

# Lucas Kanade Tracker

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## 1 INTRODUCTION

In this assignment we had to implement Lucas Kanade Tracker and using that implement video stabilization software. The algorithm we used here is Inverse Compositional Algorithm as given in *Lucas-Kanade 20 Years On: A Unifying Framework* by Baker et al. Here we use the algorithm to compute the image warp function and we stabilize the video frames using the warp parameters to keep the object at the same position.

## 2 IMPLEMENTATION

The basic overview of the algorithm is as follows:

1. Take an input image and a template image
2. Compute the gradient, Jacobian, steepest descent and Hessian of the template image
3. Iterate until marginal increase in warp parameters becomes less than a fixed bound:
  - a) Warp input image according to initial guess
  - b) Compute error in warped image and template image
  - c) Calculate the change in warp parameters using the equation in algorithm
  - d) Update the warp by composing the marginal change with the previous guess

### 3 OBSERVATIONS

We saw the following observations:

- Initial estimate of warp parameters should be close.
- The object of interest to stabilize should not exit the window.
- The object of interest should be distinctive enough from the background
- The lighting conditions must not change drastically during the video.
- The template must be carefully selected so that it is unique and gives a good estimate for warp

### 4 RESULTS

The results are computed for two videos: "Shaky Cone"[1] and "Shaky Book"[2] and the corresponding result for opencv implementation were also computed.

We saw that our implementation was at par with the stabilization by OpenCV and this could be due to the fact that we explicitly selected an object to stabilize which gave our algorithm leeway over OpenCV one which didn't had any such object explicitly.

### REFERENCES

- [1] Suyash Agrawal. Shaky cone video, 2017. [Online; accessed 25-November-2017].
- [2] Suyash Agrawal. Shaky book video, 2017. [Online; accessed 25-November-2017].



(a) Book Template



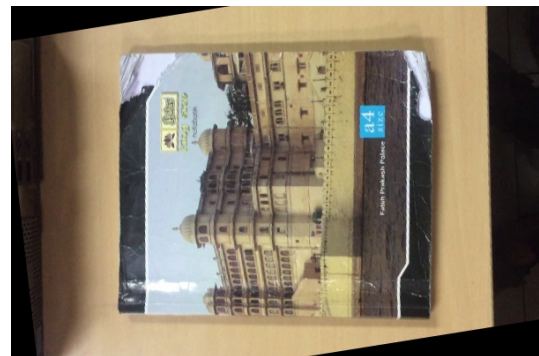
(b) Shifted Book



(c) Warped Shifted Book



(d) Rotated Book



(e) Warped Rotated Book



(f) Book out of window



(g) Warped image for book out of frame 3

Figure 1: Results with Book Video