Robot soccer without color constraints

MIPAL TEAM

I. Motivation

The main aim of RoboCup is to progressively advance the research challenges in robotics by presenting a soccer tournament played by robots. One of the main aspects that shall evolve each year is the need for color coding. For instance, in 2012 goals of the same color were adopted. However, other color restrictions have not been modified. The field remains green with white lines on it, the colors of the teams are predefined cyan and magenta and the ball continues to have no pattern and only orange. It would be interesting to remove these restrictions. Once we overcome these restrictions, each team would be able to wear its own uniform with only small color limitations to distinguish from the opponent's uniform. That would mean that at the beginning of the game each robot would have to learn which are its opponents' colors. As a consequence, we could have matches where the color of the ball, or even the goals color is not pre-determined.

II. Implementation

Assuming that colors of objects are no longer predetermined means that our previous knowledge of colors is not reliable for the match. A new parameter is needed for objects recognition, and we propose to use shapes. However, computer-vision techniques for shape recognition are, computationally, much more CPU-intensive than color recognition and perhaps they are unaffordable during the game. For this reason, our challenge proposal consist of identifying objects by their shape and extracting the colors from within these shapes. This would be implemented by identifying the objects on the basis of their shape and learning autonomously the colors of the recognized objects. The chosen shape recognition algorithm is the Histogram of Oriented Gradients, this method has been proved to be capable to recognize complex objects. Actually, this algorithm is widely used for pedestrian recognition. The most complex objects we want to recognize are other NAOs, similar in complexity for their anthropomorphic shape but less variable than human beings.

III. Demonstration

At the RoboCup Open Challenge we will position a NAO in a field where some of the colors of objects will be changed. The robot will learn the different colors and will prove it by playing and kicking the ball.
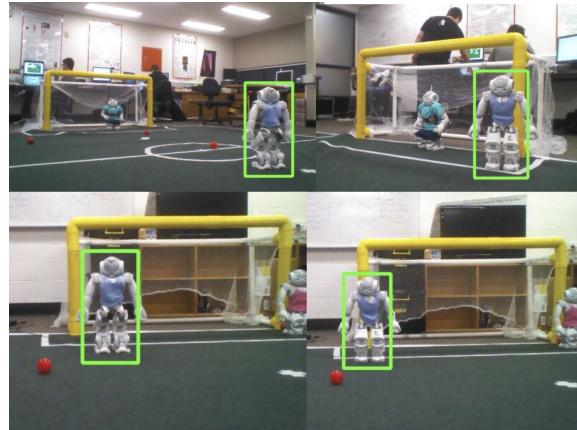

Figure 1: *Recognition of standing up NAOs with HOG*