



**Politechnika
Śląska**

Przetwarzanie Obrazów Cyfrowych

**Raport z ćwiczenia nr. 2:
Przetwarzanie obrazów w dziedzinie
częstotliwości - transformata Fouriera**

Raport opracował:
Dawid Kania
Grupa 6 Semestr 7

Data wykonania ćwiczenia: 14.11.2022

Zadanie 5. Filtracja szumu periodycznego

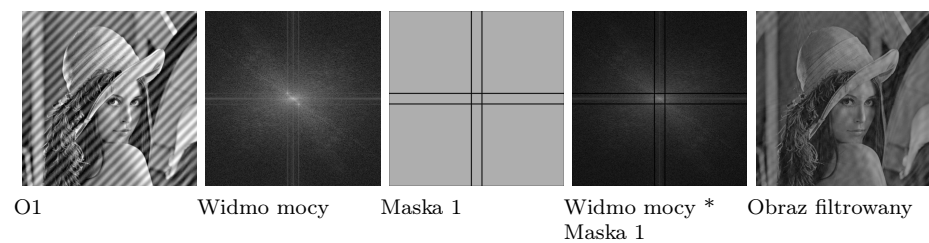


Figure 1: Porownanie

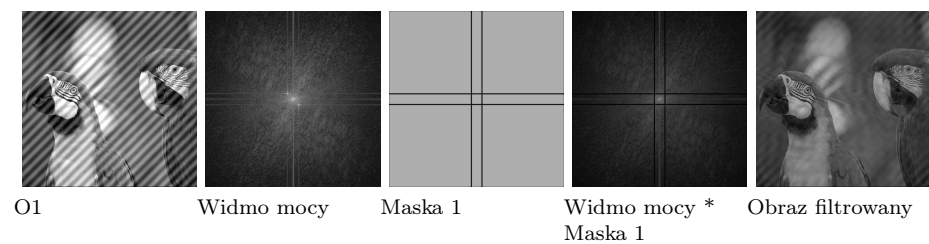


Figure 2: Porownanie

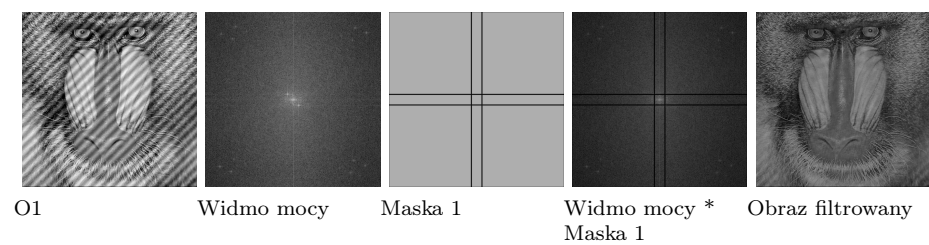


Figure 3: Porownanie

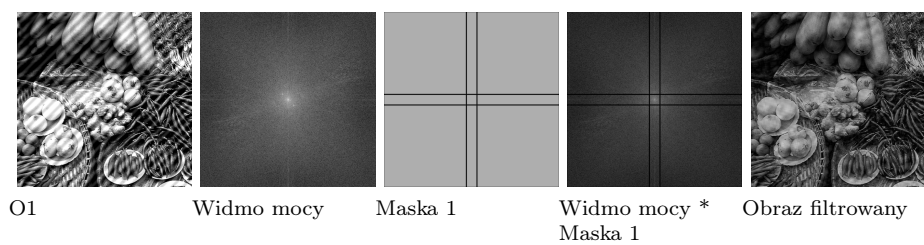


Figure 4: Porownanie

Kody programów

image_fft.m

```
1 function [im_level, im_angle, L1] = image_fft(I1)
2
3     L1 = fftshift(fft2(I1));
4     im_level = log(1+abs(L1));
5     im_angle = angle(L1);
6
7 end
```

image_ifft.m

```
1 function I1 = image_ifft(L1)
2
3     I1 = ifft2(ifftshift(L1));
4     I1 = abs(I1);
5
6 end
```

zad2.m

```
1 clear all
2 close all
3 clc
4
5
6
7
8 images_triangle_rot = [
9 %           path,   rotation, translation, scale
10 {"../images/triangle.png", 0, [0 0], 1 }
11 {'../images/triangle.png', 15, [0 0], 1 }
12 {'../images/triangle.png', 29, [0 0], 1 }
13 {'../images/triangle.png', 50, [0 0], 1 }
14 ]
15
16 images_triangle_pos = [
17 %           path,   rotation, translation, scale
18 {"../images/triangle.png", 0, [0 0], 1 }
19 {'../images/triangle.png', 0, [30 30], 1 }
20 {'../images/triangle.png', 0, [100 100], 1 }
21 {'../images/triangle.png', 0, [-100 -20], 1 }
22 ]
23
24 images_circle_pos = [
25 %           path,   rotation, translation, scale
26 {"../images/circle.png", 0, [0 0], 1 }
27 {'../images/circle.png', 0, [30 30], 1 }
28 {'../images/circle.png', 0, [100 100], 1 }
29 {'../images/circle.png', 0, [-100 -20], 1 }
30 ]
31
32
33 images_circle_scale = [
34 %           path,   rotation, translation, scale
35 {"../images/circle.png", 0, [0 0], 1 }
36 {'../images/circle.png', 0, [0 0], .5 }
37 {'../images/circle.png', 0, [0 0], 2 }
38 {'../images/circle.png', 0, [0 0], 3 }
39 ]
40
41
42 images_line_rot = [
43 %           path,   rotation, translation, scale
44 {"../images/lines.png", 0, [0 0], 1 }
45 {'../images/lines.png', 15, [0 0], 1 }
46 {'../images/lines.png', 29, [0 0], 1 }
47 {'../images/lines.png', 50, [0 0], 1 }
48 ]
49
50 images_sine = [
51 %           path,   rotation, translation, scale
52 { [0.20 0.20], 0, [0 0], 1 }
53 { [0.05 0.005], 0, [0 0], 1 }
54 { [1 0.01], 0, [0 0], 1 }
55 { [0.01 1], 0, [0 0], 1 }
```

```

56 ]
57
58
59 figure;
60 show_images(images_triangle_rot, "../zad2/triangle_rot");
61
62 figure;
63 show_images(images_triangle_pos, "../zad2/triangle_pos");
64
65 figure;
66 show_images(images_circle_pos, "../zad2/circle_pos");
67
68 figure;
69 show_images(images_circle_scale, "../zad2/circle_scale");
70
71 figure;
72 show_images(images_line_rot, "../zad2/line_rot");
73
74 figure;
75 show_images(images_sine, "../zad2/sine");
76
77
78
79 function show_images(images, dest_folder)
80
81     mkdir(dest_folder);
82
83
84     tiledlayout(3,size(images, 1), 'TileSpacing','none');
85
86     tile_indexes = 1:(3*size(images, 1));
87     tile_indexes = reshape(tile_indexes,[],3)';
88
89
90     for tile_index = tile_indexes
91
92         image = images(tile_index(1),:);
93
94         src    = image{1};
95         rot    = image{2};
96         trans  = image{3};
97         scale  = image{4};
98
99         if isa(src, 'string') || isa(src, 'char')
100             I1 = imread(src);
101             I1 = double(I1)./256;
102             I1 = rgb2gray(I1);
103
104
105             orig_size = size(I1);
106
107             I1 = imrotate(I1, rot);
108             I1 = imtranslate(I1, trans);
109             I1 = imresize(I1, scale);
110
111             if (orig_size - size(I1)) >= 0
112                 w = (orig_size - size(I1)) /2;

```

```

113         w = w + [.1, -.1];
114         w = round(w);
115         I1 = padarray(I1, w, 0);
116     else
117         I1 = imcrop(I1, centerCropWindow2d(size(I1),
orig_size));
118     end
119
120     elseif isa(src, 'double')
121         [X,Y] = meshgrid(1:512, 1:512);
122         I1 = sin(X*src(1) + Y*src(2));
123         I1 = (1 + I1)./2;
124     end
125
126
127     [im_level, im_angle] = image_fft(I1);
128
129     % scale values
130     im_level = rescale(im_level);
131     im_angle = rescale(im_angle);
132
133     nexttile(tile_index(1))
134     imshow(I1);
135
136     nexttile(tile_index(2))
137     imshow(im_level);
138     xlabel('Widmo mocy');
139
140     nexttile(tile_index(3))
141     imshow(im_angle);
142     xlabel('Faza');
143
144     imwrite(I1, dest_folder + "/" + tile_index(1) + ".png")
145     imwrite(im_level, dest_folder + "/" + tile_index(1) + "
_mag.png")
146     imwrite(im_angle, dest_folder + "/" + tile_index(1) + "
_angle.png")
147
148 end
149
150
151 trans2str = @(tran) "(" + tran(1) + ", " + tran(1) + ")"
152
153
154 Latex = [
155 "\newcommand{\ww}{0.24} "
156 "\begin{figure}[H] "
157 " \captionsetup[subfloat]{justification=raggedright,
singlelinecheck=false, position=bottom,labelformat=empty} % "
158 "
159 " \subfloat[01 \\\ rot = " + string(images{1,2}) + " \\\ trans = "
+ trans2str(images{1,3}) + " \\\ scale = " + string(images
{1,4}) + "]{
160 " \includegraphics[width=\ww\linewidth]{" + dest_folder + "/"
+ I1.png}} \hfill% "
161 " \subfloat[01 \\\ rot = " + string(images{2,2}) + " \\\ trans = "
+ trans2str(images{2,3}) + " \\\ scale = " + string(images

```

```

{2,4}) + "]"
162 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I2.png}} \hfill% "
163 " \subfloat[01 \\\ rot = " + string(images{3,2}) + " \\\ trans = "
+ trans2str(images{3,3}) + " \\\ scale = " + string(images
{3,4}) + "]"
164 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I3.png}} \hfill%"
165 " \subfloat[01 \\\ rot = " + string(images{4,2}) + " \\\ trans = "
+ trans2str(images{4,3}) + " \\\ scale = " + string(images
{4,4}) + "]"
166 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I4.png}} \hfill"
167 ""
168 " \subfloat[Widmo mocy]{ "
169 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I1_mag.png}} \hfill% "
170 " \subfloat[Widmo mocy]{ "
171 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I2_mag.png}} \hfill% "
172 " \subfloat[Widmo mocy]{ "
173 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I3_mag.png}} \hfill%"
174 " \subfloat[Widmo mocy]{ "
175 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I4_mag.png}} \hfill"
176 ""
177 " \subfloat[Faza]{ "
178 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I1_angle.png}} \hfill% "
179 " \subfloat[Faza]{ "
180 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I2_angle.png}} \hfill% "
181 " \subfloat[Faza]{ "
182 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I3_angle.png}} \hfill%"
183 " \subfloat[Faza]{ "
184 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
I4_angle.png}}"
185 ""
186 "\caption{Porownanie} "
187 ""
188 "\end{figure} "
189 "\let\ww\undefined "
190 ]
191
192 Latex = join(Latex,[''],2);
193 Latex = join(Latex,[newline],1);
194
195 fid = fopen(dest_folder + "/result.tex",'wt');
196 fprintf(fid,"%s", Latex);
197 fclose(fid);
198
199
200 end

```


zad3.m

```
1 clear all
2 close all
3 clc
4
5
6
7
8 images = [
9 %         src           ,      iterations,
10 %         filter
11 {"../images/lena_512x512.bmp", [1 2 5 10], @(I1) imfilter(I1,
12   fspecial('average',5)) , "../zad3/lena_smooth" }
13 {"../images/lena_512x512.bmp", [1 2 5 10], @(I1) imsharpen(I1)
14   , "../zad3/lena_sharp" }
15 {"../images/kodim23_512x512.png", [1 2 5 10], @(I1) imfilter(I1,
16   fspecial('average',5)) , "../zad3/kodim_smooth" }
17 {"../images/kodim23_512x512.png", [1 2 5 10], @(I1) imsharpen(I1)
18   , "../zad3/kodim_sharp" }
19 ]
20
21 for image = images'
22     figure
23     show_images(image)
24 end
25
26
27
28 function show_images(image)
29
30     tiledlayout(2,1 + length(image{2}));
31
32     tile_indexes = 1:(2*length(image{2}) + 2);
33     tile_indexes = reshape(tile_indexes,[],2)';
34
35
36     src = image{1};
37     filter_iters = image{2};
38     %filte_mat = image{3};
39     filter_func = image{3};
40     dest_folder = image{4};
41
42
43     I1 = imread(src);
44     I1 = double(I1)./256;
45     I1 = rgb2gray(I1);
46
47     [im_level, ~] = image_fft(I1);
48     im_level = rescale(im_level);
49
50
```

```

51 nexttile(tile_indexes(1,1))
52 imshow(I1);
53
54 nexttile(tile_indexes(2,1))
55 imshow(im_level,[]);
56 xlabel('Widmo mocy');
57
58
59
60 mkdir(dest_folder)
61 imwrite(I1, dest_folder + "/I1.png");
62 imwrite(im_level, dest_folder + "/I1_mag.png");
63
64
65
66 % filtering
67 x = 1;
68 for iter = filter_iters
69
70     I2 = I1;
71     for i = 1:iter
72         I2 = filter_func(I2);
73     end
74
75     [im_level, ~] = image_fft(I2);
76     im_level = rescale(im_level);
77
78     nexttile(tile_indexes(1,x + 1))
79     imshow(I2);
80
81     nexttile(tile_indexes(2,x + 1))
82     imshow(im_level,[]);
83     xlabel('Widmo mocy');
84
85
86     imwrite(I2, dest_folder + "/I1_iter" + iter + ".png");
87     imwrite(im_level, dest_folder + "/I1_iter" + iter + "_mag.
88 png");
89
90     x = x + 1;
91
92 end
93
94 Latex = [
95 "\newcommand{\ww}{0.19} "
96 "\begin{figure}[H] "
97 " \captionsetup[subfloat]{justification=raggedright,
98 singlelinecheck=false, position=bottom,labelformat=empty} % "
99 " "
100 " \subfloat[01]{ "
101 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
102 " I1.png} \hfill% "
103 " \subfloat[01 - iteracja " + filter_iters(1) + "]{ "
104 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
105 " I1_iter" + filter_iters(1) + ".png} \hfill% "
106 " \subfloat[01 - iteracja " + filter_iters(2) + "]{ "

```

```

104 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
    I1_iter" + filter_iters(2) + ".png}} \hfill%"
105 " \subfloat[01 - iteracja " + filter_iters(3) + "]{ "
106 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
    I1_iter" + filter_iters(3) + ".png}} \hfill"
107 " \subfloat[01 - iteracja " + filter_iters(4) + "]{ "
108 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
    I1_iter" + filter_iters(4) + ".png}} \hfill"
109 ""
110 " \subfloat[Widmo mocy]{ "
111 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
    I1_mag.png}} \hfill% "
112 " \subfloat[Widmo mocy]{ "
113 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
    I1_iter" + filter_iters(1) + "_mag.png}} \hfill% "
114 " \subfloat[Widmo mocy]{ "
115 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
    I1_iter" + filter_iters(2) + "_mag.png}} \hfill%"
116 " \subfloat[Widmo mocy]{ "
117 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
    I1_iter" + filter_iters(3) + "_mag.png}} \hfill"
118 " \subfloat[Widmo mocy]{ "
119 " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
    I1_iter" + filter_iters(4) + "_mag.png}} \hfill"
120 ""
121 "\caption{Porownanie} "
122 " "
123 "\end{figure} "
124 "\let\ww\undefined "
125 ]
126
127 Latex = join(Latex,[''],2);
128 Latex = join(Latex,[newline],1);
129
130 fid = fopen(dest_folder + "/result.tex",'wt');
131 fprintf(fid,"%s", Latex);
132 fclose(fid);
133
134
135
136 end

```

zad4.m

```
1 clear all
2 close all
3 clc
4
5
6 images = [
7 %           src           , mask
8 {"../images/lena_512x512.bmp", { "circle", 100, 40}, "../zad4/
   lena_circ" }
9 {"../images/kodim23_512x512.png", { "circle", 100, 40}, "../zad4/
   kodim_circ" }
10 {"../images/lena_512x512.bmp", { "gauss", 150, 70}, "../zad4/
   lena_gauss" }
11 {"../images/kodim23_512x512.png", { "gauss", 150, 70}, "../zad4/
   kodim_gauss" }
12 {"../images/lena_512x512.bmp", { "invcircle", 100, 40}, "../
   zad4/lena_invcircle" }
13 {"../images/kodim23_512x512.png", { "invcircle", 100, 40}, "../
   zad4/kodim_invcircle" }
14 {"../images/lena_512x512.bmp", { "invgauss", 150, 70}, "../
   zad4/lena_invgauss" }
15 {"../images/kodim23_512x512.png", { "invgauss", 150, 70}, "../
   zad4/kodim_invgauss" }
16 ]
17
18
19
20
21
22 for image = images'
23     show_images(image)
24 end
25
26
27 function show_images(image)
28
29
30     tiledlayout(2, 5, 'TileSpacing','none');
31
32     src = image{1};
33     mask = image{2};
34     dest_folder = image{3};
35
36
37     I1 = imread(src);
38     I1 = double(I1)./256;
39     I1 = rgb2gray(I1);
40
41
42     [im_level, ~, L1] = image_fft(I1);
43     im_level = rescale(im_level);
44
45     if mask{1} == "circle"
46         im_mask1 = MaskCircle(size(I1), mask{2});
47         im_mask2 = MaskCircle(size(I1), mask{3});
```

```

48     elseif mask{1} == "gauss"
49         im_mask1 = MaskGauss(size(I1), mask{2});
50         im_mask2 = MaskGauss(size(I1), mask{3});
51     elseif mask{1} == "invcircle"
52         im_mask1 = MaskCircle(size(I1), mask{2})*-1 + 1;
53         im_mask2 = MaskCircle(size(I1), mask{3})*-1 + 1;
54     elseif mask{1} == "invgauss"
55         im_mask1 = MaskGauss(size(I1), mask{2})*-1 + 1;
56         im_mask2 = MaskGauss(size(I1), mask{3})*-1 + 1;
57     end
58
59
60     % mask 1
61     nexttile
62     imshow(I1);
63
64     nexttile
65     imshow(im_level, []);
66
67     nexttile
68     imshow(im_mask1);
69
70     nexttile
71     imshow(im_level .* im_mask1 , []);
72
73     nexttile
74     imshow(image_ifft(L1 .* im_mask1));
75
76     % mask 1
77     nexttile
78     imshow(I1);
79
80     nexttile
81     imshow(im_level, []);
82
83     nexttile
84     imshow(im_mask2);
85
86     nexttile
87     imshow(im_level .* im_mask2 , []);
88
89     nexttile
90     imshow(image_ifft(L1 .* im_mask2));
91
92     mkdir(dest_folder)
93     imwrite(I1, dest_folder + "/I1.png");
94     imwrite(im_level, dest_folder + "/I1_mag.png"
95 );
96     imwrite(im_mask1, dest_folder + "/I1_mask1.
97 png");
98     imwrite(im_level .* im_mask1, dest_folder + "/"
99 I1_mag_mask1.png");
100     imwrite(image_ifft(L1 .* im_mask1), dest_folder + "/I1_1.png");
101
102     % imwrite(I1, dest_folder + "/I1.png");
103     % imwrite(im_level, dest_folder + "/I1_mag.
104 png");

```

```

101     imwrite(im_mask2, dest_folder + "/I1_mask2.
102     png");
103     imwrite(im_level .* im_mask2, dest_folder + "/"
104     I1_mag_mask2.png");
105     imwrite(image_ifft(L1 .* im_mask2), dest_folder + "/I1_2.png");
106
107
108     Latex = [
109     "\newcommand{\ww}{0.19} "
110     "\begin{figure}[H] "
111     " \captionsetup[subfloat]{justification=raggedright,
112     singlelinecheck=false, position=bottom,labelformat=empty} % "
113     "
114     " \subfloat[01]{ "
115     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
116     I1.png}} \hfill% "
117     " \subfloat[Widmo mocy]{ "
118     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
119     I1_mag.png}} \hfill% "
120     " \subfloat[Maska 1]{ "
121     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
122     I1_mask1.png}} \hfill% "
123     " \subfloat[Widmo mocy * Maska 1]{ "
124     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
125     I1_mag_mask1.png}} \hfill% "
126     " \subfloat[01 przefiltrowany]{ "
127     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
128     I1_1.png}} \hfill% "
129     "
130     " \subfloat[01]{ "
131     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
132     I1.png}} \hfill% "
133     " \subfloat[Widmo mocy]{ "
134     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
135     I1_mag.png}} \hfill% "
136     " \subfloat[Maska 2]{ "
137     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
138     I1_mask2.png}} \hfill% "
139     " \subfloat[Widmo mocy * Maska 2]{ "
140     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
141     I1_mag_mask2.png}} \hfill% "
142     " \subfloat[01 przefiltrowany]{ "
143     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
144     I1_2.png}} \hfill% "
145     "
146     "\caption{Porownanie} "
147     " "
148     "\end{figure} "
149     "\let\ww\undefined "
150     ]
151
152     Latex = join(Latex,[''],2);
153     Latex = join(Latex,[newline],1);
154
155     fid = fopen(dest_folder + "/result.tex",'wt');

```

```

145     fprintf(fid,"%s", Latex);
146     fclose(fid);
147
148
149
150 end
151
152
153
154
155
156
157 function M = MaskCircle(dim, r)
158
159     x = (1:dim(1)) - dim(1)/2;
160     y = (1:dim(2)) - dim(2)/2;
161     [X, Y] = meshgrid(x, y);
162
163     R2 = X.*X + Y.*Y;
164     r2 = r.*r;
165
166     M = R2 < r2;
167     M = double(M);
168
169 end
170
171
172
173 function M = MaskGauss(dim, sigma)
174
175     x = (1:dim(1)) - dim(1)/2;
176     y = (1:dim(2)) - dim(2)/2;
177     [X, Y] = meshgrid(x, y);
178
179     R = sqrt(X.*X + Y.*Y);
180
181     M = normpdf(R, 1, sigma);
182     M = M ./ max(M, [], "all");
183
184 end

```

zad5.m

```
1 clear all
2 close all
3 clc
4
5
6 images = [
7 %           src           , mask
8 {"../images/lena_512x512.bmp", { "circle", 100, 40}, "../zad4/
   lena_circ" }
9 {"../images/kodim23_512x512.png", { "circle", 100, 40}, "../zad4/
   kodim_circ" }
10 {"../images/lena_512x512.bmp", { "gauss", 150, 70}, "../zad4/
   lena_gauss" }
11 {"../images/kodim23_512x512.png", { "gauss", 150, 70}, "../zad4/
   kodim_gauss" }
12 {"../images/lena_512x512.bmp", { "invcircle", 100, 40}, "../
   zad4/lena_invcircle" }
13 {"../images/kodim23_512x512.png", { "invcircle", 100, 40}, "../
   zad4/kodim_invcircle" }
14 {"../images/lena_512x512.bmp", { "invgauss", 150, 70}, "../
   zad4/lena_invgauss" }
15 {"../images/kodim23_512x512.png", { "invgauss", 150, 70}, "../
   zad4/kodim_invgauss" }
16 ]
17
18
19
20
21
22 for image = images'
23     show_images(image)
24 end
25
26
27 function show_images(image)
28
29
30     tiledlayout(2, 5, 'TileSpacing','none');
31
32     src = image{1};
33     mask = image{2};
34     dest_folder = image{3};
35
36
37     I1 = imread(src);
38     I1 = double(I1)./256;
39     I1 = rgb2gray(I1);
40
41
42     [im_level, ~, L1] = image_fft(I1);
43     im_level = rescale(im_level);
44
45     if mask{1} == "circle"
46         im_mask1 = MaskCircle(size(I1), mask{2});
47         im_mask2 = MaskCircle(size(I1), mask{3});
```



```

48     elseif mask{1} == "gauss"
49         im_mask1 = MaskGauss(size(I1), mask{2});
50         im_mask2 = MaskGauss(size(I1), mask{3});
51     elseif mask{1} == "invcircle"
52         im_mask1 = MaskCircle(size(I1), mask{2})*-1 + 1;
53         im_mask2 = MaskCircle(size(I1), mask{3})*-1 + 1;
54     elseif mask{1} == "invgauss"
55         im_mask1 = MaskGauss(size(I1), mask{2})*-1 + 1;
56         im_mask2 = MaskGauss(size(I1), mask{3})*-1 + 1;
57     end
58
59
60     % mask 1
61     nexttile
62     imshow(I1);
63
64     nexttile
65     imshow(im_level, []);
66
67     nexttile
68     imshow(im_mask1);
69
70     nexttile
71     imshow(im_level .* im_mask1 , []);
72
73     nexttile
74     imshow(image_ifft(L1 .* im_mask1));
75
76     % mask 1
77     nexttile
78     imshow(I1);
79
80     nexttile
81     imshow(im_level, []);
82
83     nexttile
84     imshow(im_mask2);
85
86     nexttile
87     imshow(im_level .* im_mask2 , []);
88
89     nexttile
90     imshow(image_ifft(L1 .* im_mask2));
91
92     mkdir(dest_folder)
93     imwrite(I1, dest_folder + "/I1.png");
94     imwrite(im_level, dest_folder + "/I1_mag.png"
95 );
96     imwrite(im_mask1, dest_folder + "/I1_mask1.
97 png");
98     imwrite(im_level .* im_mask1, dest_folder + "/"
99 I1_mag_mask1.png");
100     imwrite(image_ifft(L1 .* im_mask1), dest_folder + "/I1_1.png");
101
102     % imwrite(I1, dest_folder + "/I1.png");
103     % imwrite(im_level, dest_folder + "/I1_mag.
104 png");

```

```

101     imwrite(im_mask2, dest_folder + "/I1_mask2.
102     png");
103     imwrite(im_level .* im_mask2, dest_folder + "/"
104     I1_mag_mask2.png");
105     imwrite(image_ifft(L1 .* im_mask2), dest_folder + "/I1_2.png");
106
107
108     Latex = [
109     "\newcommand{\ww}{0.19} "
110     "\begin{figure}[H] "
111     " \captionsetup[subfloat]{justification=raggedright,
112     singlelinecheck=false, position=bottom,labelformat=empty} % "
113     "
114     " \subfloat[01]{ "
115     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
116     I1.png}} \hfill% "
117     " \subfloat[Widmo mocy]{ "
118     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
119     I1_mag.png}} \hfill% "
120     " \subfloat[Maska 1]{ "
121     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
122     I1_mask1.png}} \hfill% "
123     " \subfloat[Widmo mocy * Maska 1]{ "
124     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
125     I1_mag_mask1.png}} \hfill% "
126     " \subfloat[01 przefiltrowany]{ "
127     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
128     I1_1.png}} \hfill% "
129     "
130     " \subfloat[01]{ "
131     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
132     I1.png}} \hfill% "
133     " \subfloat[Widmo mocy]{ "
134     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
135     I1_mag.png}} \hfill% "
136     " \subfloat[Maska 2]{ "
137     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
138     I1_mask2.png}} \hfill% "
139     " \subfloat[Widmo mocy * Maska 2]{ "
140     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
141     I1_mag_mask2.png}} \hfill% "
142     " \subfloat[01 przefiltrowany]{ "
143     " \includegraphics[width=\ww\linewidth]{ " + dest_folder + "/"
144     I1_2.png}} \hfill% "
145     "
146     "\caption{Porownanie} "
147     " "
148     "\end{figure} "
149     "\let\ww\undefined "
150     ]
151
152     Latex = join(Latex,['\n'],2);
153     Latex = join(Latex,['\n'],1);
154
155     fid = fopen(dest_folder + "/result.tex",'wt');

```

```

145     fprintf(fid,"%s", Latex);
146     fclose(fid);
147
148
149
150 end
151
152
153
154
155
156
157 function M = MaskCircle(dim, r)
158
159     x = (1:dim(1)) - dim(1)/2;
160     y = (1:dim(2)) - dim(2)/2;
161     [X, Y] = meshgrid(x, y);
162
163     R2 = X.*X + Y.*Y;
164     r2 = r.*r;
165
166     M = R2 < r2;
167     M = double(M);
168
169 end
170
171
172
173 function M = MaskGauss(dim, sigma)
174
175     x = (1:dim(1)) - dim(1)/2;
176     y = (1:dim(2)) - dim(2)/2;
177     [X, Y] = meshgrid(x, y);
178
179     R = sqrt(X.*X + Y.*Y);
180
181     M = normpdf(R, 1, sigma);
182     M = M ./ max(M, [], "all");
183
184 end

```