
GUARANÁ Robot-Soccer Team: Some Architectural Issues

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Abstract This paper describes the GUARANÁ robot-soccer team that was vice-champion of the FIRA'98 Games in the MiroSot category. An overview of the vision and the strategy modules is presented, and the hardware and software architectures of the main computer and of the robots are described.

1 Introduction

Soccer enthusiasts consider the sport an exciting strategic and artistic game, which is usually decided by the technical and physical abilities of the players as well as by their collective strategy. Likewise, robot soccer is an exciting strategic game that serves to develop applications and test techniques in computer vision, artificial intelligence and multi-agent systems. Speed, ball handling, decision making, and the team's capacity to cooperate determine the result of the game.

The MiroSot category of FIRA games is played between two robot-soccer teams, each one comprising three robots. On top of each robot is a label — blue for one team and yellow for the other — through which the vision system can identify and locate robots. Vision tasks are performed by a computer using images originating from a single camera hanging over the center of the game field. The resulting information is used by a strategy module which commands the robots via wireless communication.

This paper describes the GUARANÁ team, worldwide vice-champion team of FIRA'98 in the MiroSot category. Section 2 presents the architecture of the team and gives an overview of the vision and strategy modules. Section 3 describes its hard-

ware and software and discusses engineering issues regarding the central computer and the robots.

2 Team architecture

The GUARANÁ team architecture is composed of vision, prediction, strategy, and communication modules. In the next subsections, we describe each of these modules.

2.1 Vision

Image interpretation — essentially recognition of players and ball — is based on the colors of the image captured by the camera. We used two rectangular labels with a black margin on top of each GUARANÁ player. The first label has the team color — either blue or yellow — and the second, pink label assists the vision module in determining the robot's orientation. The ball used in the game is an orange golf ball. Figure 1 shows the labels used on top of the GUARANÁ robots.

A preliminary image processing phase consisting in subtracting an image of the empty field from the captured image is used to simplify and speed up interpretation. This subtraction occurs only in R and G channels of the image, since these are sufficient to detect any variation of every necessary color in the application. Pixels for which the result of the subtraction is bigger than a pre-established threshold are considered possible elements of the game (ball or labels). Their color patterns are analyzed using values taken from both R/G and G/B relations, in order to reduce influences of ambient illumination. Color identification is