

Shape Based Round Object Detection Using Edge Orientation Histogram

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Abstract. In this paper we introduce a shape based method to globally detect the ball in a RoboCup soccer scenario. The method can be used for any round object with detectable edges. The concept of integral images presented in Viola & Jones 2001, is used, however the integration is applied to a vector representation of the gradient orientation histogram of each pixel. The method takes advantage from the fact that large areas of the image can be filtered out, as these are only covered by straight edges. An overlapped binary search quickly reduces the search area and locates ball candidates in the image. The candidates are finally selected using an outlier elimination technique.

1 Introduction

Shape based object detection methods are often more reliable than methods that rely on color information. However, this is generally achieved at the cost of more processing power. The computational effort can be strongly reduced if the generality of the scenario is limited.

RoboCup Soccer is such an example. According to the RoboCup 2050 mission, robots shall be capable of tolerating outdoor lighting conditions and play with a standard FIFA ball. To reach this goal, the rules are shifted year by year to motive researches.

The work presented here is inspired by the previous work on *Histogram of oriented Gradients*¹ introduced by Dalal and Triggs[4]. Originally, the HOG algorithm focused on the problem of pedestrian detection in static images. Today it has expanded to other objects such as animals, vehicles and other media such as video streams. The method is of great importance as it is only based on the shape data of the image rather than other more environment-dependent information like brightness and color. The method we present here extends this idea by using integral images and an overlapped binary search. To accelerate the algorithm we were also inspired by intensity integral images presented in Viola et al. [12].

Ball detection without color information has been focused on in RoboCup competitions since its early years, as the RoboCup 2050 goal includes the use of a standard FIFA ball. The use of an arbitrary ball in RoboCup competitions is still limited to the "technical challenges" in many leagues. The biggest improvements

¹ HOG