Exploiting Reflection Change for Automatic Reflection Removal (Supplemental Materials)

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Description

This supplemental material includes additional figures not included in the original paper. Figure 1 and Figure 2 show additional comparisons of the alignment results obtained by optical flow and SIFT-flow. This is intended to show that SIFT-flow is reasonably robust to reflection interference. Figure 3 shows an additional example comparing our method with the results produce by Levin and Weiss [2] and Gai et al. [1]. In this Figure we also show the user markup provided to the algorithm used by Levin and Weiss [2]. Figure 4 shows a failure case and how this can be fixed by simply cropping the image. Finally, we show more results with associated edge maps in Figure 5.

Fig. 1. This figure shows the results of pixel-wise image alignment for images with reflection interference. The approach compares optical flow and SIFT-flow. Input I_2 is registered to the reference view (*i.e.* I_1). For the optical flow method, we used a state-of-art method in 2010 [3]. This result is obtained using the code provided by the author at http://www.cs.brown.edu/∼dqsun/code/.

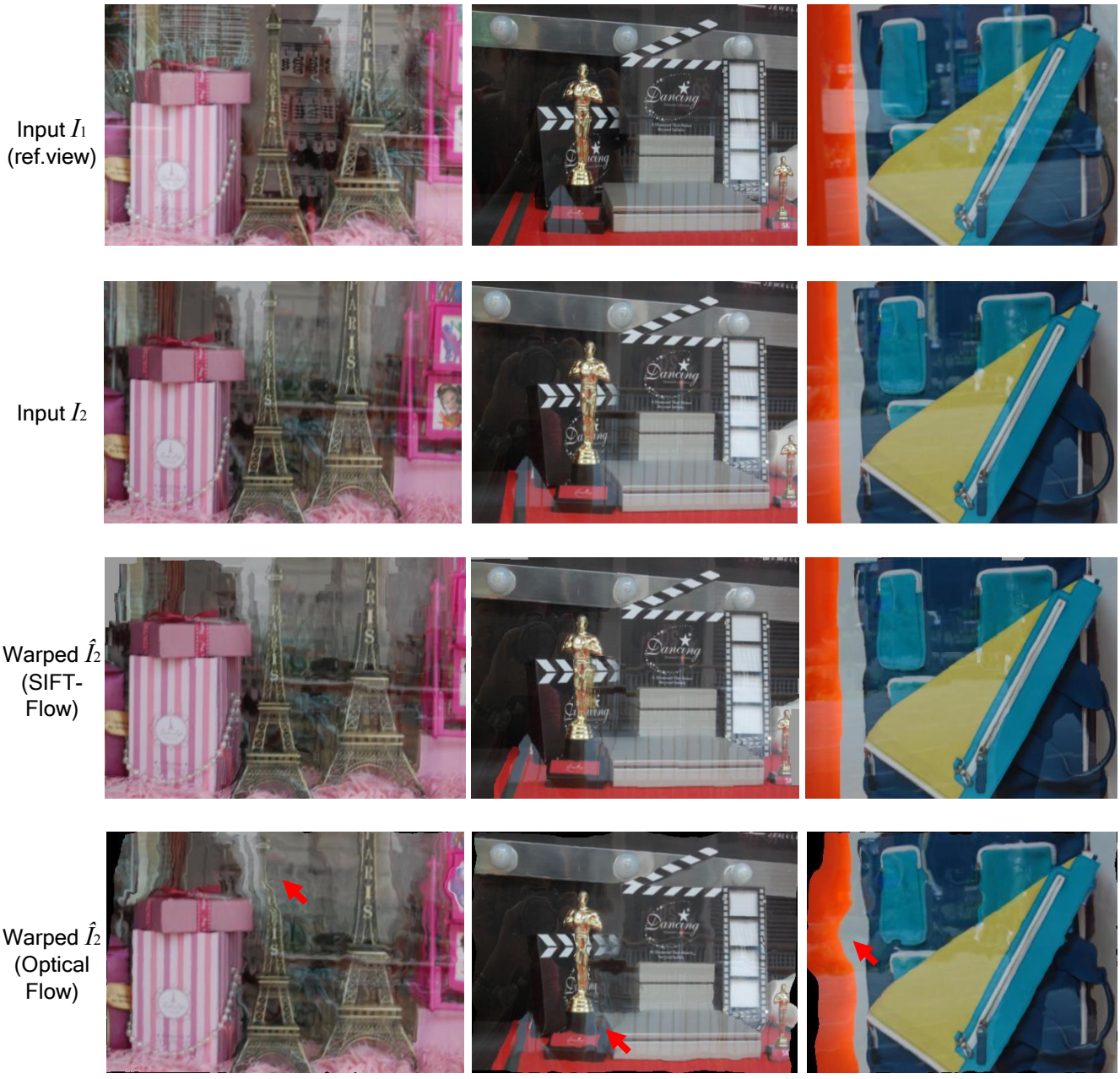

Fig. 2. This figure shows three more examples comparing optical flow and SIFT-flow on images with reflection interference. Top row shows the reference images; second row shows the input images that need to be aligned to the references; third row shows the results obtained by SIFT-flow; fourth row shows the results obtained by optical flow. Arrows point out notable errors in the alignment estimation.

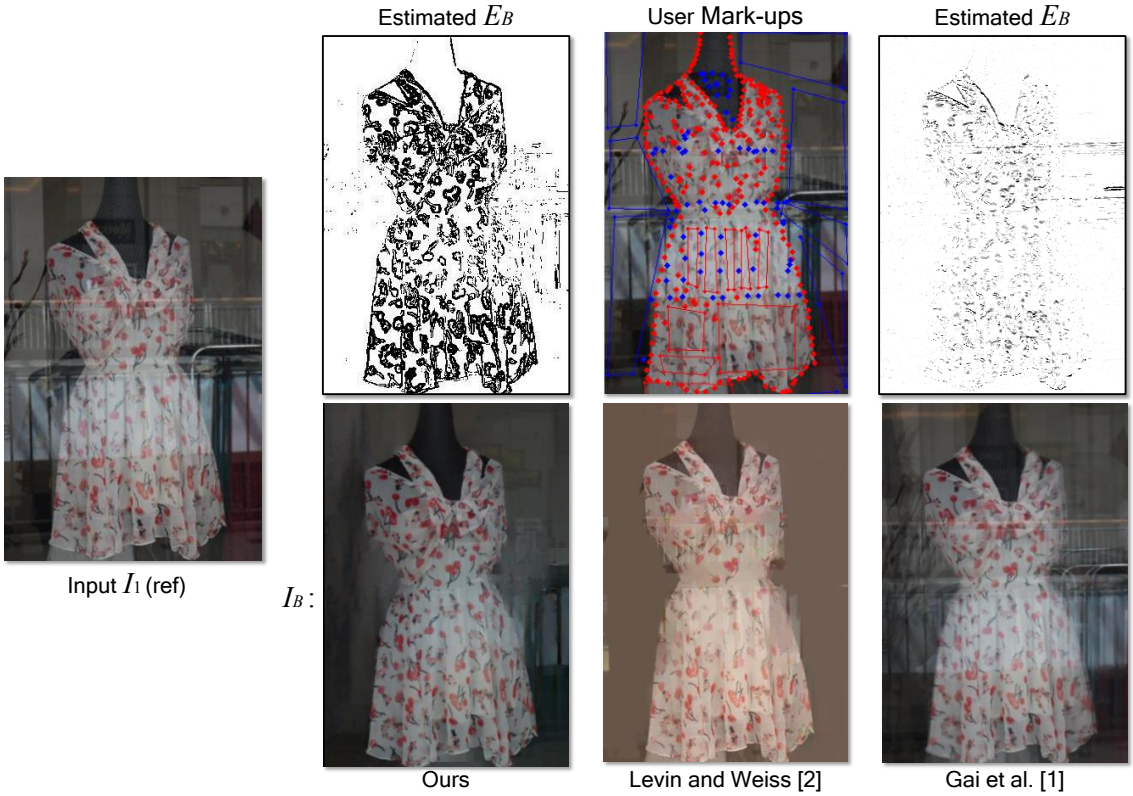

Fig. 3. This figure shows an additional comparison between our method and those in Gai et al. [1] and Levin and Weiss [2]. We show the final reflection removal results and a crucial intermediate step used by our method and [2] of labelling edges belonging to reflection or background . For the method in [2], this step is done by having the user provided markup. The result shows our method can get a clearer and more accurate edge map of the background than the method in [1]. This is caused by the unsatisfactory alignment using the global transformation in their method. For the method in [2], large amount of user markup is needed. Even with this elaborate markup, the reflection removal result is not as satisfactory as ours.

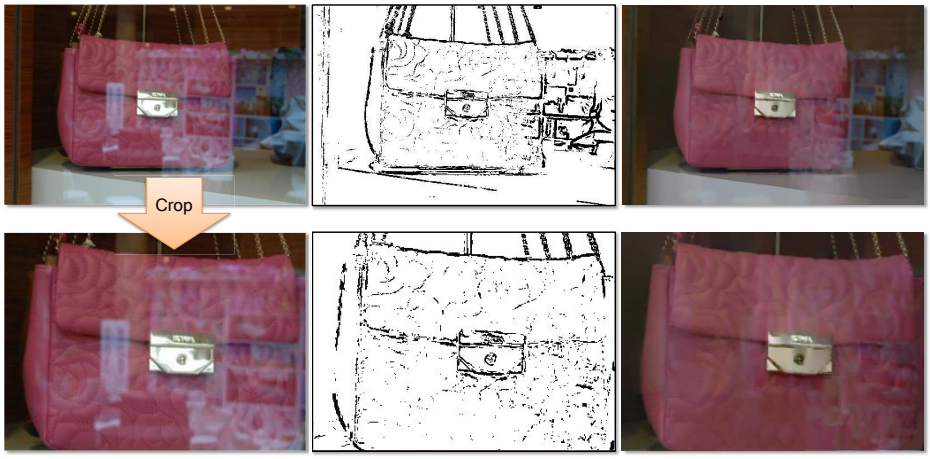

Fig. 4. This example shows a failure case of our approach. The first row shows an example that fails due to the dominant reflection against the background on the right part of the image. This will cause the warping procedure to align to the foreground instead of the background which leads to improper edge labelling. If we simply crop the image and discard that part, this ambiguity does not exist any more and our method can produce good separation result as can be seen in the second row.

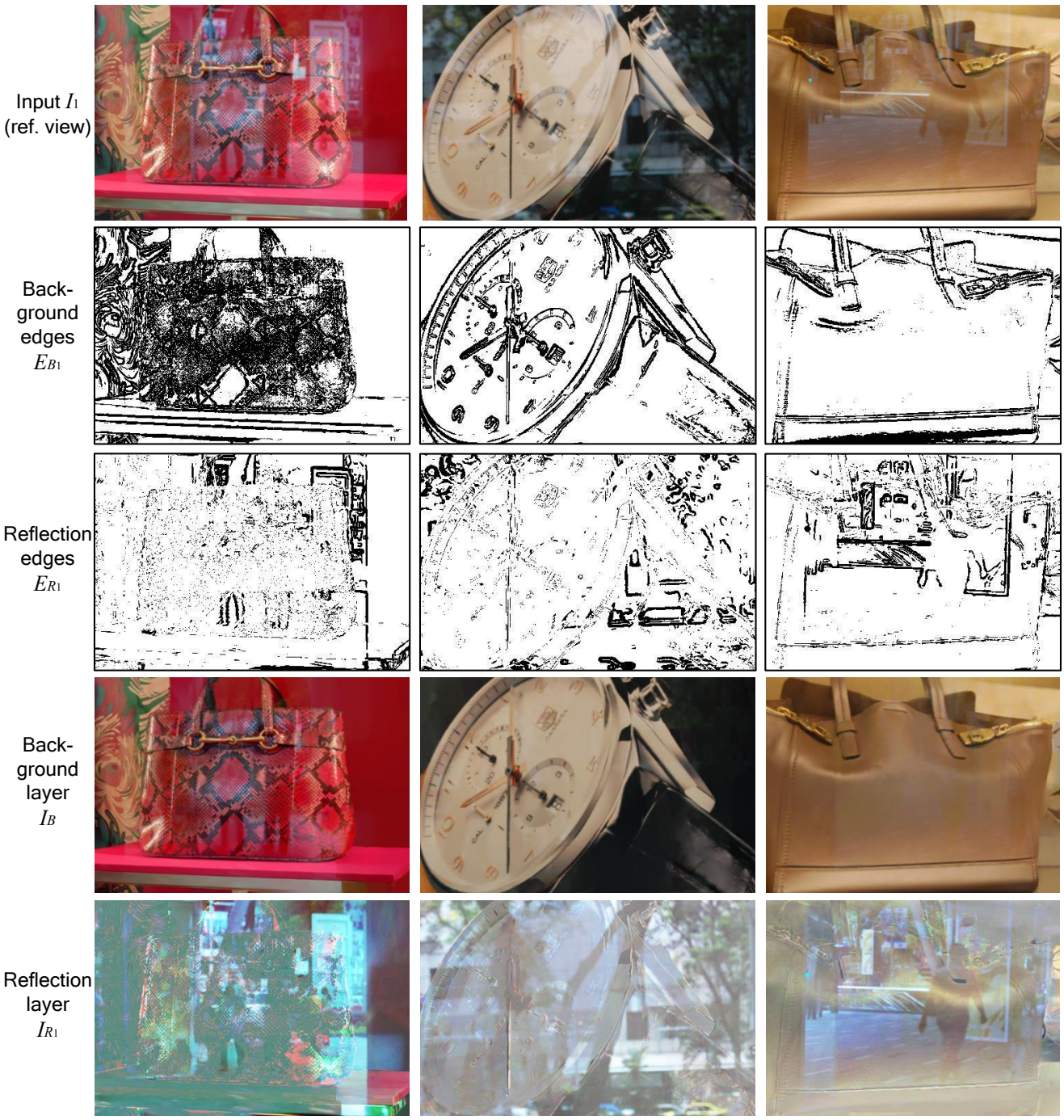

Fig. 5. Additional results of our method with associate edge maps.

References

[1] K. Gai, Z. Shi, and C. Zhang. Blind separation of superimposed moving images using image statistics. *TPAMI*, 34(1):19–32, 2012.

[2] A. Levin and Y. Weiss. User assisted separation of reflections from a single image using a sparsity prior. *TPAMI*, 29(9):1647–1654, 2007.

[3] D. Sun, S.Roth, and M. Black. Secrets of optical flow estimation and their principles. In *CVPR*, 2010.