

# Advanced Vision Assignment 2 Report

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26th February 2013

## 1 Introduction

This report describes the work done for the second assignment of the AV course. The aim of the assignment was to track three coloured balls through a set of video frames. The algorithm for ball detection and segmentation is discussed. The performance of the approach is evaluated using a gold standard.

## 2 Algorithm and implementation

In order to segment out the balls from the subject image (the current frame being considered), we removed background regions, and thresholded using values obtained from training data.

The following regions had to be removed from the image:

1. Static background
2. Juggler's clothing
3. Juggler's hands
4. Juggler's face
5. Shadow caused by the juggler on the door

To remove the above regions the following techniques were applied:

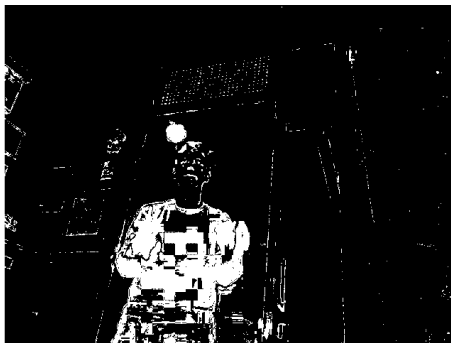
1. Average background subtraction
2. NRGB colourspace
3. HSV colourspace
4. Training samples based on ground truth



## 2.1 Static background

A picture of the empty room had been given, however when subtraction of the background from the subject image did not eliminate the shadow of the door, which had similar values to the yellow ball even in normalized RGB. Thus we obtained a mean of all the frames and used the resulting image as the background; By converting the subject and the new background images to N-RGB, subtracting and thresholding out the low brightness regions we obtained a mask which eliminated:

1. Static background
2. Shadow on the door
3. Juggler's face



## 2.2 Slant normalisation

Another algorithm.

# 3 Experiments and results

# 4 Discussion and Conclusion

## 4.1 Formatting: tables

An example of a table is shown as Table 1. Somewhat different styles are allowed according to the type and purpose of the table.

Table 1: *This is an example of a table.*

ratio	decibels
1/1	0
2/1	$\approx 6$
3.16	10
10/1	20
1/10	-20
100/1	40
1000/1	60

To include text without formatting, use this (scriptsize uses a significantly smaller font, intermediate sizes are footnotesize and small):

I\O	1	2	3	4	5	6	7	8	9	10
1	71.2	8.8	1.2	0.0	2.5	3.8	7.5	0.0	5.0	0.0
2	0.0	87.5	1.2	0.0	2.5	2.5	0.0	5.0	0.0	1.2
3	0.0	0.0	67.5	5.0	1.2	11.2	3.8	7.5	3.8	0.0
4	0.0	0.0	1.2	62.5	3.8	22.5	0.0	6.2	2.5	1.2
5	0.0	2.5	0.0	0.0	76.2	0.0	1.2	6.2	0.0	13.8
6	5.0	1.2	6.2	21.2	5.0	47.5	1.2	5.0	1.2	6.2
7	17.5	6.2	3.8	0.0	5.0	0.0	57.5	0.0	10.0	0.0
8	0.0	0.0	2.5	1.2	8.8	0.0	0.0	73.8	2.5	11.2
9	11.2	0.0	2.5	8.8	2.5	3.8	5.0	2.5	61.3	2.5
10	1.2	0.0	0.0	2.5	20.0	0.0	0.0	12.5	0.0	63.7

If you want to use both columns, put it in a figure\*: (figure\* uses both columns, figure just 1): it is likely to float away to an unexpecte place, though.

I\O	1	2	3	4	5	6	7	8	9	10
1	71.2	8.8	1.2	0.0	2.5	3.8	7.5	0.0	5.0	0.0
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7	17.5	6.2	3.8	0.0	5.0	0.0	57.5	0.0	10.0	0.0
8	0.0	0.0	2.5	1.2	8.8	0.0	0.0	73.8	2.5	11.2
9	11.2	0.0	2.5	8.8	2.5	3.8	5.0	2.5	61.3	2.5
10	1.2	0.0	0.0	2.5	20.0	0.0	0.0	12.5	0.0	63.7

Figure 1: Confusion Matrix

## 4.2 Maths, if needed

$$x(t) = s(f_{\omega}(t)) \quad (1)$$

where  $f_{\omega}(t)$  is a special warping function

$$f_{\omega}(t) = \frac{1}{2\pi j} \oint_C \frac{\nu^{-1k} d\nu}{(1 - \beta\nu^{-1})(\nu^{-1} - \beta)} \quad (2)$$

A residue theorem states that

$$\oint_C F(z) dz = 2\pi j \sum_k \text{Res}[F(z), p_k] \quad (3)$$

Applying (3) to (1), it is straightforward to see that

$$1 + 1 = \pi \tag{4}$$

And here is an included image (png and pdf formats are allowed).

### 4.3 References

References should be numbered in order of appearance, for example [1], [2], and [3]. You *can* use `bibtex` to prepare references, or do it by hand if there are very few.

### References

- [1] Smith, J. O. and Abel, J. S., “Bark and ERB Bilinear Transforms”, IEEE Trans. Speech and Audio Proc., 7(6):697–708, 1999.
- [2] Lee, K.-F., Automatic Speech Recognition: The Development of the SPHINX SYSTEM, Kluwer Academic Publishers, Boston, 1989.
- [3] Rudnick, A. I., Polifroni, Thayer, E. H., and Brennan, R. A. ”Interactive problem solving with speech”, J. Acoust. Soc. Amer., Vol. 84, 1988, p S213(A).