Project1

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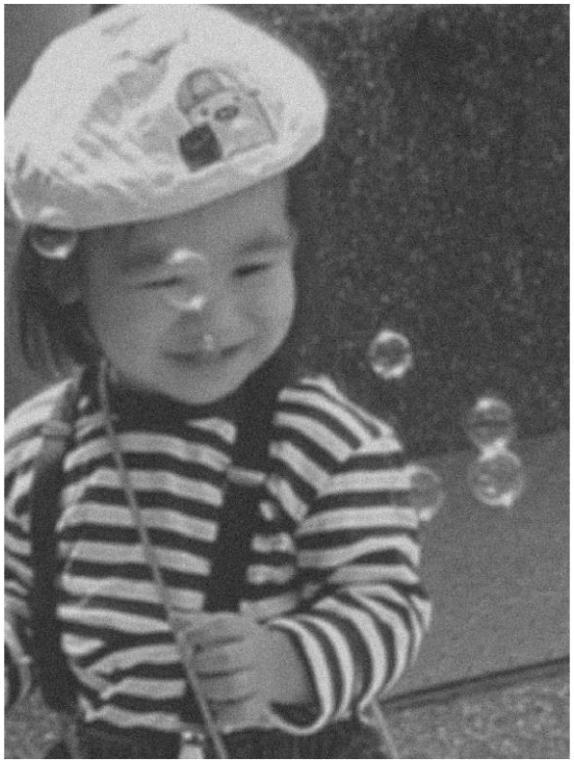
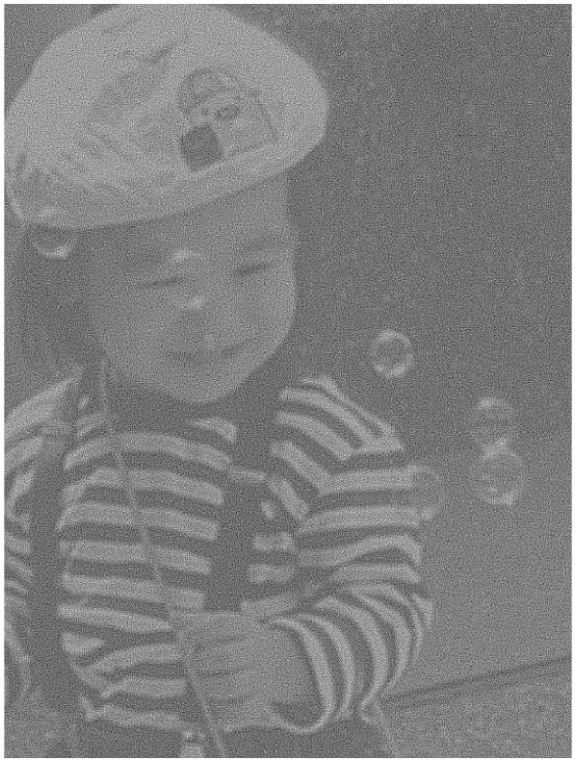
1. Kid blurred-noisy.tiff

(a) original

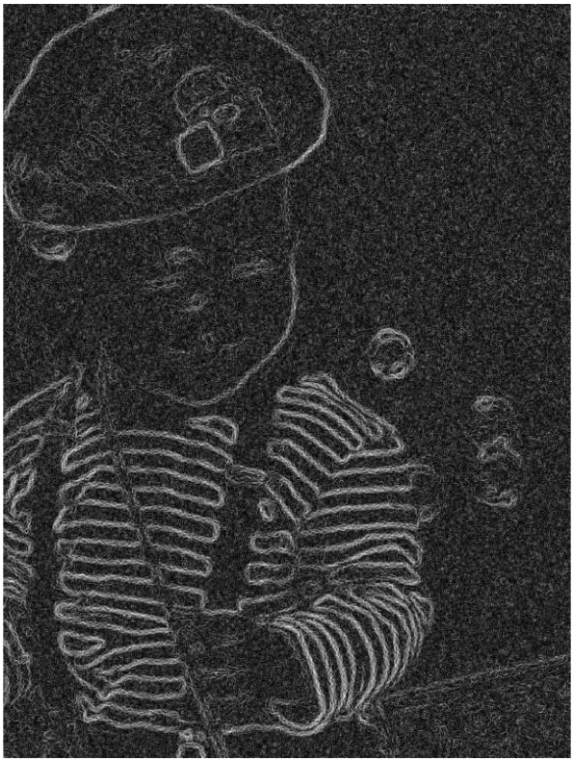


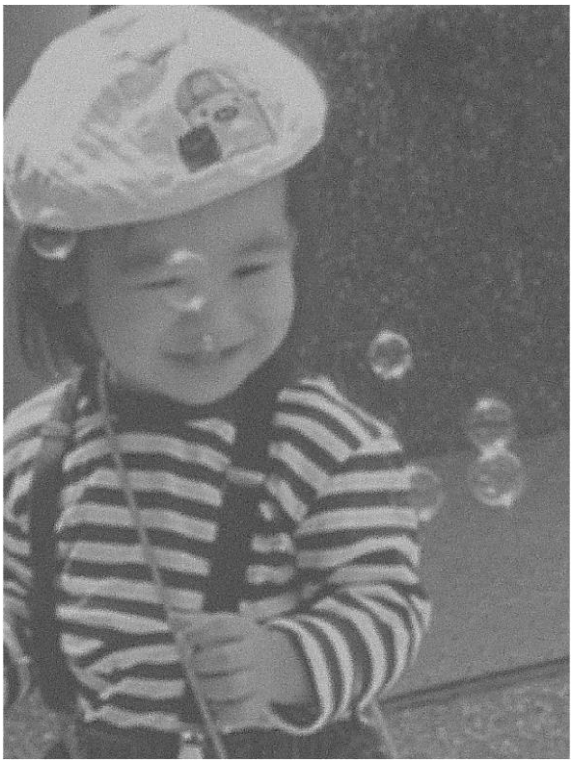
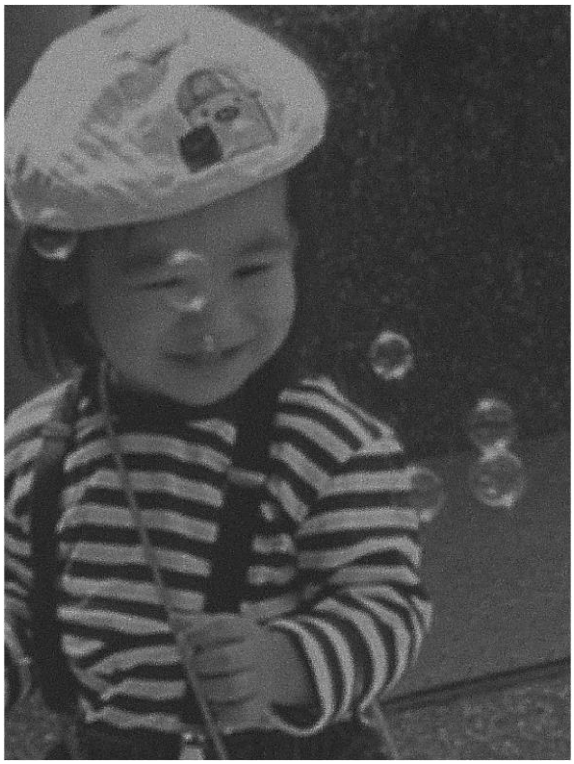
(b) Laplacian

(c) Laplacian-sharpened

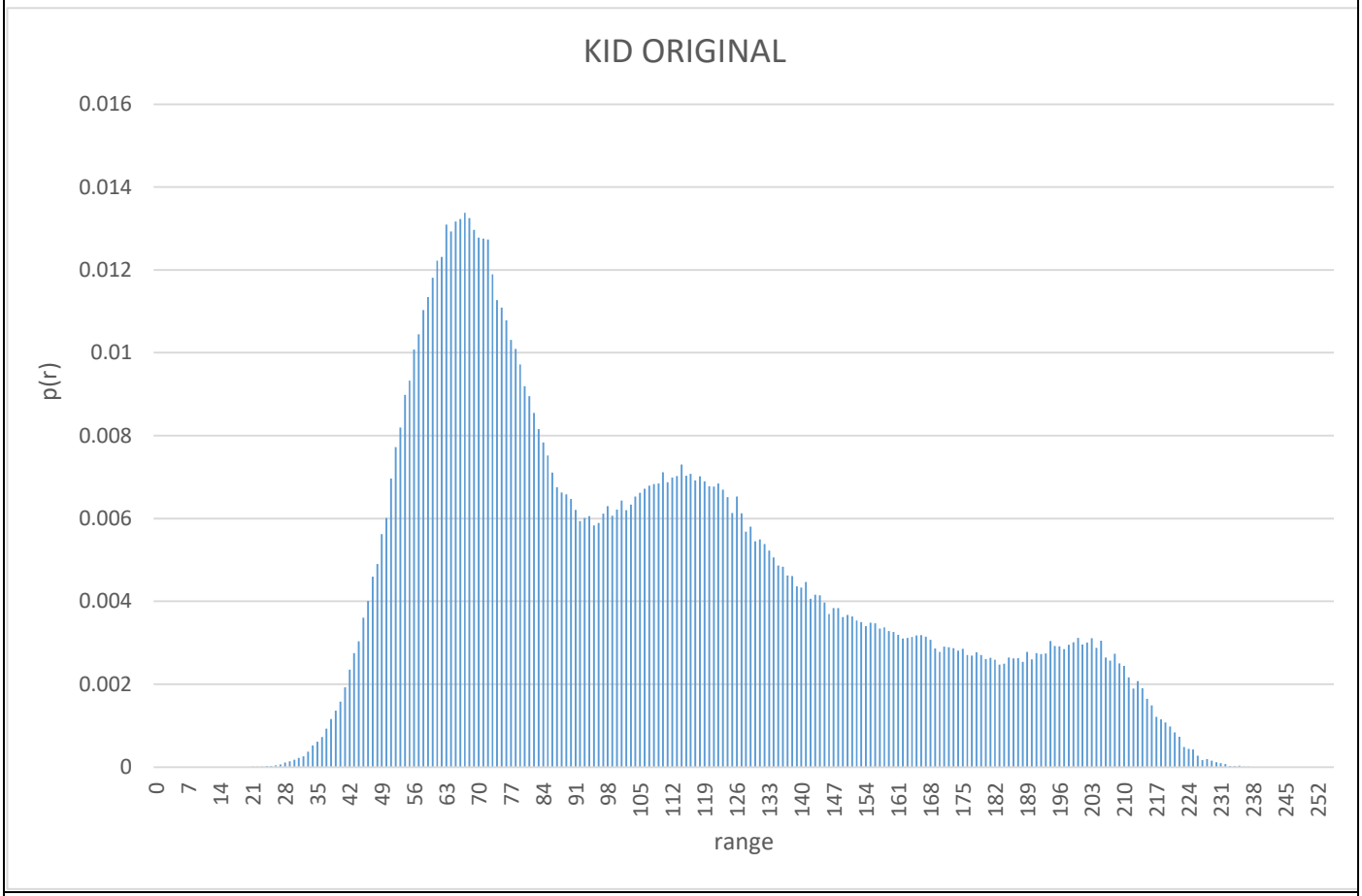


(d) Sobel-gradient

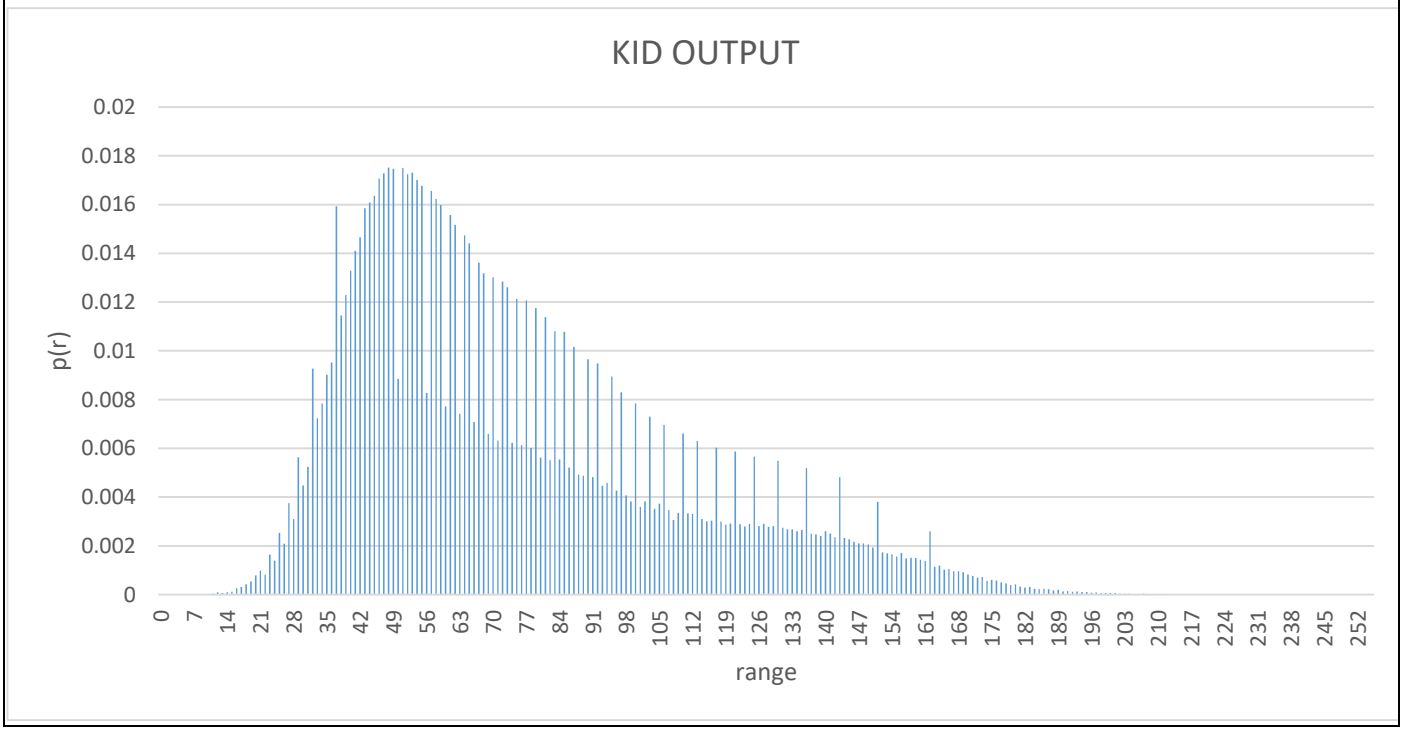


(e) smoothed gradient	(f) (e) • (b)
	
(g) (a)+(f)	(h) power-law transformation of (g)
	

Original histograms



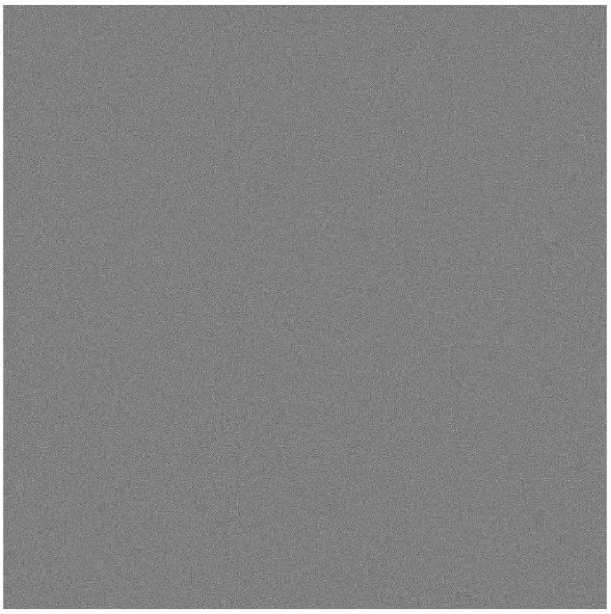
Output histograms



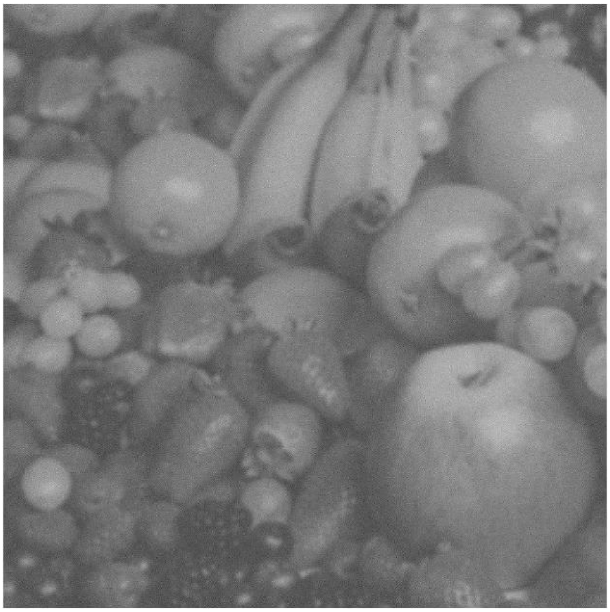
2. Fruit blurred-noisy.tiff

(a) original

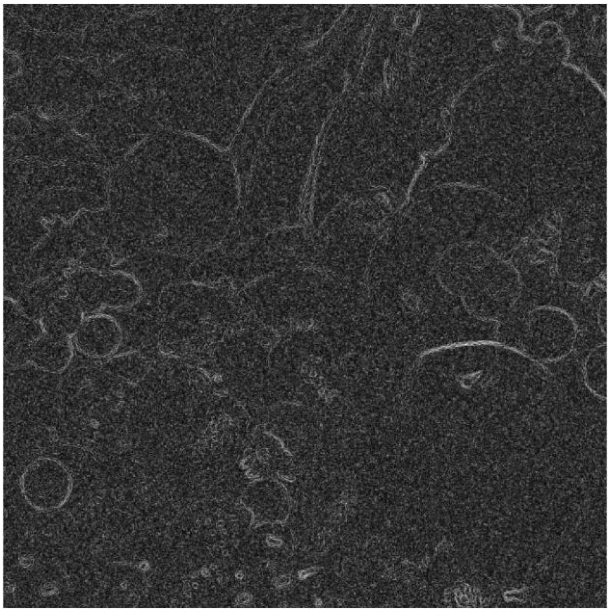
(b) Laplacian



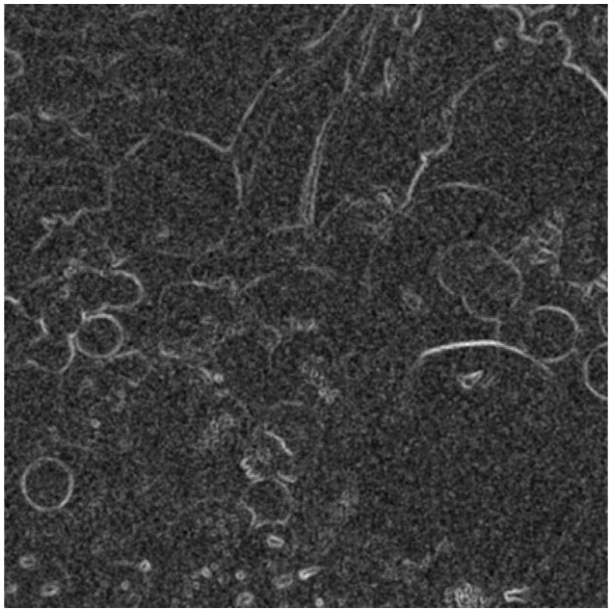
(c) Laplacian-sharpened



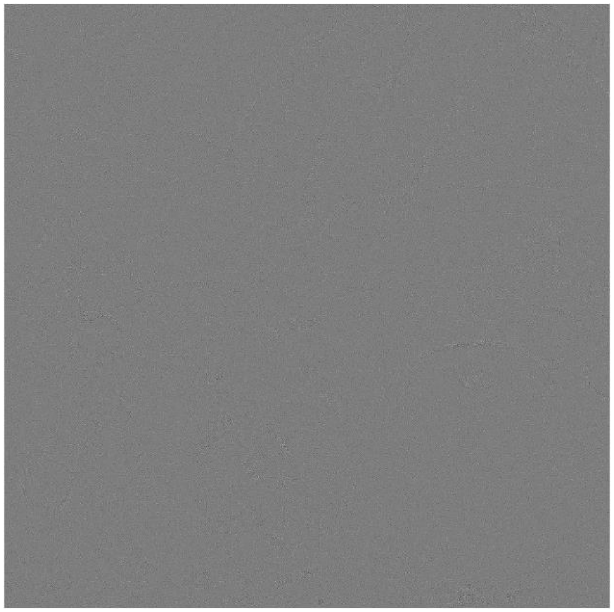
(d) Sobel-gradient



(e) smoothed gradient



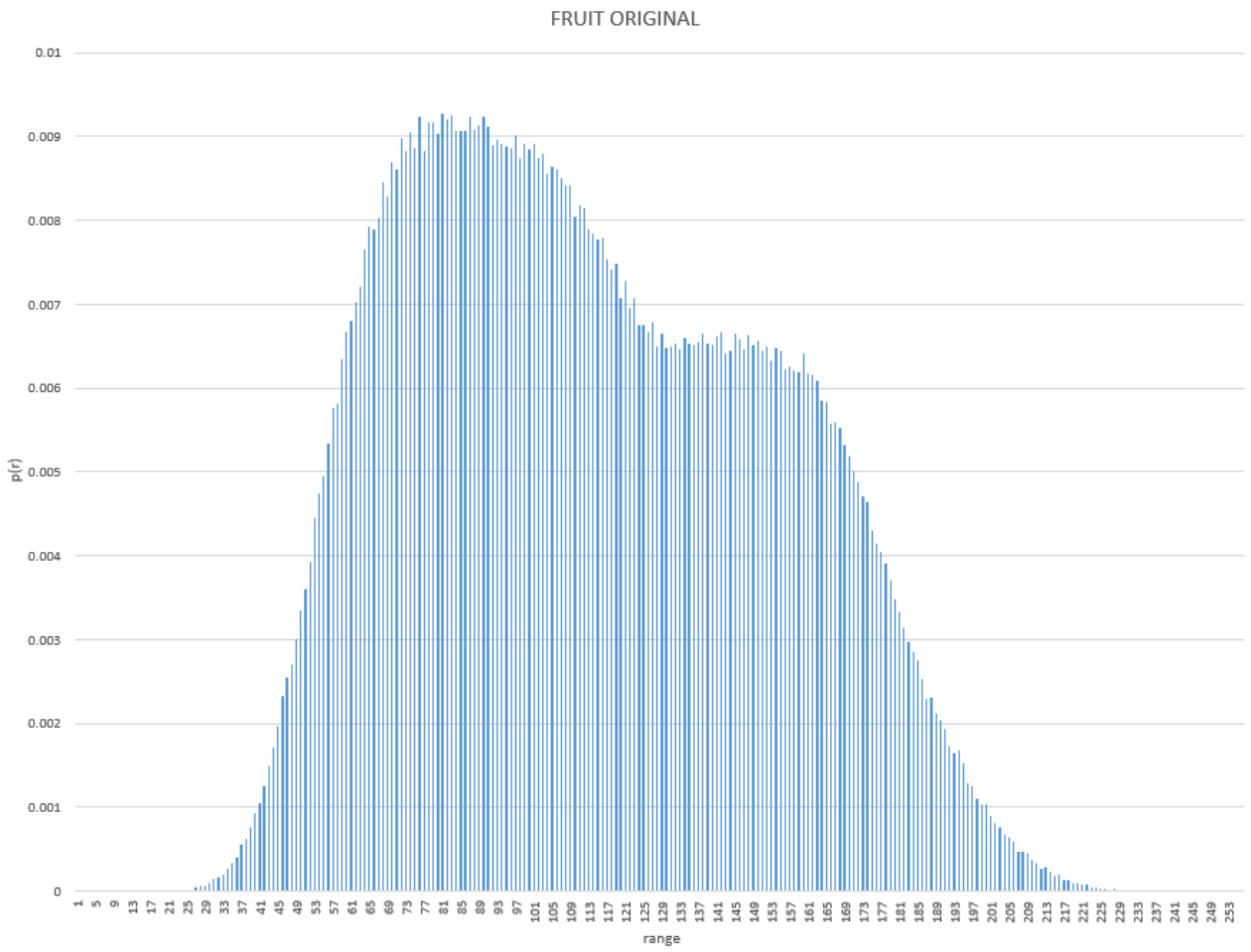
(f) (e)・(b)



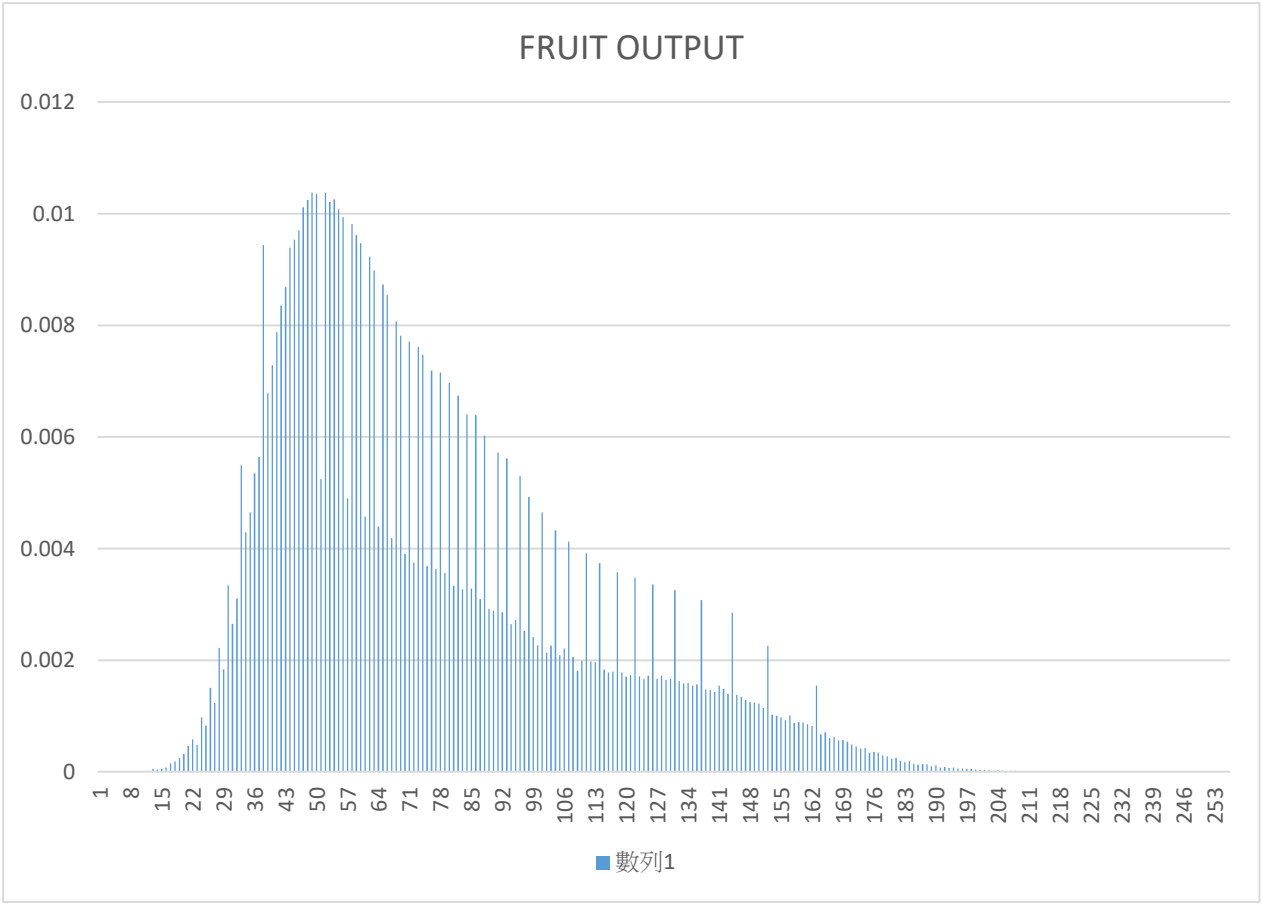
(g) (a)+(f)

(h) power-law transformation of (g)

Original histograms



Output histograms



r	*Kid Ori*	*Kid Out*	*Fruit Ori*	*Fruit Out*
0	0	1.04167E-05	0	2.46914E-06
1	0	0.00000625	0	2.46914E-06
2	0	1.04167E-05	0	1.23457E-06
3	0	8.33333E-06	0	4.93827E-06
4	0	1.66667E-05	0	4.93827E-06
5	0	0.00001875	0	1.11111E-05
6	0	0.00001875	0	2.34568E-05
7	0	3.54167E-05	0	3.20988E-05
8	0	0.0000875	0	4.5679E-05
9	0	0.00006875	0	7.77778E-05
10	0	0.0000875	0	4.07407E-05
11	0	0.000122917	0	0.000139506
12	0	0.00025625	0	0.000182716
13	0	0.0003125	0	0.000355556
14	0	0.000414583	0	0.000539506
15	0	0.0005375	0	0.000341975
16	2.08333E-06	0.000785417	0	0.000923457
17	0	0.000983333	2.46914E-06	0.001553086
18	0	0.0008125	3.7037E-06	0.002246914
19	2.08333E-06	0.001645833	1.23457E-06	0.001404938
20	2.08333E-06	0.001395833	2.46914E-06	0.0038
21	8.33333E-06	0.0025375	7.40741E-06	0.002358025
22	0.0000125	0.002085417	9.87654E-06	0.005903704
23	1.04167E-05	0.00375	1.48148E-05	0.003616049
24	2.70833E-05	0.003102083	1.48148E-05	0.008362963
25	2.91667E-05	0.005635417	1.35802E-05	0.004944444
26	3.95833E-05	0.004470833	3.7037E-05	0.011104938
27	6.66667E-05	0.005239583	5.55556E-05	0.006330864
28	0.0001125	0.009266667	5.67901E-05	0.013774074
29	0.000135417	0.0072375	0.0001	0.007051852
30	0.000177083	0.007841667	0.000138272	0.015007407
31	0.000222917	0.009027083	0.00017037	0.007859259
32	0.000258333	0.009516667	0.000192593	0.016504938
33	0.000372917	0.015922917	0.000269136	0.00832716
34	0.000525	0.011447917	0.00032716	0.008418519
35	0.000614583	0.012291667	0.000404938	0.017385185
36	0.000727083	0.01329375	0.000558025	0.008791358

37	0.000925	0.0141	0.000617284	0.008932099
38	0.001160417	0.014660417	0.000753086	0.018019753
39	0.001358333	0.015847917	0.000935802	0.009291358
40	0.00158125	0.016091667	0.001049383	0.009124691
41	0.001920833	0.016366667	0.001260494	0.008985185
42	0.002354167	0.017070833	0.001491358	0.018122222
43	0.00275	0.017285417	0.001712346	0.00907284
44	0.0030375	0.017514583	0.001967901	0.009111111
45	0.00360625	0.01746875	0.002319753	0.009171605
46	0.0040125	0.008845833	0.002544444	0.018316049
47	0.00459375	0.01750625	0.002698765	0.009137037
48	0.004904167	0.017235417	0.003008642	0.009208642
49	0.005625	0.01730625	0.003337037	0.009250617
50	0.0060125	0.017008333	0.003608642	0.009034568
51	0.006966667	0.0167625	0.003925926	0.009022222
52	0.007720833	0.008266667	0.004444444	0.018079012
53	0.00819375	0.016560417	0.004744444	0.008722222
54	0.008979167	0.016229167	0.004940741	0.008692593
55	0.009329167	0.01598125	0.005340741	0.008891358
56	0.010079167	0.007720833	0.005758025	0.008771605
57	0.01044375	0.015572917	0.005816049	0.008746914
58	0.01103125	0.015160417	0.006338272	0.008714815
59	0.011347917	0.007416667	0.006665432	0.008919753
60	0.0118125	0.01473125	0.006802469	0.017682716
61	0.012222917	0.014410417	0.00702716	0.009064198
62	0.0123125	0.007070833	0.007209877	0.008912346
63	0.013095833	0.013622917	0.007654321	0.008893827
64	0.012927083	0.013185417	0.007920988	0.008890123
65	0.013170833	0.00659375	0.007890123	0.008966667
66	0.01323125	0.013008333	0.008025926	0.008662963
67	0.013379167	0.00631875	0.00845679	0.008830864
68	0.013247917	0.012847917	0.008277778	0.008907407
69	0.01296875	0.0126	0.008687654	0.008623457
70	0.012777083	0.00621875	0.008598765	0.008528395
71	0.01275625	0.012133333	0.008971605	0.008374074
72	0.012733333	0.006127083	0.008828395	0.008125926
73	0.01189375	0.012070833	0.009049383	0.008137037
74	0.011272917	0.006008333	0.008851852	0.007953086
75	0.01109375	0.011758333	0.009239506	0.007714815
76	0.010783333	0.005625	0.008823457	0.00767284
77	0.010308333	0.011379167	0.009165432	0.007395062

78	0.010091667	0.005516667	0.009164198	0.007249383
79	0.009714583	0.010802083	0.009028395	0.007182716
80	0.009195833	0.005541667	0.009262963	0.007004938
81	0.00895	0.010783333	0.009197531	0.006861728
82	0.008545833	0.005214583	0.009254321	0.006718519
83	0.008154167	0.010164583	0.00905679	0.006654321
84	0.007835417	0.004925	0.009058025	0
85	0.007516667	0.004870833	0.009059259	0.006495062
86	0.00710625	0.009652083	0.00922716	0.006609877
87	0.006754167	0.004820833	0.009085185	0.006365432
88	0.006629167	0.009479167	0.009124691	0.006454321
89	0.00658125	0.004464583	0.009225926	0.00652716
90	0.006466667	0.004585417	0.009118519	0.006444444
91	0.006208333	0.00894375	0.008895062	0.006395062
92	0.005939583	0.0042625	0.008964198	0.00637037
93	0.006010417	0.008304167	0.008918519	0.006403704
94	0.006054167	0.004075	0.008869136	0
95	0.005829167	0.003822917	0.008859259	0.006469136
96	0.005891667	0.00784375	0.009019753	0.006617284
97	0.006114583	0.003597917	0.008745679	0.006545679
98	0.006295833	0.00381875	0.008912346	0.006533333
99	0.006066667	0.007295833	0.008839506	0.00652716
100	0.0062125	0.003520833	0.008911111	0.006535802
101	0.006429167	0.003727083	0.008739506	0.006660494
102	0.0062	0.0069625	0.008791358	0
103	0.006335417	0.003466667	0.008555556	0.006825926
104	0.006529167	0.0030625	0.008632099	0.006445679
105	0.006620833	0.003352083	0.008606173	0.006620988
106	0.006716667	0.006604167	0.0085	0.006645679
107	0.006795833	0.003329167	0.008409877	0.00645679
108	0.006829167	0.0033125	0.008423457	0
109	0.00684375	0.006302083	0.008038272	0.006585185
110	0.007114583	0.00309375	0.008181481	0.006688889
111	0.006872917	0.003	0.008146914	0.006560494
112	0.006989583	0.003027083	0.007885185	0.006344444
113	0.007022917	0.00603125	0.007835802	0
114	0.007304167	0.002997917	0.007775309	0.006476543
115	0.00703125	0.00288125	0.007791358	0.006508642
116	0.007079167	0.002920833	0.00752716	0.006544444
117	0.006922917	0.00586875	0.007412346	0.006562963
118	0.00701875	0.002883333	0.007487654	0

119	0.006895833	0.002795833	0.007076543	0.006297531
120	0.006775	0.002902083	0.007277778	0.006417284
121	0.006766667	0.005664583	0.006961728	0.006519753
122	0.006841667	0.002808333	0.007067901	0.006548148
123	0.006695833	0.002902083	0.00675679	0
124	0.0065125	0.002779167	0.006750617	0.006387654
125	0.006135417	0.0028125	0.006661728	0.006491358
126	0.006529167	0.005491667	0.006783951	0.006524691
127	0.006125	0.002745833	0.006491358	0
128	0.005679167	0.002675	0.006650617	0.006491358
129	0.005804167	0.00268125	0.006483951	0.006514815
130	0.005452083	0.002604167	0.006493827	0.006476543
131	0.005491667	0.002647917	0.006535802	0
132	0.00538125	0.005185417	0.006459259	0.006361728
133	0.005227083	0.00249375	0.006591358	0.006419753
134	0.0050625	0.002472917	0.006519753	0.006244444
135	0.004866667	0.002408333	0.006511111	0
136	0.004835417	0.002604167	0.00654321	0.006035802
137	0.004622917	0.00250625	0.006646914	0.005895062
138	0.00460625	0.002354167	0.006520988	0
139	0.004358333	0.004814583	0.006512346	0.005835802
140	0.004335417	0.002329167	0.006614815	0.005683951
141	0.004464583	0.002266667	0.006659259	0.005477778
142	0.004064583	0.002166667	0.006406173	0
143	0.004158333	0.00210625	0.006439506	0.00527037
144	0.00414375	0.002095833	0.006653086	0.005092593
145	0.00396875	0.002060417	0.006582716	0
146	0.00369375	0.00193125	0.006453086	0.004992593
147	0.003839583	0.003802083	0.006630864	0.004716049
148	0.003833333	0.001727083	0.006506173	0.004564198
149	0.003622917	0.001697917	0.006566667	0
150	0.003675	0.001652083	0.006434568	0.004330864
151	0.003635417	0.0015625	0.006493827	0.004288889
152	0.0035375	0.001704167	0.006325926	0
153	0.003497917	0.001477083	0.006475309	0.004020988
154	0.0034	0.00150625	0.006440741	0.003839506
155	0.00348125	0.001495833	0.00621358	0
156	0.003466667	0.001433333	0.00625679	0.003723457
157	0.003341667	0.001383333	0.006212346	0.00347037
158	0.00336875	0.002602083	0.006190123	0
159	0.003283333	0.0011375	0.006414815	0.003230864

160	0.003260417	0.001195833	0.006179012	0.003101235
161	0.003189583	0.001022917	0.006161728	0
162	0.003104167	0.00105	0.006087654	0.002992593
163	0.003116667	0.000952083	0.005855556	0.002817284
164	0.0031375	0.00095625	0.005838272	0
165	0.003177083	0.000914583	0.00557284	0.002682716
166	0.0031875	0.000822917	0.005585185	0.002465432
167	0.003147917	0.000764583	0.005524691	0
168	0.003072917	0.0007	0.005317284	0.002320988
169	0.002858333	0.000720833	0.005191358	0.002187654
170	0.002777083	0.000564583	0.005018519	0
171	0.002910417	0.0006	0.00487284	0.002018519
172	0.002891667	0.00058125	0.004701235	0.0019
173	0.002866667	0.0005	0.004638272	0
174	0.00280625	0.000464583	0.004295062	0.001848148
175	0.002852083	0.000397917	0.004138272	0.001635802
176	0.002704167	0.000420833	0.004049383	0
177	0.002689583	0.00033125	0.003902469	0.001528395
178	0.00276875	0.000291667	0.003708642	0.001491358
179	0.002702083	0.000316667	0.003488889	0
180	0.002608333	0.000239583	0.003325926	0.001374074
181	0.002633333	0.000216667	0.003149383	0
182	0.002589583	0.00023125	0.002971605	0.001218519
183	0.002475	0.000222917	0.002848148	0.001076543
184	0.002497917	0.000170833	0.002741975	0
185	0.002647917	0.00019375	0.002525926	0.001045679
186	0.002620833	0.000127083	0.002298765	0.001009877
187	0.002627083	0.000145833	0.002302469	0
188	0.0025375	0.000116667	0.00211358	0.000912346
189	0.002779167	0.000125	0.00202716	0
190	0.002597917	0.000102083	0.001928395	0.000845679
191	0.002747917	0.000102083	0.00172716	0.0008
192	0.002729167	7.91667E-05	0.001644444	0
193	0.002739583	8.54167E-05	0.001683951	0.00067284
194	0.003039583	6.66667E-05	0.001528395	0
195	0.00291875	0.0000625	0.001293827	0.000628395
196	0.002914583	6.04167E-05	0.001250617	0.00057037
197	0.002845833	0.0000625	0.001092593	0
198	0.002954167	3.33333E-05	0.001025926	0.000546914
199	0.003010417	3.95833E-05	0.001025926	0.000481481
200	0.00311875	0.0000375	0.00088642	0

201	0.002958333	0.000025	0.000812346	0.000387654
202	0.003002083	2.91667E-05	0.000766667	0
203	0.0031125	3.33333E-05	0.000667901	0.000382716
204	0.002879167	0.000025	0.000639506	0
205	0.003052083	2.08333E-05	0.000593827	0.000316049
206	0.002641667	0.0000125	0.00047284	0.000253086
207	0.002570833	2.08333E-05	0.00047284	0
208	0.002735417	0	0.000444444	0.000211111
209	0.002502083	1.66667E-05	0.000365432	0
210	0.00244375	1.45833E-05	0.000328395	0.000182716
211	0.0021625	0.00000625	0.000264198	0.00017037
212	0.001891667	8.33333E-06	0.000274074	0
213	0.002075	4.16667E-06	0.000238272	0.000138272
214	0.0019	4.16667E-06	0.000183951	0
215	0.001647917	4.16667E-06	0.000192593	9.87654E-05
216	0.001485417	1.04167E-05	0.000124691	0
217	0.001214583	8.33333E-06	0.000133333	0.0001
218	0.001147917	0.00000625	9.38272E-05	8.02469E-05
219	0.001072917	1.45833E-05	9.01235E-05	0
220	0.000977083	0	7.03704E-05	5.55556E-05
221	0.000839583	0	7.53086E-05	0
222	0.00073125	8.33333E-06	5.18519E-05	4.81481E-05
223	0.000483333	8.33333E-06	4.07407E-05	0
224	0.000435417	0	2.83951E-05	5.30864E-05
225	0.000427083	0	2.71605E-05	2.71605E-05
226	0.000272917	0	1.7284E-05	0
227	0.000166667	0	2.59259E-05	1.85185E-05
228	0.000191667	0.00000625	8.64198E-06	0
229	0.00015625	0	9.87654E-06	1.7284E-05
230	0.000114583	4.16667E-06	6.17284E-06	0
231	0.00009375	0	2.46914E-06	2.71605E-05
232	0.000075	2.08333E-06	2.46914E-06	0
233	2.91667E-05	0	1.23457E-06	1.48148E-05
234	2.70833E-05	2.08333E-06	4.93827E-06	3.7037E-06
235	3.54167E-05	0	1.23457E-06	0
236	1.45833E-05	0	1.23457E-06	7.40741E-06
237	1.04167E-05	0	0	0
238	4.16667E-06	0	0	1.23457E-05
239	0	0	0	0
240	0	0	0	4.93827E-06
241	0	2.08333E-06	0	0

242	0	0	0	1.23457E-06
243	0	0	0	0
244	0	0	0	4.93827E-06
245	0	0	0	0
246	0	0	0	1.23457E-06
247	0	0	0	0
248	0	0	0	0
249	0	0	0	1.23457E-06
250	0	0	0	0
251	0	2.08333E-06	0	0
252	0	1.04167E-05	0	0
253	0	0.00000625	0	0
254	0	1.04167E-05	0	0
255	0	8.33333E-06	0	1.23457E-06

3.code

```
%Gray_Image
% grayImage = imread("kid blurred-noisy.tif");
grayImage = imread("fruit blurred-noisy.tif");
imshow(grayImage);
ax = gcf;
exportgraphics(ax, "Gray_Image.png",'Resolution', 200);

% Laplacian_Gradient
% laplacianKernel = [-1,-1,-1;-1,8,-1;-1,-1,-1]; % kid
laplacianKernel = [0, 1, 0; 1,-4, 1; 0, 1, 0]; % fruit
laplacianImage = imfilter(double(grayImage), laplacianKernel, "replicate");
laplacianImag = uint8(255*mat2gray(laplacianImage));
imshow(laplacianImag);
ax = gcf;
exportgraphics(ax, "Laplacian_Gradient.png",'Resolution', 200);

% Laplacian_Sharpen
sharpenedImage = double(grayImage) + laplacianImage;
sharpenedImag = uint8(255*mat2gray(sharpenedImage));
imshow(sharpenedImag);
ax = gcf;
exportgraphics(ax, "Laplacian_Sharpen.png",'Resolution', 200);

% Sobel_Gradient
[magnitudeImage, directionImage] = imgradient(grayImage, 'Sobel');
magnitudeImag = uint8(255*mat2gray(magnitudeImage));
imshow(magnitudeImag);
ax = gcf;
exportgraphics(ax, "Sobel_Gradient.png",'Resolution', 200);

% Smooth_Gradient
SmoothGradient = imboxfilt(magnitudeImage,5)/25;
SmoothGradien = uint8(255*mat2gray(SmoothGradient));
imshow(SmoothGradien);
ax = gcf;
exportgraphics(ax, "Smooth_Gradient.png",'Resolution', 200);

% Extracted_Feature
ExtractedFeature = immultiply(SmoothGradient,laplacianImage);
ExtractedFeatur = uint8(255*mat2gray(ExtractedFeature));
imshow(ExtractedFeatur);
```

```
ax = gcf;
exportgraphics(ax, "Extracted_Feature.png",'Resolution', 200);

% A_Plus_F
AF = double(ExtractedFeatur) + double(grayImage);
AF1 = uint8(255*mat2gray(AF));
imshow(AF1);
ax = gcf;
exportgraphics(ax, "A_Plus_F.png",'Resolution', 200);

% Powerlaw_Transformation
const = 1;
gama = 2;
image = double(AF);
S = const * (image .^gama);
% T = 255/(const * (255 .^gama));
% powerlaw = uint8(T * S);
powerlaw = uint8(255*mat2gray(S));
imshow(powerlaw);
ax = gcf;
exportgraphics(ax, "Powerlaw_Transformation.png",'Resolution', 200);
```