

Feature Point Matching-based Video Stabilization in Android Smartphones

Introduction:

The quality of digital video sometimes suffers from undesired effects such as image blurring, image distortion, uneven contrast, among others. Unstable movement of hand-held devices such as smartphones, for example, can lead to visible, annoying jitters in the final video output stream. To automatically improve the quality of these videos without the need for manual intervention from the user, applications employ software-based video stabilization.

The process of video stabilization aims to remove the unwanted movement of the video by repositioning and rotating the frames so that the video looks stable [1]. Although there are different methods for achieving this effect, video stabilization frameworks usually implement these 3 stages in sequence: motion estimation, motion smoothing and, finally, motion compensation [2]. Due to the interest in deploying video stabilization algorithms in power-constrained hand-held devices such as smartphones, it's worth considering methods that are not too computationally-intensive but that still yield reasonable results. Therefore, the goal of the project is to explore implementation details of video stabilization algorithms in smartphones.

Plan:

For the project, we will aim to implement a video stabilization algorithm that runs entirely on an Android-based smartphone. The algorithm uses feature point matching methods. The video stabilization process is outlined as follows:

- 1) Extract features from each frame using feature-detection methods such as FAST (Featured from Accelerated Segment Test). If time allows, we will additionally do ORB (Oriented FAST and rotated BRIEF).
- 2) Detect matching features between 2 consecutive frames.
- 3) Compute the geometric transformation matrix between the 2 frames. The M-estimator Sample Consensus (MSAC) algorithm can be used for this task.

The list above is inspired by [3].

We plan on using OpenCV on this project.

References:

- [1] Farid, Hany and Jeffrey B. Woodward. "Video Stabilization and Enhancement." Department of Computer Science, Dartmouth University.
- [2] Shamsundar Kulkarni et al. "Video Stabilization Using Feature Point Matching." 2017 J. Phys.: Conf. Ser. 787 012017
- [3] "Video Stabilization Using Point Feature Matching." *Mathworks*.
[https://www.mathworks.com/help/vision/examples/video-stabilization-using-point-
ture-matching.html](https://www.mathworks.com/help/vision/examples/video-stabilization-using-point-
ture-matching.html)