# Learning through Decision Tree in Simulated Soccer Environment

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## Abstract

*The robotic soccer is one of the most complex multi-agent systems in which agents play the role of soccer players. The characteristics of such systems are: real-time, noisy, collaborative and adversarial. Therefore, playing agents must be capable to making decisions. This paper describes the use of decision tree to kick and catch the ball for two simulated soccer agents. One player shoots towards the goal and the other plays the role of goalkeeper. Experimental results have shown that rules achieved from decision tree lead to more effective operations in simulated soccer agent.*

## 1. Introduction

One of the main goals of robotic soccer environments is to have a perfect domain for researchers and a standard problem for investigating and examining new artificial intelligence as well as multi-agent approaches and techniques [1 and 2].
In RoboCup simulation [3], where the challenge is to learn a group of agents to play soccer, playing agents connect to the server which gives environmental inputs and receives actions from them [4].
Many attempts have been made for the soccer agents to have the ability to learn in continuous soccer environment since last decades; because the problem detected for the limited number of samples. On the other hand it is possible to assign symbolic decisions in decision trees to new samples. Therefore decision trees are being used for decision making and classification in machine learning.
This paper investigates the use of decision tree for learning the kicking and catching skills of soccer agent acting in the RoboCup 2D simulator.
To this end, we make use of well-known algorithm for creating decision trees. The C4.5 algorithm is a powerful method which creates small decision trees and increments learning speed in real-time soccer environment [5].
The paper is organized as follows: section 2 describes C4.5 algorithm concisely. Section 3 describes the dataset and how it is selected by simulated soccer agents. Section 4 presents the experiments performed, and shows the rules obtained the decision tree. Finally, the conclusion is presented in section 5.

## 2. C4.5 algorithm

C4.5 is an algorithm introduced by Quinlan which summarizes the learning data in the form of a decision tree.
C4.5 uses the fact that each feature of the data can be used to make a decision that splits the data into smaller subsets [6]. C4.5 examines the normalized information Gain that results from choosing a feature for splitting the data. The feature with the highest normalized information gain is the one used to make the decision. The algorithm then recurs on the smaller sub lists and terminated when all the samples in your list belong to the same class.

## 3. Implementation and practical Experimental

To select dataset we have used two agents: One player that shoots towards the goal by scoring policy that used by UvA team [7 and 8] and the other goalkeeper.
Each of these samples includes five features:

- The head angle of the goalkeeper (GHA)
- The body angle of the goalkeeper(GBA)
- The head angle of the player shoots the goal(SHA)
- The body angle of the player shoots the goal(SBA)
- The distance between the ball and the goalkeeper(BDG)

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