

CS513 Homework 1

Automatic Lens Smear Detection
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Method

- All methods implemented in python using primarily numpy and skimage packages
- Images from a camera are sampled with some interval
- Pixel-wise normalized cross-correlation with a window (11x11) is computed between each subsequent image
- Correlations values above a threshold (0.2) are kept
- Average correlation between pairs is computed and output as mask

Parameters

-h, --help show this help message and exit

--cam CAM which camera default 0

--d D correlation window size default 11

--skip SKIP frame interval use default 100

--scale SCALE how much to scale image default 4.0 ($\frac{1}{4}$ image size)

--t T correlation threshold default 2.0

--num NUM number of images to correlate default 10

Rationale

- Pixel regions with high regions accumulated over many distant frames should correlate to camera artifacts
- Using normalized cross-correlation is fairly efficient and more robust than just using correlation

Possible Improvements

- Multi-core processing of images or pixel region correlation
- GPU computation implementation
- Current implementation is rather slow and therefore cannot handle many large images
- The paper mentions an efficient way to compute correlation over whole image but only cites the paper used which is behind a paywall

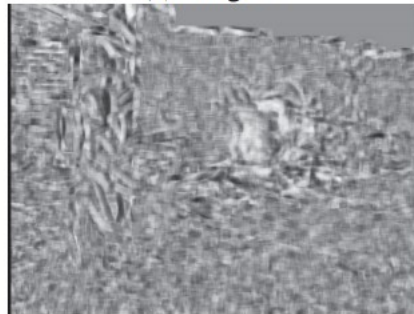
Results (from paper)



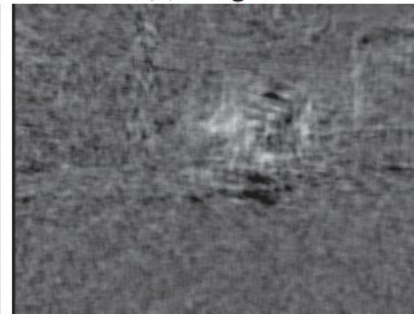
(a) image 1



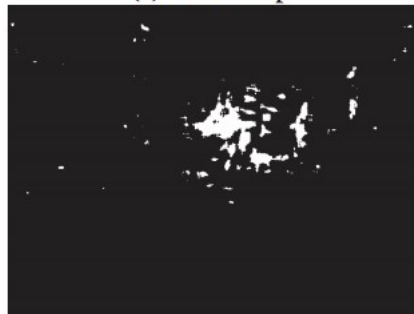
(b) image 2



(c) NCC map



(d) aggregated NCC map



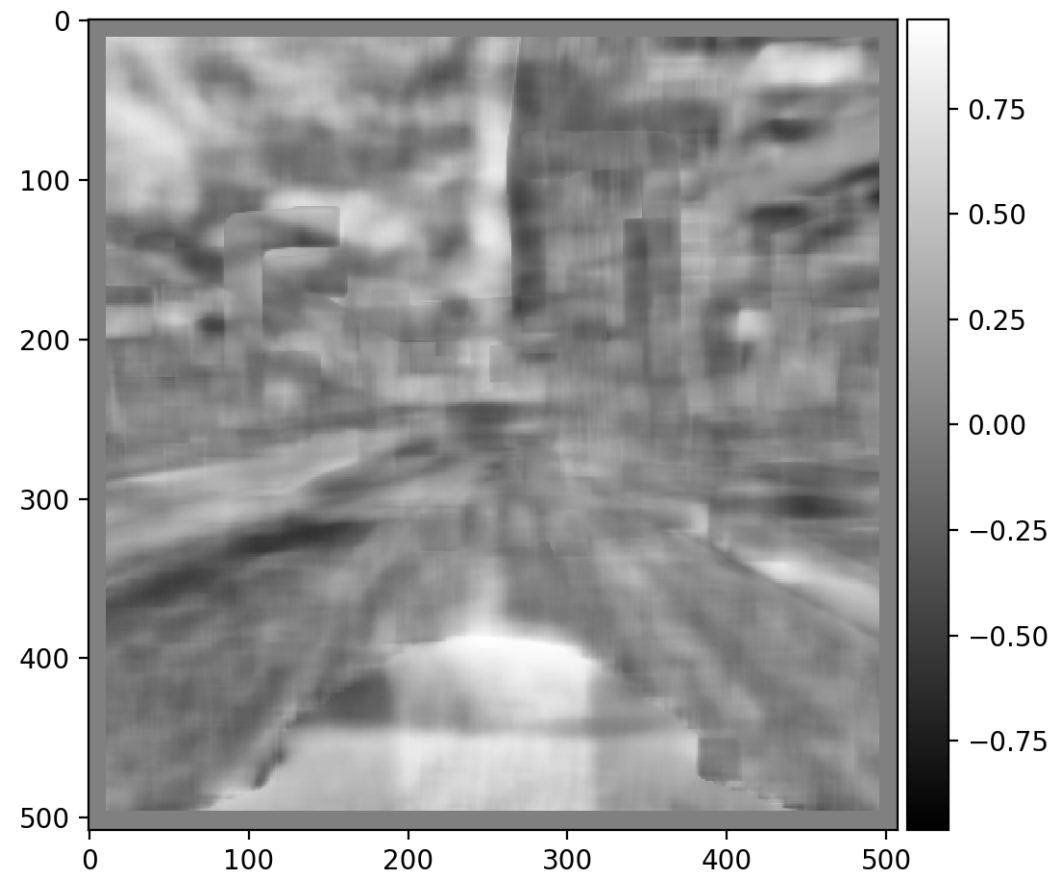
(e) thresholded NCC map



(f) detection overlay

Results (from implementation)

- Cam0 Results over only 4 images
- The benchmark smudge on bottom image is clearly detected
- By playing with the threshold and number of images used we should see better results



References

- Detection of Camera Artifacts from Camera Images, 2014 IEEE