IP'21 Apps Specs

2- Shooting Target Score

# Description

## Main Idea

A shooting sport is a competitive sport that involves testing accuracy and speed of contestants in aiming at targets. Shooting targets come in various forms and shapes and are used for firearm shooting practice (pistol, rifle, shotgun), as well as other non-firearm related sports (darts, target archery, crossbow).

The center of the target is often called the bullseye, which gives the highest points. Less points are given for hitting further ranges away from the center. Usually the referee, or the shooter, examines the target after a shooting session and calculates the score by summing the points associated with marks/holes on the target. This application aims to automate this process.

Assume the shooting target is round and consists of a board with several circles (ranges) stemming from the center (see figures below). The application should “examine” the target, detect the hits if any, and evaluate a final score depending on the locations of these hits.

### Rule

* A bullseye hit (smallest circle): (100 × number of ranges) points.
* Each ranges hit is 50 points less than the previous range.
* If a hit spans two ranges, take the best-score range.

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| **Input** | D:\Dropbox\[Teaching]\[IP'16]\Apps\Shooting Target Score\Samples\depositphotos_30644581-Shoot-target-bad-missing.jpg | D:\Dropbox\[Teaching]\[IP'16]\Apps\Shooting Target Score\Samples\12185089-Target-with-bullet-holes-grunge-background-Stock-Photo-target-shooting-gun.jpg | D:\Dropbox\[Teaching]\[IP'16]\Apps\Shooting Target Score\Samples\Target50_1.jpg |
| **Output** | Bullseye hit = 100×7=700  Total score = 1×500 + 2×450 + 3×0 = 1400 | Bullseye hit = 100×5=500  Total score = 2×500 + 3×450 = 2350 | Bullseye hit = 100×7=700  Total score = 2×650 + 2×600 + 1×550 = 3050 |

## Minimum Requirements

Compute the score from a picture of a shooting target with:

1. Frontal view with no background scene.
2. Frontal view with background scene (possibly other objects).
3. Different distances from the camera.
4. Any color and any number or ranges.

## Possible Add-ons (Bonuses)

Compute the score from a picture of a shooting target with:

1. Varying illumination conditions and noise.
2. Arbitrary perspectives (different camera angles).
3. If a hit spans two ranges, take the range which contain max part of the shot.
4. Different shapes (e.g. human board for gun target practice).

# Suggested Search Tracks and Keywords

You may use some/all of the following keywords as a guide (not restricted to them):

1. Segmentation
2. Hough transform
3. Morphological operations
4. Region properties
5. Color processing

# Test Images for Minimum Requirements

Case1: Frontal scene of a shooting target with no other objects.

Case2: Frontal scene of a shooting target with background scene.

Case3: Cases 1, 2 with different colors and ranges.

Case4: Cases 1, 2, 3 with varying distances from the camera.

# Test Images for Bonuses

Case5: Non-uniformly illuminated versions of cases 1-4.

Case6: A scene of a shooting target from arbitrary perspectives.

Case7: Samples from previous cases with one or more hits span two ranges

Case8: Different target shapes.

# References

1. Textbook Ch. 3: Intensity Transformations and Spatial Processing
2. Textbook Ch. 9: Morphological Image Processing
3. Textbook Ch.10: Image Segmentation
4. Textbook Ch. 11: Representation and Description