DIGITAL IMAGE PROCESSING - PROJECT PROPOSAL

By: It’s Something

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Problem Statement

Dart board scoring is often done by eyeballing the board and calculating the points. Nowadays, even plastic dart boards with inbuilt sensors are available, but the sensors in the boards are highly prone to damage from dart impacts over time. This leaves image processing methods. The problem dealt with in this paper is thus to score a dart board using image processing techniques. We should be able to accurately determine the location of a dart on the board and score it accordingly.

There are further optimizations mentioned in the research paper to decrease computation time which we can tackle if time permits.

Project Solution - At a glance

The point of this project as a whole is to create a point-to-number pixel mapping, which maps each pixel to a value relating to the number of points the each region on the dart board is worth. The detection of each region is done is based on the intensity values obtained from the colored image.

Deliverables -

- Regional masks for two-point and three-point regions (binary mask)
- Single-point region segments on the board (binary mask)
- Filters for removing any unnecessary glare and finding the dart's location

Implementing the Deliverables

In order to create regional masks, Otsu's thresholding must first be used to eliminate unnecessary background pixels. Since the format of a dartboard is already known, we may generate a pixel mask of the dartboard's point multiplier areas.

To give point values to each slice, we may also determine the radial dividers of the board using the Hough transform. Any respectable edge detection technique coupled with the Hough transform may accomplish this job. We choose the 10 most notable edges for this in hough transform.

Implementing the Deliverables

Knowing that double and triple rings consist only of red and green sections that alternate, we may take the intensity of the red and green channels and delete additional pixels. This provides the coordinates of each segment's radial border for point maps. A logical OR of these masks produces rings around the double and triple multiplier zones, as well as the bull's eye.

We may use closing to create continuous rings to iterate over the radial dimension more efficiently. After this, basic image arithmetic is used to produce masks for each portion of the acquired picture (point maps).

Implementing the Deliverables

Once the point map is complete, all that remains is to locate the dart and award a score. We utilise Sift match to check that both images (with and without the dart) are properly aligned using homographic transposition. The images are smoothed and a difference is calculated to locate the dart.

We rerun OTSU for a better thresholded picture and then dilate the image to combine the dart's segmented sections. After determining the dart's angle, we may determine where the dart's tip truly landed.

Since each dart is color-coded, we can easily determine which dart belongs to which player based on the colour values.

Project Timeline

Week 1: Dividing the dartboard picture into 1-point, 2-point, 3-point, inner and outside bullseye, and zero-point zones and assigning these regions their associated multipliers.

Week 2 - After establishing multiplier zones, split the dartboard into several angular sections and assign them points, and be able to determine the precise value of each pixel in the picture.

Week 3: Using image processing methods to determine the dart's position in the picture and to identify the dart's owner.

Weeks 4 and 5 - Integrating all of the preceding subparts to produce our end output of calculating and obtaining a dart's score, troubleshooting issues, and presenting our work