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Glassy Effects for General Images

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Abstract

This paper proposes a new grassy effect generation method. The grassy effect changes original image as the one behind the grass. Random number generation function is used to decide block size and the pixel location. Various block size and pixel location give unexpected grassy effect to the original image. Objective and visual performance comparison reveals that the proposed method successfully generates glassy effected images.

Keywords: *Image processing, glassy effect, random number generation, variable length block*

1. Introduction

With the fast computing devices, embedded systems and image processors available in the 21st century, digital image processing field has achieved many missions [1,2]. Image processing yields an effect on the original image and perform to obtain desired image [3-5]. One of image processing effects is glassy effect (GE). The GE effect helps original image to look of glassy image.

The glass is an amorphous solid object which shows a glass–liquid transition. This is the reversible transition in amorphous objects from a rigid and fragile state into a melted or elastomer state. Therefore, glasses are generally fragile and are optically transparent. The GE is a use of computer methods to conduct image processing on digital signals. As a subcategory of digital image processing, it changes original image as the one behind the grass. Normally the GE is performed over 2D signal, however this can be modeled in the multi-dimensional signal [6-15].

Figure 1 shows the process of GE effect. The observer after GE effect may see the original image behind the glass. As one can see the GE effect applied image loses high frequency energy and the image look blurred.

In this paper, we propose a real time GE method. The rest of the paper is organized as follows. Section 2 describes the proposed GE method. Section 3 shows simulation results and discussion is provided. Finally, conclusion remarks are drawn in Section 4.

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2. Proposed Method

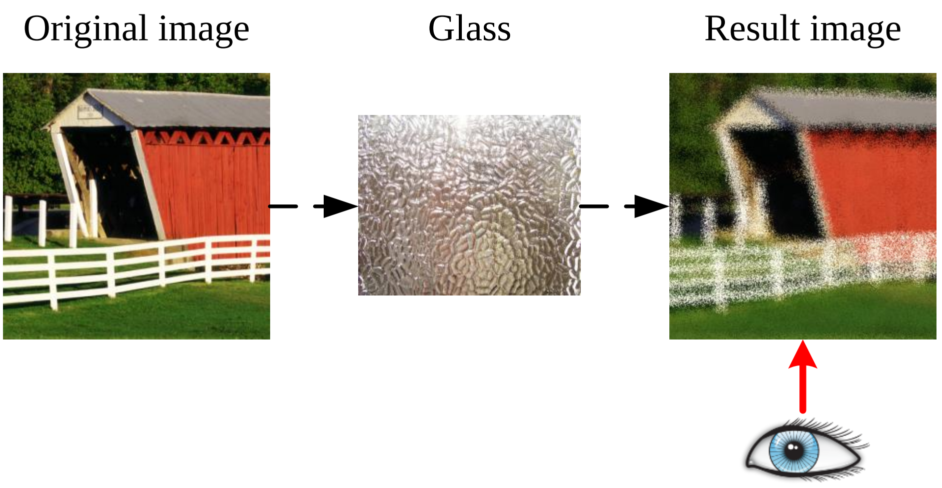


Figure 1. The Process of the Glassy Effect

The proposed method consists of three steps as shown in Figure 2. Here is pseudo code of the proposed method.

Pseudo Code:

Step 1

Generate two random numbers (both numbers ≤ 20) and choose them as a horizontal and vertical block size (b_1, b_2) for every pixel location. Parameters c_H and c_V are currently processed pixel position

```
b1 = ceil(rand(1)*20);
b2 = ceil(rand(1)*20);
block = image(cH:cH+b1-1,cv:cv+b2-1,:);
```

Step 2

Generate two random numbers and choose them as a horizontal and vertical pixel positions (s_1, s_2)

```
s1 = ceil(rand(1)*b1);
s2 = ceil(rand(1)*b2);
```

Step 3

Select the corresponding pixel as a result one

```
Red_intensity = image(s1,s1,1);
Green_intensity = image(s1,s1,2);
Blue_intensity = image(s1,s1,3);
```

Step 4

The process is conducted for all pixels

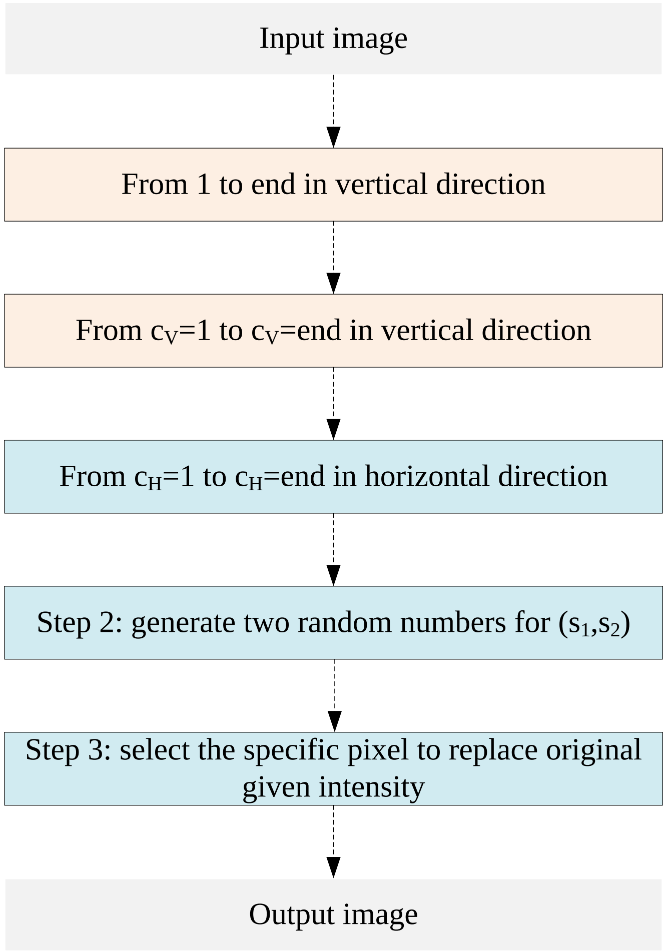


Figure 2. Block Diagram of the Proposed Method

Let us assume 18th McM image as the test image and the pixel location (c_H, c_V) = (493, 493). After applying Step 1, one obtains (b_1, b_2) = (7,7). The results blocks for red, green, and blue are shown as Figure 3.

94	95	80	75	80	92	90
105	114	98	96	103	105	106
114	115	116	105	102	96	101
126	118	115	120	109	106	95
119	124	115	109	108	115	109
101	105	112	92	106	120	114
87	77	89	92	105	119	122

(a)

123	123	118	105	104	120	122
128	137	129	123	129	133	133
131	138	136	128	131	132	130
138	138	136	139	138	138	126
132	145	139	134	137	142	129
122	131	137	118	131	143	129
111	102	117	121	129	139	137

(b)

41	42	34	29	29	43	44
44	50	46	38	40	45	50
47	45	47	41	42	43	45
51	44	45	47	49	48	39
50	53	46	42	48	51	43
41	45	45	38	44	48	45
34	30	39	40	40	45	51

(c)

Figure 3. (a) Red Channel, (b) Green Channel, and (c) Blue Channel of Selected Block

After Step 2, one may obtain (s_1,s_2) which is pixel location in a block. Note that parameters s_1 and s_2 are smaller than b_1 and b_2, respectively. When $(s_1, s_2) = (4,4)$, color components are obtained as follows:

Red_intensity = image(497, 497, 1);

Green_intensity = image(497, 497, 2);

Blue_intensity = image(497, 497, 3);

As (cH, cV) = (493, 493), pixel (497, 497) is located 4 pixels to the right and 4 pixels to the down, respectively. Now, the red, green, and blue intensities at (497, 497) position is (120,139,47). This process is shown in Figure 4, which is the results of Step 3.

94	95	80	75	80	92	90
105	114	98	96	103	105	106
114	115	116	105	102	96	101
126	118	115	120	109	106	95
119	124	115	109	108	115	109
101	105	112	92	106	120	114
87	77	89	92	105	119	122

(a)

123	123	118	105	104	120	122
128	137	129	123	129	133	133
131	138	136	128	131	132	130
138	138	136	139	138	138	126
132	145	139	134	137	142	129
122	131	137	118	131	143	129
111	102	117	121	129	139	137

(b)

41	42	34	29	29	43	44
44	50	46	38	40	45	50
47	45	47	41	42	43	45
51	44	45	47	49	48	39
50	53	46	42	48	51	43
41	45	45	38	44	48	45
34	30	39	40	40	45	51

(c)

Figure 4. Selected Red, Green, and Blue Channel Intensity

Finally, the original pixel (94,123,41) is replaced by (120,139,47) for performing GE.

3. Simulation Results

Figure 5. McM Dataset

We experiment with 18 McM images, which is shown in Figure 5. Tables 1-3 show the mean squared error (MSE) and the peak signal-to-noise ratio (PSNR) performance results for different (s_1, s_2) combinations. Note that (s_1, s_2) are computed with random number generating function. However to compare the performance, we selected three conditions of (s_1, s_2) parameters. Each table has four MSE and four PSNR results which are for red, green, blue, and color information, respectively.

Tables 1-3 are results with (s_1, s_2) = (5, 5), (s_1, s_2) = (10, 10), and (s_1, s_2) = (20, 20), respectively.

Table 1. MSE and PSNR Results of (s_1, s_2) = (5,5)

	MSE				PSNR			
	Red	Green	Blue	Color	Red	Green	Blue	Color
1	4085.29	4926.19	4965.01	4658.83	12.019	11.206	11.172	11.448
2	2814.61	2688.54	2301.28	2601.48	13.637	13.836	14.511	13.979
3	3580.38	2882.91	3699.52	3387.60	12.592	13.532	12.449	12.832
4	5492.03	2973.79	6039.08	4834.96	10.733	13.398	10.321	11.287
5	1518.36	2169.48	2762.50	2150.11	16.317	14.767	13.718	14.806
6	1591.63	1438.49	1234.70	1421.61	16.112	16.552	17.215	16.603
7	2161.87	2128.85	2035.76	2108.82	14.783	14.849	15.044	14.890
8	2031.17	1671.25	1397.86	1700.09	15.053	15.900	16.676	15.826
9	2346.30	1377.16	1178.33	1633.93	14.427	16.741	17.418	15.998
10	1653.60	1525.86	1188.29	1455.92	15.946	16.296	17.382	16.499
11	1681.07	1042.14	495.24	1072.82	15.875	17.952	21.183	17.826
12	1066.49	1476.94	909.69	1151.04	17.851	16.437	18.542	17.520
13	742.62	728.81	465.09	645.51	19.423	19.505	21.455	20.032
14	928.76	872.26	961.96	921.00	18.452	18.724	18.299	18.488
15	1282.14	949.09	748.12	993.11	17.051	18.358	19.391	18.161
16	3272.25	3346.86	461.54	2360.22	12.982	12.884	21.489	14.401
17	3440.21	1844.32	1710.74	2331.76	12.765	15.472	15.799	14.454
18	6014.00	5709.69	7077.96	6267.22	10.339	10.565	9.632	10.160
Avg.	2539.04	2208.48	2201.81	2316.45	14.80	15.39	16.21	15.29

Table 2. MSE and PSNR Results of (s_1, s_2) = (10,10)

	MSE				PSNR			
	Red	Green	Blue	Color	Red	Green	Blue	Color
1	3185.82	3902.09	3801.63	3629.85	13.099	12.218	12.331	12.532
2	2062.37	1965.39	1701.77	1909.85	14.987	15.196	15.822	15.321
3	3019.46	2465.73	3177.35	2887.51	13.332	14.211	13.110	13.526
4	4726.22	2545.87	5188.34	4153.47	11.386	14.072	10.981	11.947
5	1145.15	1700.02	2211.91	1685.69	17.542	15.826	14.683	15.863
6	1191.31	1112.81	964.23	1089.45	17.371	17.667	18.289	17.759

7	1561.20	1545.81	1492.71	1533.24	16.196	16.239	16.391	16.275
8	1565.12	1303.23	1083.35	1317.23	16.185	16.981	17.783	16.934
9	1872.41	1089.81	964.65	1308.96	15.407	17.757	18.287	16.962
10	1242.09	1134.46	896.65	1091.07	17.189	17.583	18.605	17.752
11	1232.79	825.60	377.59	811.99	17.222	18.963	22.361	19.035
12	804.97	1171.83	745.05	907.28	19.073	17.442	19.409	18.553
13	568.01	550.07	360.38	492.82	20.587	20.727	22.563	21.204
14	699.98	646.30	693.07	679.78	19.680	20.026	19.723	19.807
15	932.07	678.51	531.46	714.01	18.436	19.815	20.876	19.594
16	2582.12	2727.27	410.16	1906.52	14.011	13.774	22.001	15.328
17	2688.14	1475.01	1373.61	1845.58	13.836	16.443	16.752	15.469
18	4273.64	4065.75	4898.84	4412.74	11.823	12.039	11.230	11.684
Avg.	1964.05	1716.98	1715.15	1798.73	15.96	16.50	17.29	16.42

Table 3. MSE and PSNR Results of (s_1, s_2) = (20,20)

	MSE				PSNR			
	Red	Green	Blue	Color	Red	Green	Blue	Color
1	2980.42	3664.85	3573.78	3406.35	13.388	12.490	12.600	12.808
2	1921.09	1820.09	1595.19	1778.79	15.295	15.530	16.103	15.630
3	2915.86	2398.89	3111.60	2808.78	13.483	14.331	13.201	13.646
4	4640.98	2503.73	5135.94	4093.55	11.465	14.145	11.025	12.010
5	1088.29	1539.11	2033.13	1553.51	17.763	16.258	15.049	16.218
6	1123.35	1050.03	905.24	1026.21	17.626	17.919	18.563	18.018
7	1347.31	1342.86	1298.90	1329.69	16.836	16.851	16.995	16.893
8	1476.69	1230.33	1022.80	1243.27	16.438	17.231	18.033	17.185
9	1778.23	1044.42	954.78	1259.15	15.631	17.942	18.332	17.130
10	1207.16	1025.43	827.76	1020.12	17.313	18.022	18.952	18.044
11	1067.24	716.23	318.16	700.54	17.848	19.580	23.104	19.676
12	744.12	1079.28	691.80	838.40	19.414	17.799	19.731	18.896
13	548.66	533.10	349.95	477.24	20.738	20.863	22.691	21.343
14	765.29	682.32	663.08	703.56	19.293	19.791	19.915	19.658
15	860.24	612.74	482.06	651.68	18.785	20.258	21.300	19.990
16	2480.33	2638.00	397.75	1838.69	14.186	13.918	22.135	15.486
17	2511.39	1374.44	1278.33	1721.39	14.132	16.750	17.064	15.772
18	3894.69	3690.17	4328.51	3971.12	12.226	12.460	11.767	12.142

Avg.	1852.85	1608.11	1609.38	1690.11	16.21	16.79	17.59	16.70

The MSE and PSNR results of color information of Tables 1-3 can be drawn as Figure 6.

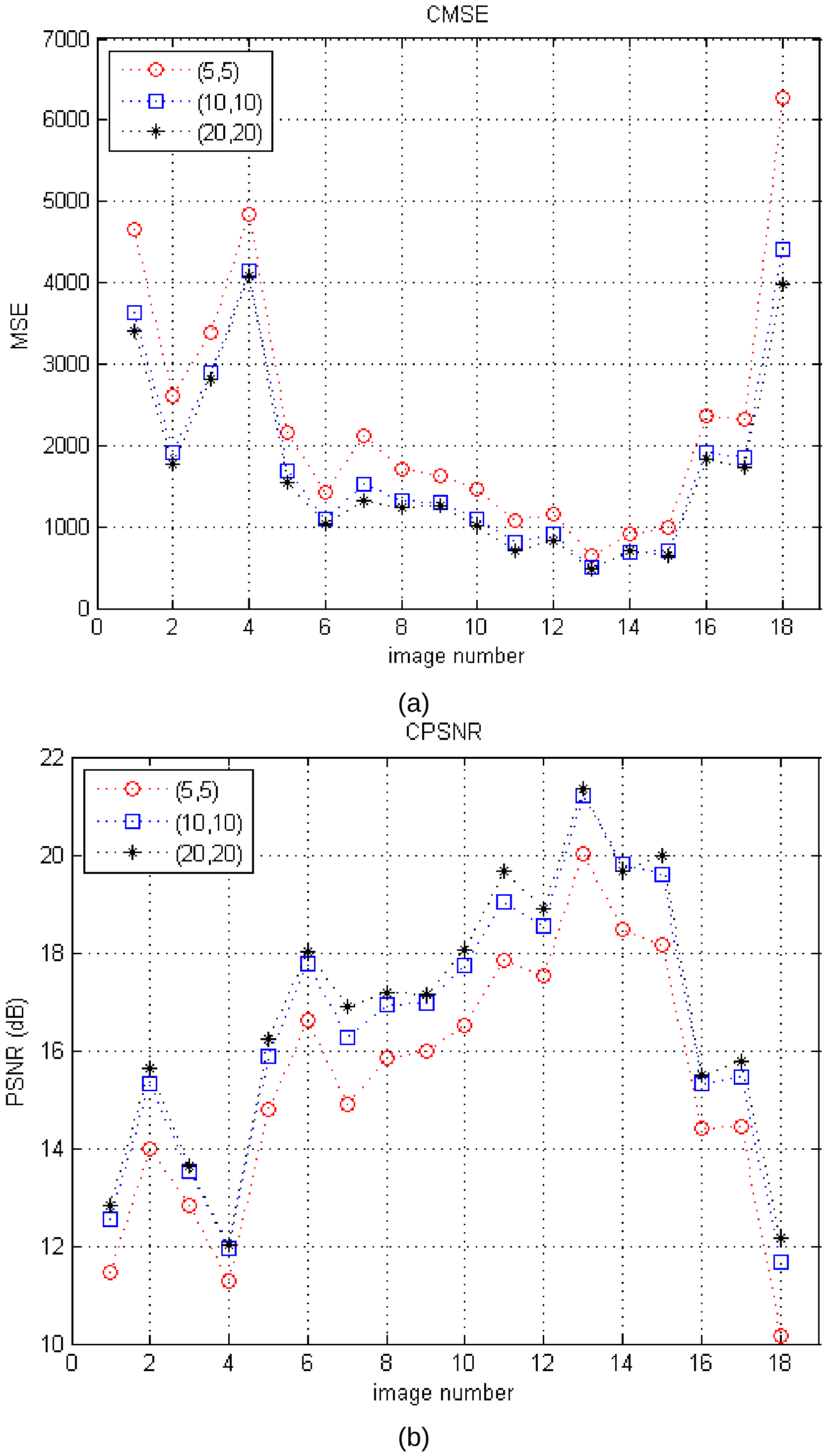
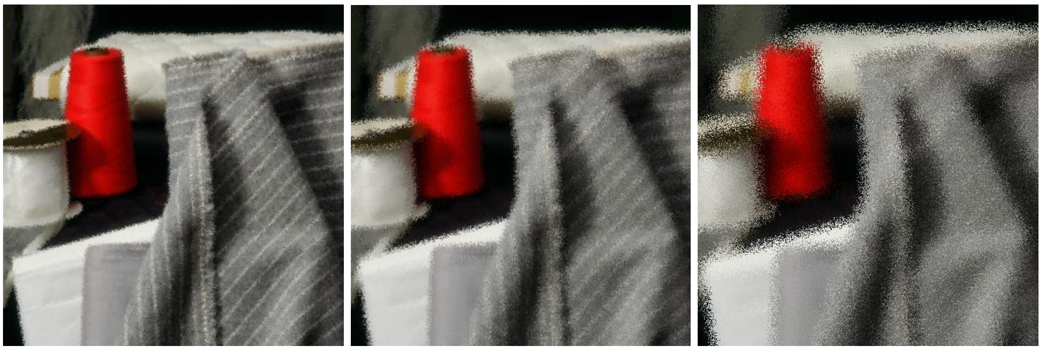


Figure 6. Performance Comparison on Three (s_1, s_2) Conditions: (a) CMSE, (b) CPSNR

The visual performance is compared in Figures. 7-10. As we can see, image with higher (s_1, s_2) are more blur, and the high frequency energy was lost.

(a) (b) (c)

Figure 7. Visual Performance Comparison for #3 McM Image: (a) (s_1, s_2) = (5, 5), (b) (s_1, s_2) = (10, 10), and (c) (s_1, s_2) = (20, 20)

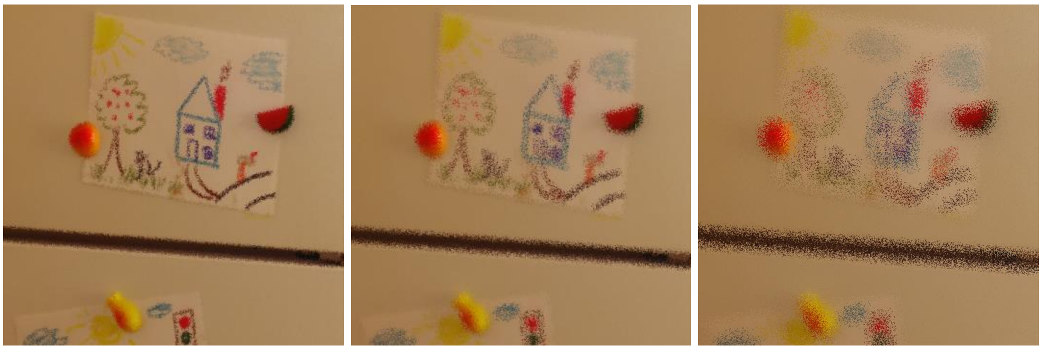


(a) (b) (c)

Figure 8. Visual Performance Comparison for #7 McM Image: (a) (s_1, s_2) = (5, 5), (b) (s_1, s_2) = (10, 10), and (c) (s_1, s_2) = (20, 20)

(a) (b) (c)

Figure 9. Visual Performance Comparison for #11 McM Image: (a) (s_1, s_2) = (5, 5), (b) (s_1, s_2) = (10, 10), and (c) (s_1, s_2) = (20, 20)



(a) (b) (c)

Figure 10. Visual Performance Comparison for #13 McM Image: (a) (s_1, s_2) = (5, 5), (b) (s_1, s_2) = (10, 10), and (c) (s_1, s_2) = (20, 20)

4. Conclusions

In this paper, we presented a new grassy effect method which make original image look blurred. Random number generator was used for block size and pixel location selection. Different block size and pixel location parameters provide various grassy effects. Simulation results reveals that the presented method successfully provide glassy effected images.

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Footnote

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