

Seminar 3



Circles: An Existential Crisis

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What I intended to achieve

- I promised the world: Assess electronic rifle scoring solutions. LASER vs computer vision.
- In the end: Built a computer vision system that focused on novel ways of finding circles and their perspective, then warping them. It also happened to be able to score them afterwards.
- Focus was shifted from building a product to developing novel heuristic based techniques, actual research was more interesting than what I intended to do.
- I developed an understanding for generalised algorithms that try to achieve what I built heuristic algorithms for.

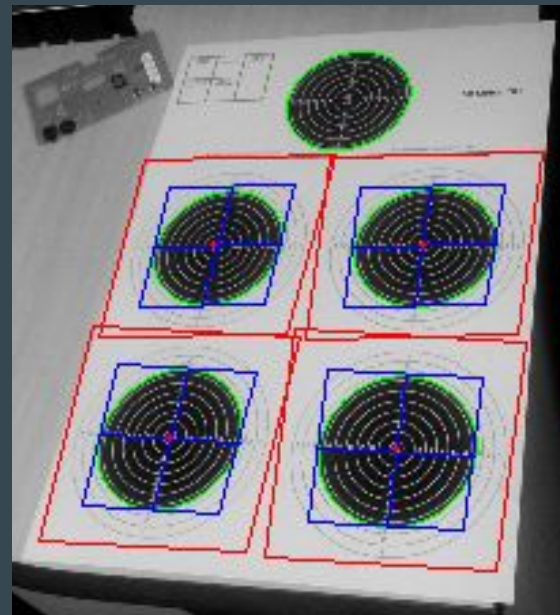
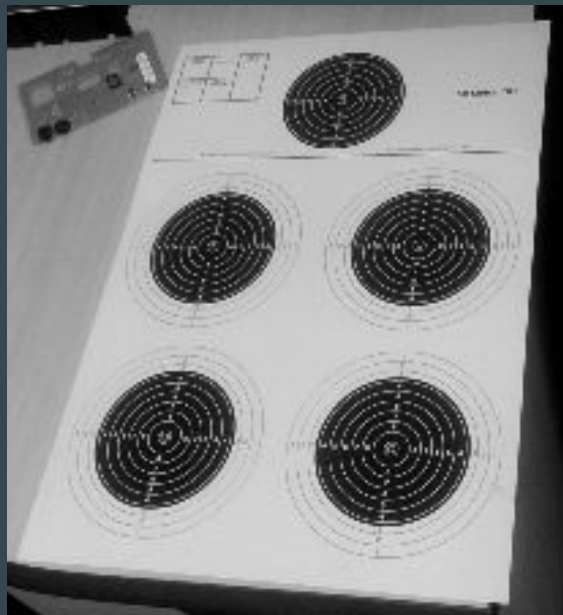
Demonstration

Process

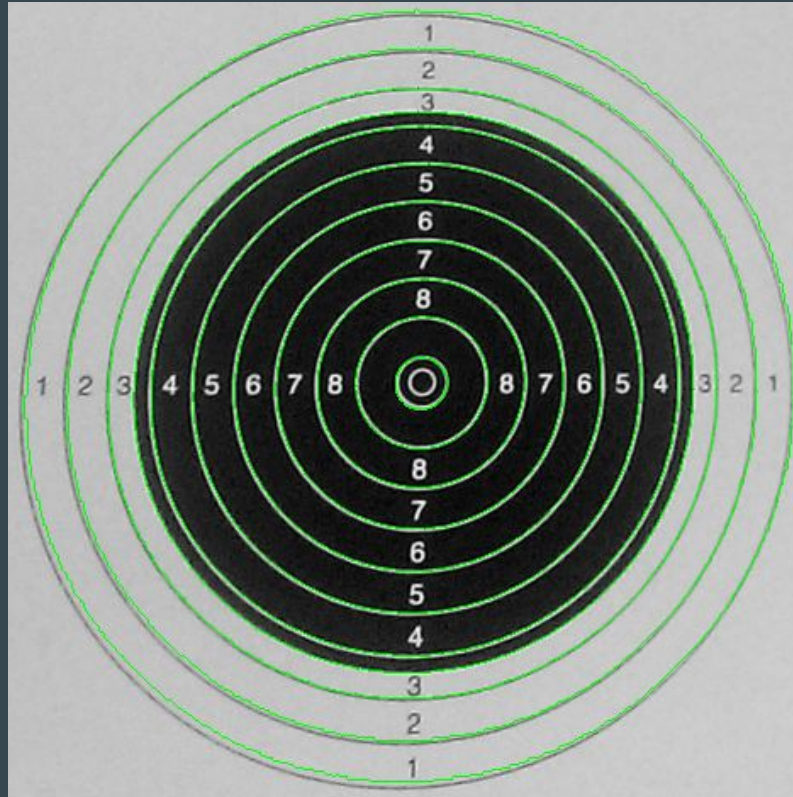
Two major components to the system:

- Calibration
 - Finds target in the image and determines static properties about each target unit, such as: position, perspective transform and ring locations in the post-warped image.
- Scoring
 - Uses static info produced in calibration to score bullet holes in the target unit.

Process - Calibration



Process - Calibration



Putting problems with “circles” into perspective



A perfect ellipse is hopeful. The cap was in the centre of the image hence regular shape, if it were out of centre then it would be distorted.

All real world “circles” are ellipses within some acceptable error



Process - Calibration

Find target units in image:



1. Recursive edge detection, discard open contours
2. Discard contours that are not in size range.
3. Determine circularity: compare area of contour to area of circle with diameter equal to contour's average width.
4. If there are more than 5 candidates, discard based on:
 - 4.1. Percent black
 - 4.2. Position
 - 4.3. Relative Size

Process - Calibration

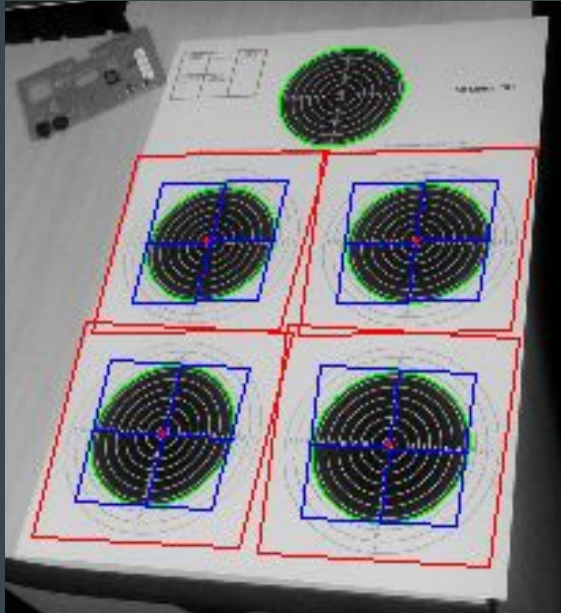


Smoothing

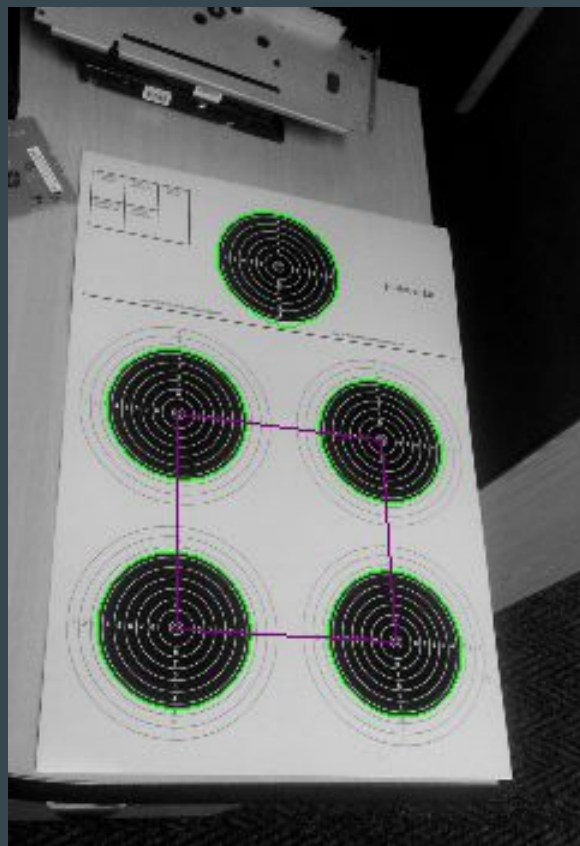
Process - Calibration

Find Transform Matrix

1. Centres of 4 targets
2. Line through target numbers



Process - Calibration



Process - Scoring

```
146.231.123.6 - PuTTY  
pi@spyro:~$ score_baby.py  
Score is as follows:  
10-ring: 4  
9-ring: 3  
8-ring: 1  
Total Score: 75  
pi@spyro:~$ █
```

