Supplementary Material for Intrinsic Image Decomposition with Step and Drift Shading Separation

Bin Sheng, Ping Li, Yuxi Jin, Ping Tan, and Tong-Yee Lee, *Senior Member, IEEE*

Abstract

This supplementary provides some more experimental results, which could not be fit in the main paper due to the page limit.

I. More Experimental Results

In addition to the intuitive demonstration of curve chart on the MIT dataset, we show some more detailed experimental results of MIT dataset in TABLE I and Fig. 1. In TABLE I, we compare our results with those of other state-of-the-art methods. As shown, our method outperforms other approaches in most cases. For those non-ideal examples (our results are better than others but assessed value are not perfect), we can figure out that conditions are really complicated. In Fig. 1, we compare our method with the classical Retinex algorithm, which our method slightly leverage. We can see that our method has achieved the desired and anticipated performance. We also show the parameters tuning in Fig. 2 and demonstrate the applicable ranges of parameters of θ^g and θ^{t1} on a set of images. Moreover, in Fig. 3, we give more examples on extensional application of our method, such as retexturing and relighting.

TABLE I
Comparison Results of LMSE$\times 10^3$ on Images from the MIT Dataset

Samples	Color Retinex	Rother et al. [1]	Zhao et al. [2]	SR [3]	SRC [3]	Ours
Box	12.59	11.58	5.00	3.60	1.80	1.60
Cup1	7.17	5.90	10.00	4.30	3.00	2.82
Cup2	11.36	12.20	5.00	5.20	4.50	4.74
Deer	41.67	36.90	45.00	41.30	41.90	35.05
Dinosaur	36.15	34.17	26.00	31.70	21.60	19.86
Frog1	64.80	50.71	51.00	55.80	48.30	47.10
Frog2	70.76	64.47	69.00	58.70	47.20	41.43
Panther	10.50	7.01	6.00	7.50	7.80	1.97
Paper1	3.74	0.94	8.00	1.90	1.40	0.86
Paper2	4.12	1.54	5.00	2.70	2.10	1.47
Raccoon	14.95	5.49	4.00	5.20	4.80	1.95
Squirrel	69.54	57.17	74.00	85.60	79.40	49.27
Sun	2.88	1.93	2.00	2.40	2.30	1.29
Teabag1	31.31	24.32	42.00	28.00	28.00	22.93
Teabag2	22.46	22.30	17.00	15.10	14.10	13.91
Turtle	67.87	53.81	37.00	34.90	17.40	13.20
Average	29.49	23.90	25.40	24.00	20.40	16.22

References

[1] C. Rother, M. Kiefel, L. Zhang, B. Schölkopf, and P. V. Gehler, "Recovering intrinsic images with a global sparsity prior on reflectance," in *Advances in Neural Information Processing Systems*, 2011, pp. 765–773.
[2] Q. Zhao, P. Tan, Q. Dai, L. Shen, E. Wu, and S. Lin, "A closed-form solution to retinex with nonlocal texture constraints," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 34, no. 7, pp. 1437–1444, 2012.
[3] L. Shen, C. Yeo, and B.-S. Hua, "Intrinsic image decomposition using a sparse representation of reflectance," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 35, no. 12, pp. 2904–2915, 2013.
[4] E. H. Land and J. J. McCann, "Lightness and retinex theory," *Journal of the Optical Society of America*, vol. 61, no. 1, pp. 1–11, 1971.

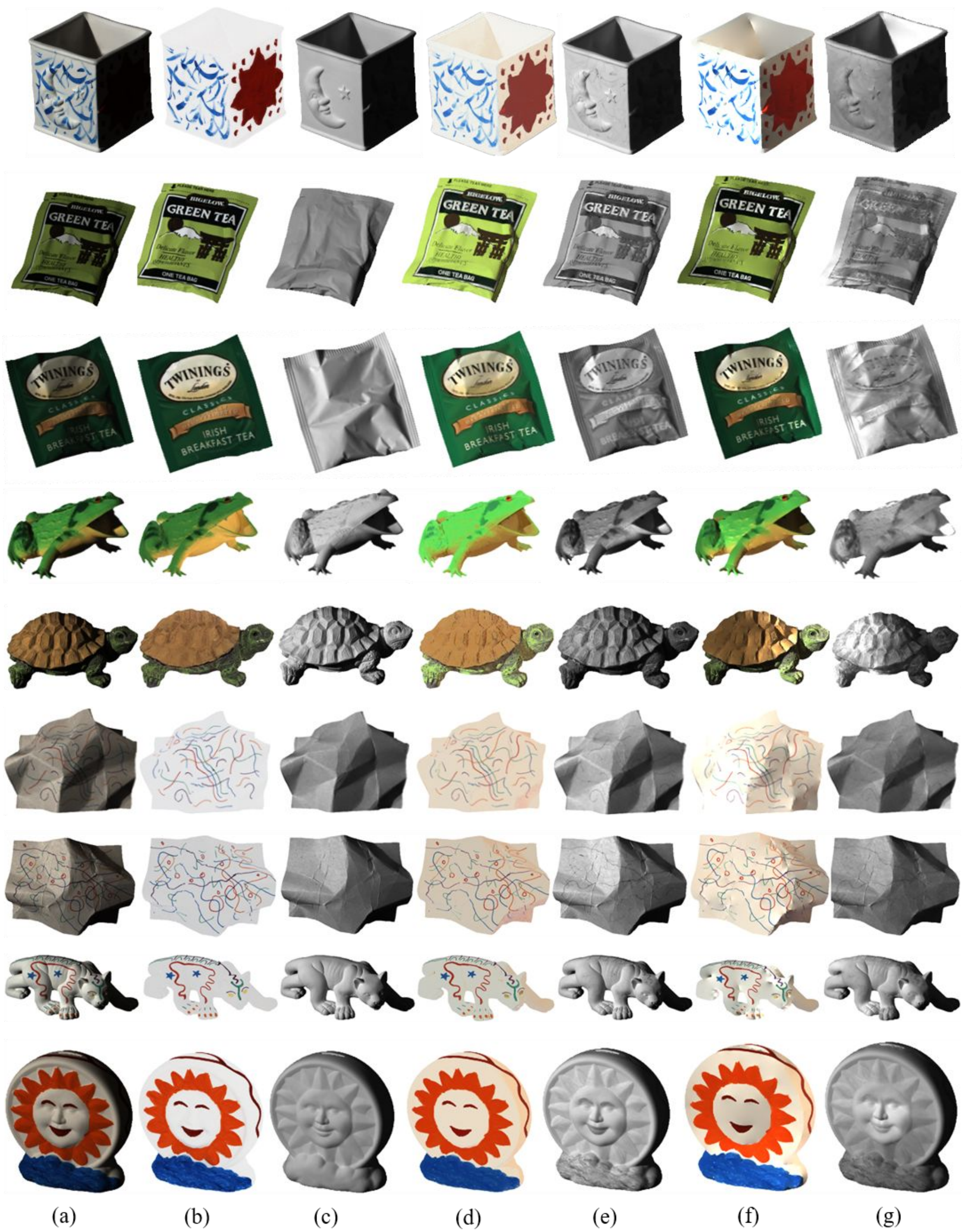
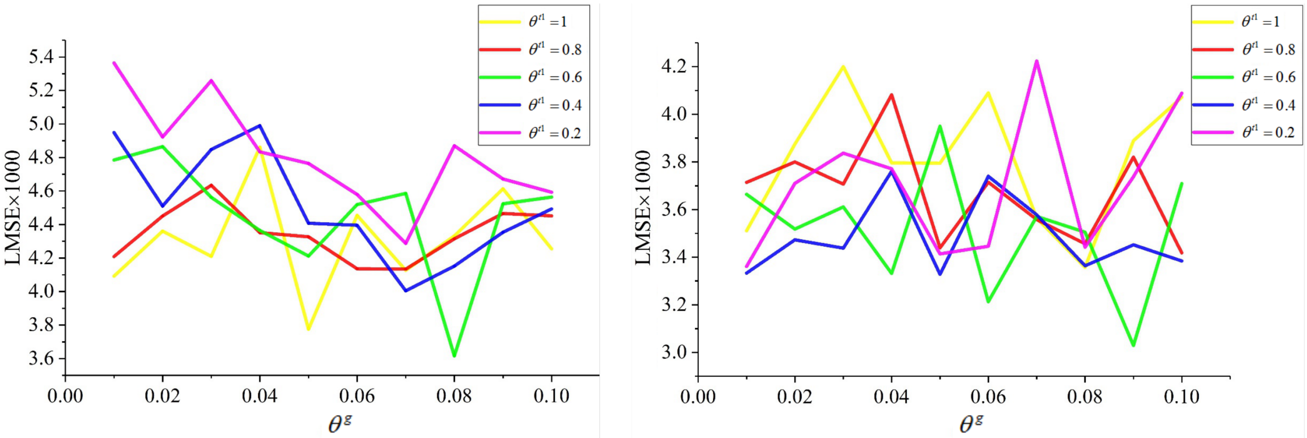
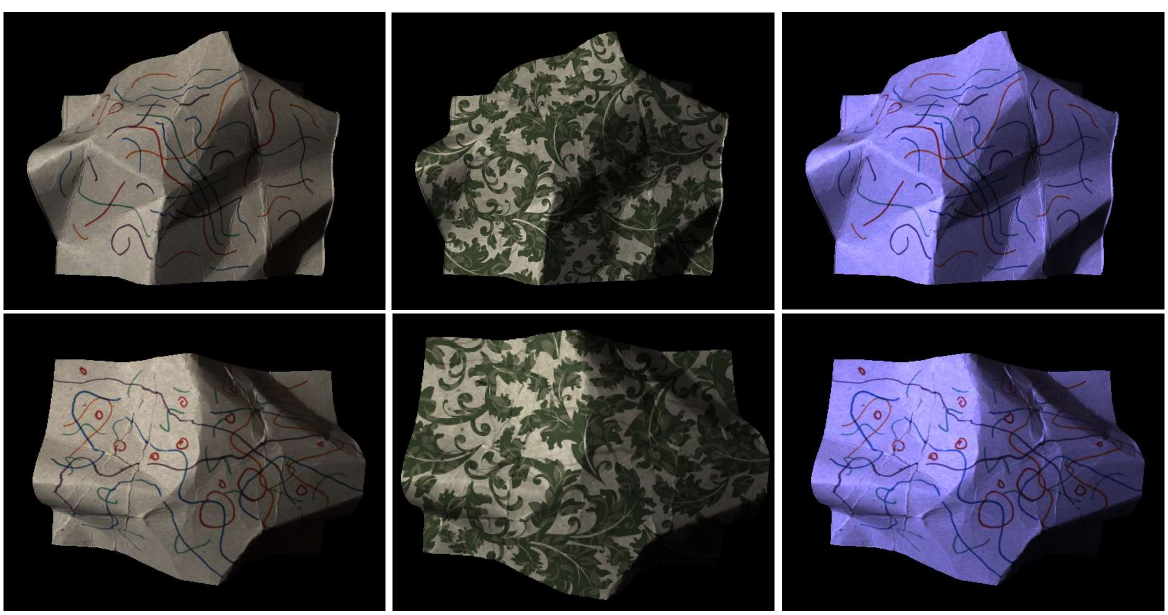


Fig. 1. Visual results of intrinsic image recovery on the MIT dataset. (a) Single input image, (b) and (c) ground truth, (d) and (e) our result, and (f) and (g) the Retinex algorithm [4]. Here, our method has a more exact shading component; for instance, the shadow boundary is clearer. In the albedo component, the effect of shadow is alleviated by the decomposition of the illumination into two elements. In the MIT dataset, there is only a single object per image and occlusion by other objects does not exist.



(a) (b)

Fig. 2. The mean LMSE values over all edges on the real image data set change with thresholds varies. (a) $\theta^{t1} = 1, 0.8, 0.6, 0.4, 0.2$ and θ^{g} varies from 0.01 to 0.10, with $\gamma = 0.01$ fixed. (b) $\theta^{t1} = 1, 0.8, 0.6, 0.4, 0.2$ and θ^{g} varies from 0.01 to 0.10, with $\gamma = 0.1$ fixed. To balance the performace, we can set θ^{g} a value from 0.05 to 0.08, while set θ^{t1} a value from 0.6 to 0.8, with $\gamma = 0.01$ fixed.



Input Image Modified reflectance Modified light

Fig. 3. Our method has some applications, such as retexturing and relighting. After estimating reflectance and shading from a single image, we can modify any of those two properties to obtain new effects.