

Single Image Reflection Removal

A Study of Speed and Quality Tradeoffs

EE368 Project Proposal

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Proposal:

Undesirable reflection artifacts can occur in photographs taken across a partially reflective surface such as a glass window. It is not always possible for the photographer to avoid the glass window between camera and the scene of interest. Examples include shots taken from inside a building, from inside a train, in a museum, or through an airplane's window.

Image processing methods to remove unwanted reflections to recover intended scene image is an active area of research. Some approaches proposed in literature make use of multiple images of the scene to assist reflection removal. While this helps constrain the solution space better, its practical usefulness may be limited because often in practice, only a single image is available. Therefore, in this project, we intend to focus on the "Single Image Reflection Removal (SIRR)" problem.

A recent literature survey of SIRR algorithms is available in [3]. The authors of [3] have also created a dataset of 140 scenes with ground truth called SIR^2 , a subset of which we desire to use in our project. Given below are two examples from this dataset:

Captured Image	Transmission Component	Reflection Component
		
		

Two specific SIRR algorithms that we plan to pursue are described in [1] and [2]. Our plan is to implement these algorithms in MATLAB and analyze their strengths and weaknesses on different scenes in dataset. We will leverage any code relevant to these algorithms that might already be available.

Our reading of literature so far suggests that SIRR algorithms are computationally demanding and take a long time to run. For example, [1] reports a runtime of 22 minutes for a single 400 x 600 image on a 24-core machine. Since SIRR appears to be too slow to run in real time, we do not intend to use Android for this project. However, we do intend to analyze the tradeoff between algorithm run time and quality of result. This analysis can also be our original contribution as we have not found it available in literature.

As time permits, and depending on insights we are able to develop, we would like to explore our own modifications to SIRR algorithms to improve some figure of merit (e.g. accuracy, run time or robustness).

References:

- [1] Y. C. Shih, D. Krishnan, F. Durand, and W. T. Freeman. *Reflection removal using ghosting cues*. The IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2015, pp. 3193-3201
- [2] Y. Li and M. S. Brown. *Single image layer separation using relative smoothness*. The IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2014.
- [3] Renjie Wan, Boxin Shi, Ling-Yu Duan, Ah-Hwee Tan, Alex C. Kot. *Benchmarking Single-Image Reflection Removal Algorithms*. The IEEE International Conference on Computer Vision (ICCV), 2017, pp. 3922-3930