Computer Image Processing

Classes 6 - thresholding, operations on two images

Binarization

Example 1

The relationship between image histogram and thresholding.

```
L1=imread('portrait.jpg');
figure;
imshow(L1);
figure;
imhist(L1);
ylabel('Number of pixels', 'FontSize',15,'FontName','Arial CE');
L2a=L1>120;
figure;
imshow(L2a);
L2b=L1>180;
figure;
imshow(L2b);
```

Example 2

Determining the threshold using the Otsu algorithm.

```
L1=imread('portret.jpg');
figure;
imshow(L1);
level = graythresh(L1);
L2 = im2bw(L1,level);
figure;
imshow(L2);
```

Exercise 1

Basing on the histogram analysis, try to determine the optimal threshold for the image *santa.jpg*

Example 3

Binarization with two thresholds.

```
L = imread('portrait.jpg');
imshow(zeros(600,800));
subplot(1,2,1),imshow(L);
subplot(1,2,2),imhist(L);
prompt = {'Enter threshold:','Enter tolerance range:'};
answer = inputdlg(prompt);
thresh = str2num(answer{1});
tol = str2num(answer{2});
L2 = (L<(thresh+tol))&(L>(thresh-tol));
figure;
imshow(L2);
```

answer = inputdlg(prompt) – returns variable of cell type, that contains elements of string type
thresh = str2num(answer{1}) – reference to 1st element in 'answer' variable and conversion to the numeric type
L2 = (L<(thresh +tol))&(L>(thresh -tol)) – thresholding with determined threshold ± tolerance range

Exercise 2

Modify previous example in a way that user could click on the image with the mouse button. The value of pixel from the position of click is the threshold value, the tolerance range should be entered into dialog box.

```
L = imread('portrait.jpg');
imshow(L);
[x y] = ginput(1);
answer = inputdlg('Enter tolerance range);
thresh = L(fix(y),fix(x))
tol = str2num(answer{1});
L2 = (L<( thresh +tol))&(L>( thresh -tol));
figure;
imshow(L2);
```

Exercise 3

With the use of created program try to determine thresholding parameters in the *cells.bmp* image so that only contours of the cells are visible.

Example 4

Animation of binarization.

```
L = imread('portrait.jpg');
for i=1:256
    imshow(L>i);
    pause(0.01);
end;
```

Operations on two images

Example 5

Adding two images of different size.

```
[L1a,map1a] = imread('Beaux.bmp');
L1a=ind2gray(L1a,map1a);
figure; imshow(L1a);
L1a=L1a(201:650,101:700);
figure; imshow(L1a);
[L1b,map1b] = imread('tree.bmp');
L1b=ind2gray(L1b,map1b);
figure; imshow(L1b)
L2a=L1a+L1b;
figure; imshow(mat2gray(L2a))
```

Example 6

Transition one image into another one.

```
[L1a,map1a] = imread('Beaux.bmp');
L1a=ind2gray(L1a,map1a);
L1a=L1a(201:650,101:700);
[L1b,map1b] = imread('tree.bmp');
L1b=ind2gray(L1b,map1b);
```

```
figure
for i=0:0.01:1
    L2a=imlincomb(i,L1a,(1-i),L1b);
    imshow(L2a);
    pause(0.01);
end
```

Exercise 4

Create transitions between two images - overlapping from left to right or from top to bottom (similar to that in PowerPoint).

```
[L1a,map1a] = imread('Beaux.bmp');
L1a=ind2gray(L1a,map1a);
L1a=L1a(201:650,101:700);
[L1b,map1b] = imread('drzewo.bmp');
L1b=ind2gray(L1b,map1b);
figure;
L2a = L1a;
[w k] = size(L1a);
for i=1:k %przenikanie w pionie
   L2a(:,i)=L1b(:,i);
   imshow(L2a);
   pause(0.001);
end
for i=1:w %przenikanie w poziomie
   L2a(i,:)=L1b(i,:);
   imshow(L2a);
   pause(0.001);
end

% while j<(w+k) %losowe
%     lw = randi(w-50,1);
%     lk = randi(k-50,1);
%     L2a(lw:(lw+50),lk:(lk+50))=L1b(lw:(lw+50),lk:(lk+50));
%     imshow(L2a);
%     pause(0.0001);
%     j=j+1;
% end
```

Exercise 5

To subtract images we could use two functions - *imabsdiff* and *imsubtract*. Subtract two images with the use of that functions, and then change the subtraction sequence. Is the subtraction operation alternating or not?

Example 7

Logical conjunction of binary images.

```
L1a=imread('wykr_10.tif')
figure;imshow(L1a)
L1b=imread('wykr_14.tif')
figure;imshow(L1b)
L2=L1a&L1b %lub: L2=bitand(L1a,L1b)
figure; imshow(L2)
```

Exercise 6

Perform operations on binary images: negation, disjunction, exclusive disjunction. Try to create subtraction with the use of logical operators.