Computer Image Processing

Classes 7 - image filtering

Example 1

The influence of kernel size on the image filtering process.

```
L=ones([16, 16])*255;
L(6:11, 6:11)=(0:43:255)'*ones([1 6]);
L(14,14)=0;
L=uint8(L);
figure(1); imshow(L, 'InitialMagnification','fit');

Kernel1 = ones(3);
L1=filter2(Kernel1, L);
L1=mat2gray(L1);
figure(2); imshow(L1, 'InitialMagnification','fit');

Kernel2 = ones(5);
L2=filter2(Kernel2, L);
L2=mat2gray(L2);
figure(3); imshow(L2, 'InitialMagnification','fit');

Kernel3 = ones(16);
L3=filter2(Kernel3, L);
L3=mat2gray(L3);
figure(4); imshow(L3, 'InitialMagnification','fit');
```

Exercise 1

Perform filtering of the image *portrait.jpg* with the use of three different kernel sizes.

```
L=imread('portrait.jpg');
figure(1);
imshow(L);

Kernel1 = ones(3);
L1=filter2(Kernel1, L);
L1=mat2gray(L1);
figure(2); imshow(L1);
title('Kernel size = 3 x 3');

Kernel1 = ones(5);
L1=filter2(Kernel1, L);
L1=mat2gray(L1);
figure(3); imshow(L1);
title('Kernel size = 5 x 5');

Kernel1 = ones(10);
L1=filter2(Kernel1, L);
L1=mat2gray(L1);
figure(4); imshow(L1);
title('Kernel size = 10 x 10');
```

Notice the black frame around the image. The bigger the kernel size the wider the frame is.

Example 2

Linear averaging filters (lowpass).

```
L=ones([16, 16])*255;
L(6:11, 6:11)=(0:43:255)'*ones([1 6]);
L(14,14)=0;
L=uint8(L);
figure(1); imshow(L, 'InitialMagnification','fit');

Kernel1 = [1,1,1; 1,2,1; 1,1,1];
L1=filter2(Kernel1, L);
L1=mat2gray(L1);
figure(2); imshow(L1, 'InitialMagnification','fit');

Kernel2 = [1,1,1; 1,0,1; 1,1,1];
L2=filter2(Kernel2, L);
L2=mat2gray(L2);
figure(3); imshow(L2, 'InitialMagnification','fit');
```

Example 3

Gauss linear filters.

```
L=ones([16, 16])*255;
L(6:11, 6:11)=(0:43:255)'*ones([1 6]);
L(14,14)=0;
L=uint8(L);
figure(1); imshow(L, 'InitialMagnification','fit');

Kernel1 = [1,4,1; 4,12,4; 1,4,1];
L1=filter2(Kernel1, L);
L1=mat2gray(L1);
figure(2); imshow(L1, 'InitialMagnification','fit');

Kernel2 = [1,3,1; 3,16,3; 1,3,1];
L2=filter2(Kernel2, L);
L2=mat2gray(L2);
figure(3); imshow(L2, 'InitialMagnification','fit');
```

Example 4

Highpass filters.

```
L=imread('portrait.jpg');
figure(1);
imshow(L);

Kernel1=[-1,-1,-1; -1,9,-1; -1,-1,-1];
L1=filter2(Kernel1, L);
L1=L1/255;
figure(2); imshow(L1);

Kernel2=[1,-2,1; -2,5,-2; 1,-2,1];
L2=filter2(Kernel2, L);
L2=L2/255;
figure(3); imshow
```

Exercise 2

Create three custom highpass kernels, where the sum of kernel elements is equal 0, 1 and 2 accordingly.

```
L=imread('portrait.jpg');
figure(1);
imshow(L);

Kernel1=[-1,-1,-1; -1,8,-1; -1,-1,-1];
L1=filter2(Kernel1, L);
L1=L1/255;
figure(2); imshow(L1);
title('Sum of kernel elements = 0')

Kernel1=[-1,-1,-1; -1,9,-1; -1,-1,-1];
L1=filter2(Kernel1, L);
L1=L1/255;
figure(3); imshow(L1);
title('Sum of kernel elements = 1')

Kernel1=[-1,-1,-1; -1,10,-1; -1,-1,-1];
L1=filter2(Kernel1, L);
L1=L1/255;
figure(4); imshow(L1);
title('Sum of kernel elements = 2')
```

Notice changes of brightness of the image.

Exercise 3

Function imnoise(L, 'salt & pepper', 0.1) **adds salt and pepper noise to the image with the given density. Add this noise type to the image Cracow_1.jpg and try to remove it with the use of known filters.**

Solution in classes 8.