

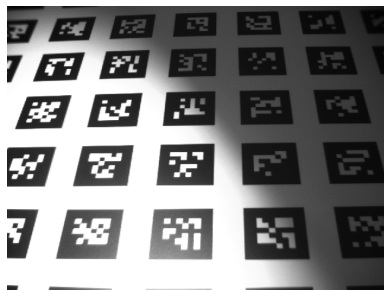
**Note**

All printed documents allowed. Send your matlab code via the campus website (zip files if several files are to be sent).

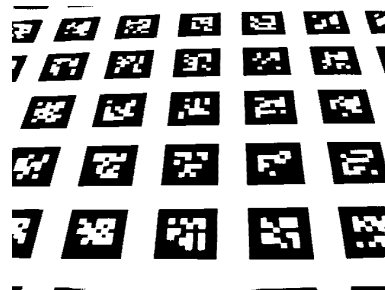
## 1 Segmentation (13 points)



- Segment the image.



(a) Image to be segmented, from [1].



(b) Segmented image

Figure 1: Test image

## 2 Integral image (7 points)

If the original image is denoted  $f$ , the integral image  $I$  is defined by the following equation, for all pixels of coordinates  $(x, y)$ :

$$I(x, y) = f(x, y) + I(x - 1, y) + I(x, y - 1) - I(x - 1, y - 1)$$



- Code a function that computes this integral image. The prototype of this function must be `function II=int_image(I)`.
- Code a function that computes the local average of the image  $f$ . Notice that:

$$\sum_{x=x_1}^{x_2} \sum_{y=y_1}^{y_2} f(x, y) = I(x_2, y_2) - I(x_2, y_1 - 1) - I(x_1 - 1, y_2) + I(x_1 - 1, y_1 - 1)$$

- Compare it to a mean filter coded with the matlab functions `imfilter` and `fspecial` (result and computation time).

## References

- [1] Derek Bradley and Gerhard Roth. Adaptive thresholding using the integral image. *Journal of graphics tools*, 12(2):13–21, 2007.