicking the ball broadcast the intended target of the kick to its teammates, and then uses SCRAM role assignment [2] to select which players should move toward the anticipated location the ball is being kicked to.

The presentation will conclude with a demonstration of a keepaway task in which a team is able to maintain possession and keep the ball away from the 2014 RoboCup champion UT Austin Villa team for over two minutes.

1. P. MacAlpine, M. Depinet, and P. Stone. UT Austin Villa 2014: RoboCup 3D simulation league champion via overlapping layered learning. In *Proceedings of the Twenty-Ninth AAAI Conference on Artificial Intelligence (AAAI)*, January 2015.
2. P. MacAlpine, E. Price, and P. Stone. SCRAM: Scalable collision-avoiding role assignment with minimal-makespan for formational positioning. In *Proceedings of the Twenty-Ninth AAAI Conference on Artificial Intelligence (AAAI)*, January 2015.