EEE391 - Basics of Signals and Systems
Spring 2017
Computer Assignment 3

Selin Fildiş
21402228

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Part 1

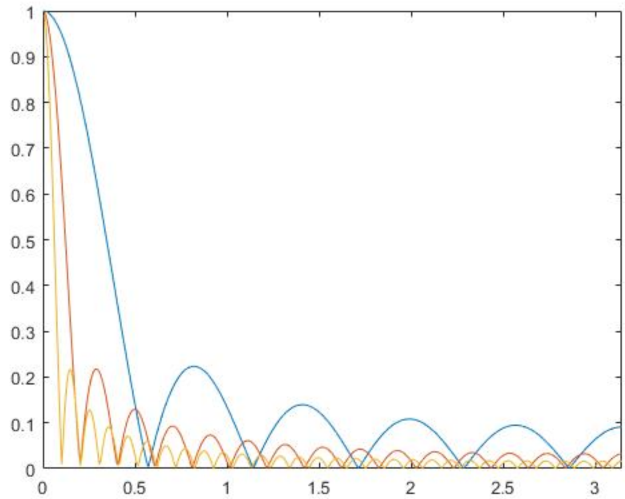

Figure 1: Plot of $H(exp(-iw))$ values

i

This filter blurs the image.

ii

The details are getting less visible when the M value increases.

iii

The visual effect would not change.

iv

Since this filter was an averaging filter, on application the filter will average the values, smoothing it out.

v

The edges remain sharper than the inner parts of the image as we take 0 for the values out of index.

Figure 2: Original Image

Figure 3: M = 11 Averaging Filter

Figure 4: M = 31 Averaging Filter

Figure 5: M = 61 Averaging Filter

Figure 6: c = 0.2, M = 11

Figure 7: c = 0.2, M=31

Figure 8: c = 0.2, M=61

Figure 9: c = 1, M=11

Figure 10: c = 1, M=31

Figure 11: c = 1, M=61

vi

Yes it does. the noise reduces with larger M values.

vii

The image blurs, which may make the image unusable/non-understandable

vii

Out of the three M = 11 is the best choice.

Part 2

Figure 12: clown.bmp with a first differentiator filter

i

The whitest/brightest parts of the image is seen, since we subtract a certain amount from each pixel.

ii

I would expect it to be peaking in some points but mostly in the same level theoretically so it is similar to expectation.

iii

Figure 13: The first differentiator filter with reverse indicies.

Matlab Code

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                PART 1              %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
A=imread('clown.bmp');
J=mat2gray(A, [0 255]);
%Averaging
A1 = conv2(J, ones(11,11)/121);
A2 = conv2(J, ones(31,31)/(31*31));
A3 = conv2(J, ones(61,41)/(61*41));
figure;
```

```
imshow(J);
figure;
imshow(A1(6:512-5,6:512-5));
figure;
imshow(A2(16:512-15, 16:512-15));
figure;
imshow(A3(31:512-30,31:512-30 ));
%Noise c = 0.2
J1= J + (rand(512,512)*((0.5)*0.2));
A1 = conv2(J1, ones(11,11)/121);
A2 = conv2(J1, ones(31,31)/(31*31));
A3 = conv2(J1, ones(61,41)/(61*41));
figure;
imshow(A1(6:512-5,6:512-5));
figure;
imshow(A2(16:512-15, 16:512-15));
figure;
imshow(A3(31:512-30,31:512-30 ));
%Noise c = 1
J2= J + (rand(512,512)*(0.5));
A1 = conv2(J2, ones(11,11)/121);
A2 = conv2(J2, ones(31,31)/(31*31));
A3 = conv2(J2, ones(61,41)/(61*41));
figure;
imshow(A1(6:512-5,6:512-5));
figure;
imshow(A2(16:512-15, 16:512-15));
figure;
imshow(A3(31:512-30,31:512-30 ));
%H values.
omega = -pi:pi/400:pi;
H11 = (1/11)*(1-exp(-1j*omega*11))./(1-exp(-1j*omega));
H31 = (1/31)*(1-exp(-1j*omega*31))./(1-exp(-1j*omega));
H61 = (1/61)*(1-exp(-1j*omega*61))./(1-exp(-1j*omega));
plot(omega,[abs(H11);abs(H31);abs(H61)]);
axis([0, pi, 0, 1]);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%              PART 2             %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

for n = 1:512
    for m = 2:512
```

```
            A1(m,n) = J(m,n)-J(m-1,n);
      end
end
figure;
imshow(A1(1:512,1:512));
```