Philadelphia University
Faculty of IT

Marking Scheme

Exam Paper

BSc CS

Digital Image Processing (0750474)

Second exam | Second semester | Date: 02/05/2012

Section 1

Weighting 20% of the module total

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Marking Scheme

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The presented exam questions are organized to overcome course material through 6 questions.
The *all questions* are compulsory requested to be answered.

Marking Assignments

Question 1 This question is attributed with 4 marks if answered properly; the answers are as following:

1. To map a narrow range of low gray-level input image into a wider range of output levels , we use
   a) Log Intensity Transformation Function
   b) Power-law Intensity Transformation Function
   c) Inverse Log Intensity Transformation Function
   d) Identity Intensity Transformation Function
2. The sum of all elements in the mask of the smoothing averaging spatial filtering must be equal to
   a) m rows
   b) n columns
   c) $m * n$
   d) 1
3. Sharpening the images is commonly accomplished by performing a spatial -------- of the image field.
   a) Min Filter
   b) Smoothing Filter
   c) Integration
   d) Differentiation
4. One of the following filters is nonlinear
   a) Gaussian Filter
   b) Averaging Filter
   c) Laplacian Filter
   d) Median

Question 2: This question is attributed with 2 marks if answered properly, the answers are as following:

Solution: Let p and q be as shown in Fig. Then,

a) S_1 and S_2 are not 4-connected because q is not in the set $N_4(p)$;

b) S_1 and S_2 are 8-connected because q is in the set $N_8(p)$;

c) S_1 and S_2 are m-connected because

i. q is in $N_D(p)$, and

ii. The set $N_4(p) \cap N_4(q)$ is empty.

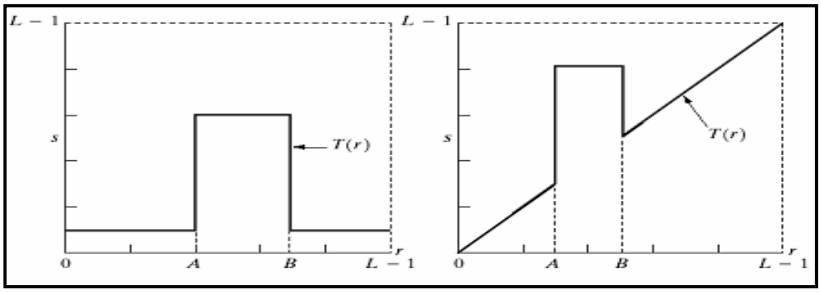
	S_1				S_2				
0	0	0	0	0	0	0	1	1	0
1	0	0	1	0	0	1	0	0	1
1	0	0	1	0	1 (q)	1	0	0	0
0	0	1	1	1 (p)	0	0	0	0	0
0	0	1	1	1	0	0	1	1	1

Question 3: This question is attributed with 2 marks if answered properly, the answers are as following:

Highlighting a specific range of gray levels in an image: Display a high value of all gray levels in the range of interest and a low value for all other gray levels.

a) Transformation highlights range [A, B] of gray level and reduces all others to a constant level

b) Transformation highlights range [A, B] but preserves all other levels



Question 4: This question is attributed with 3 marks if answered properly, the answers are as following:

Solution

a) 3.67

b) 16

c) 3.59

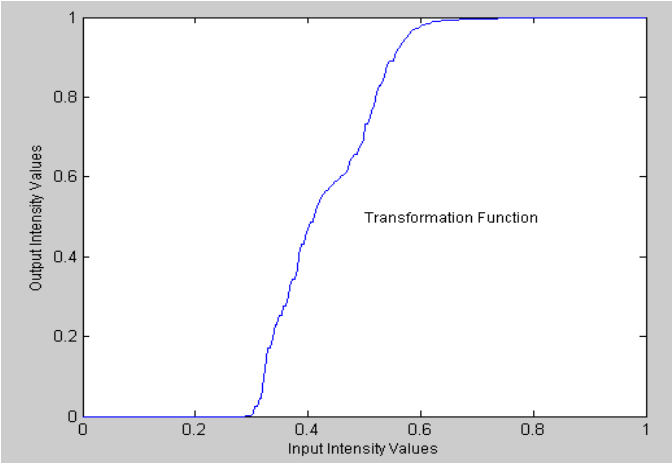
d) histogram of the whole image:

Intensity	0	1	2	3	4	5	6	7
Frequency	2	4	5	2	3	3	3	3

Question 5: This question is attributed with 3 marks if answered properly, the answers are as following:

The complete code for this question as the following:

```
f = imread('pout.tif');
cdf = cumsum(imhist(f)./numel(f));
x = linspace(0,1,100);
plot(x,cdf);
axis([0 1 0 1]);                                          (2 marks)
set(gca,'xtick',0:0.2:1);
set(gca,'ytick',0:0.2:1);
xlabel('Input Intensity Values','fontsize', 9);
ylabel('Output Intensity Values','fontsize', 9);
text(0.5,0.5,'Transformation Function','fontsize',9); (1 mark)
```



Question 6: This question is attributed with 6 marks if answered properly, the answers are as following:

The complete code for this question as the following:

```
function  imf_gaussian (imagename,varargin)
% IMF_GAUSSIAN (IMAGENAME,'default')
%using fspecial function to create the filter mask
%gaussian filter mask size of 7 rows and 7 columns
%standard deviation equal 5
%filterMode ='conv'
% IMF_GAUSSIAN (IMAGENAME,'manual')
%create manually a blur (Gaussian) filter mask
%mask =  [ 1,4,7,4,1;
%          4,20,33,20,4;
%          7,33,55,33,7;
%          4,20,33,20,4;
%          1,4,7,4,1
%         ]
%standard deviation equal 5
%filterMode ='conv'
% IMF_GAUSSIAN (IMAGENAME,'special',filtersize,sigma,filterMode)
%using fspecial function to create the filter mask
%gaussian filter mask size defined by filtersize
%standard deviation defined by sigma
%filtering Mode = filterMode
%the default value are
```

```
%filtersize =[5 5];
%sigma =1
%filtermode = 'corr'
error(nargchk(2, 5, nargin))
imagenamematrix = imread(imagename);                                    (1 mark)
method = varargin{1};
switch method
    case 'default'
        filtersize = [7 7];    sigma = 5;
        gaussianFilter = fspecial ('gaussian',filtersize,sigma);
        filterMode = 'conv';
        gaussianimage = imfilter(imagenamematrix, gaussianFilter,...
            'symmetric',filterMode );                                   (1 mark)
    case 'manual'
        gaussianFilter =[ 1,4,7,4,1;4,20,33,20,4;7,33,55,33,7;...
                4,20,33,20,4;1,4,7,4,1 ];
        sigma = 5;
        filterMode = 'conv';
        gaussianimage = imfilter(imagenamematrix, gaussianFilter,...
            'symmetric',filterMode );                                   (1 mark)
        case 'special'
        if length(varargin)==1
            filtersize =[5 5];
            sigma =1;
            filtermode = 'corr';
        elseif length(varargin)== 4
            filtersize = varargin{2};
            sigma = varargin{3};
            filtermode = varargin{4};
        else
             error('See help file to call the function corectly');
        end
        gaussianFilter = fspecial ('gaussian',filtersize,sigma);
        gaussianimage = imfilter(imagenamematrix, gaussianFilter,...
            'symmetric',filtermode );                                   (2 marks)
    end
imshow(imagenamematrix);
figure , imshow(gaussianimage)
title('Blurred peppers');                                               (1 mark)
```