# Robust Lens Ghosting Recovery

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## 1   Goal

Lens ghosting can be a prevalent artifact when taking pictures of a scene with a direct bright light. This is especially visible on sunset pictures for instance where a green or purple dot appears on the image (See Figure 1).

Ghosting is usually caused by internal reflections of the lens due to a thin (or inexistent) anti reflective coating. This is usually a visible issue with smartphone cameras.

This project aims at automatically and robustly remove such artifacts to produce a clean image. We will design an algorithm involving two steps: ghosts detection and recovery of the damaged region.

## 2   Method

### Detection

The lens ghosting will be precisely detected in the image. Ghosts have specific features which can be used to segment the image in a robust way and avoid false-positive (such as a green traffic light in the fog for instance). Some of those properties used for detection include their circular shape [1], their intensity distribution and color profile.

### Recovery

Finally we will recover the area damaged by the identified ghosting artifacts. In order to fill those small regions we will evaluate and select an inpainting algorithm based on edge preserving diffusion using nonlinear partial differential equations [2][3][4].
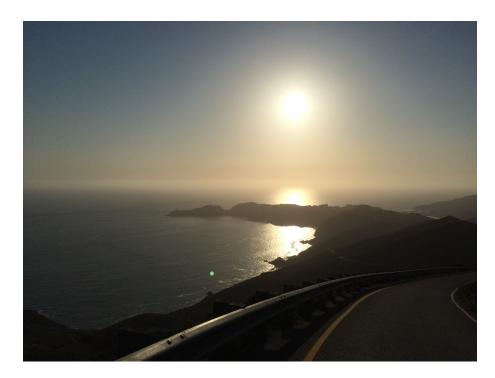
Figure 1: Picture with lens ghosting artifact (green "dot")

# References

[1] Dimitrios Ioannou , Walter Huda , Andrew F. Laine, *Circle recognition through a 2D Hough Transform and radius histogramming*, Image and Vision Computing 17, 1999

[2] Marcelo Bertalmio, Vicent Caselles, Simon Masnou, Guillermo Sapiro *Inpainting*, `http://math.univ-lyon1.fr/~masnou/fichiers/publications/survey.pdf`

[3] Pascal Getreuer, *Total Variation Inpainting using Split Bregman*, Image Processing On Line, 2012

[4] Tony F. Chan, Jianhong Shen, *Non-Texture Inpainting by Curvature-Driven-Diffusions*, Visual Comm Image Rep 06/2001