FMAN20 - Assignment 1

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The image matrix is given by

$$f = \begin{bmatrix} 0 & 11.25 & 15 & 11.25 & 0 \\ 0 & 11.25 & 15 & 11.25 & 0 \\ 0 & 11.25 & 15 & 11.25 & 0 \\ 0 & 11.25 & 15 & 11.25 & 0 \\ 0 & 11.25 & 15 & 11.25 & 0 \end{bmatrix} \tag{1}$$

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4.1   Scalar Product

The scalar product of two images f and g is defined as

$$f \cdot g = \sum_{i=0}^{M} \sum_{j=0}^{N} f(i,j) g(i,j). \tag{2}$$

4.2   Norm

The norm of an image f is defined as

$$\|f\| = (f^* \cdot f)^{1/2}. \tag{3}$$

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The MATLAB code for segmentation (`im2segment.m`) is listed below:

```
function [S] = im2segment(im)
% [S] = im2segment(im)

nrofsegments = 4;
m = size(im,1);
n = size(im,2);

% Thresholding algorithm. Set all 'pixels' < T = 0
% This improves contrast.
T=220;
im2 = im; im2(im2 < T) = 0;
% Invert the pixels (convert white -> black & black -> white)
im2 = not(im2)*255;

% Find the start and end of the entire group
% start_idx: Start of the characters
% end_idx  : End of the characters
% sum of a column of pixels exceeds 'threshold' => separation
threshold = 255*m*0.965;
row_sum = sum(im,1);
start_idx = find(row_sum < threshold, 1);
end_idx = n - find(fliplr(row_sum) < threshold, 1);
% row_sum = 1 where characters are present. Otherwise, its zero.
row_sum = row_sum(start_idx:end_idx) < threshold;

% Find each of the individual characters
segment_start=1;
for kk = 1:nrofsegments;
    segment_end = segment_start + find(row_sum(segment_start:end) < 1,1) - 1;
    temp = zeros(m,n);
    temp_idx = start_idx +(segment_start:segment_end);
    temp(:,temp_idx) = im2(:,temp_idx);
    S{kk} = temp;
    segment_start = segment_end + find(row_sum(segment_end:end)>0,1) - 1;
end;
segment_end=length(row_sum);
```

(a) OCR to be segmented

(b) Segment 1

(c) Segment 2

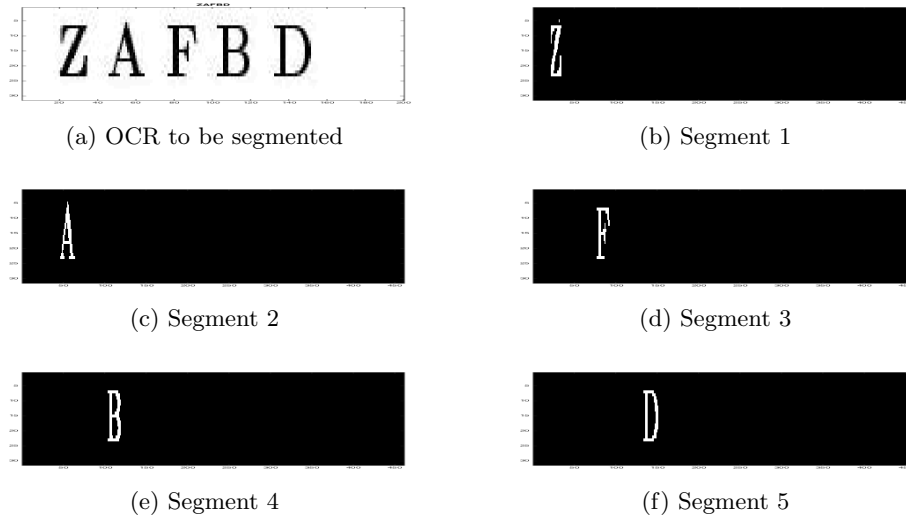(d) Segment 3

(e) Segment 4

(f) Segment 5

Figure 1: Result of im2segment

```
temp_idx = start_idx +(segment_start:segment_end);
temp = zeros(m,n);
temp(:,temp_idx) = im2(:,temp_idx);
S{kk+1} = temp;
```

The result from benchmarking script is listed below:

```
>> inl1_test_and_benchmark
You tested 10 images in folder ../datasets/short1
The jaccard scores for all segments in all images were
    0.8211    0.8288    0.8980    0.8794    0.9008
    0.8631    0.7823    0.8652    0.7886    0.9851
    0.8611    0.8881    0.8525    0.7965    0.8611
    0.7876    0.8131    0.8737    0.8378    0.9531
    0.8631    0.8632    0.7736    0.8824    0.8721
    0.9029    0.7857    0.8904    0.8000    0.8814
    0.8721    0.8706    0.7823    0.8552    0.8925
    0.7876    0.9778    0.8690    0.8689    0.8537
    0.9028    0.8889    0.7799    0.8630    0.7736
    0.8611    0.9683    0.7895    0.8673    0.9029

The mean of the jaccard scores were 0.85756
You can do better
```

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