

Final Project Proposal

Cinematic Digital Video Stabilization Techniques

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1 Motivation

Video stabilization serves many purposes, from professional filming to casual vlogging. Filming a video by hand can result in jittery footage. Stabilizing video is crucial, especially in film production, for creating smooth, visually appealing footage and for reducing jitter that distracts audiences from the scene itself.

In film production, stabilization equipment, such as dollies, jibs, gimbals, and camera rigs, would produce the fluid cinematic motion seen in a movie. Most amateur filmmakers, however, do not have access to this equipment. Instead, digital video stabilization techniques can be used to correct unstable footage in post-production and resolve this issue.

For the final project, I want to survey digital video stabilization techniques with the intent to apply them to professional cinematography.

2 Related Work

Grundmann et al. [2] proposed a 2D video stabilization method that optimizes jittery camera paths with the L1-norm in a linear programming algorithm to emulate the smooth camera paths of professional film equipment, which are modeled to have either zero first, second, or third derivatives. Building on top of this work, Bradley et al. [1] introduced a model that works with homographies to further improve video distortion as well as crop ratios, preserving more areas of the raw video.

Both aforementioned techniques use the L1-norm which addresses global motion but not local motion [3]. Using other regularization methods, such as L2 regularization, could address local motion and preserve object details in an unstable video.

3 Final Goals

This project will focus on recreating this 2D video stabilization technique and implementing L2 or TV regularization to address local motion.

4 Milestones

Week 8: Set up code for 2D video stabilization using L1 norm.

Week 9: Tune hyperparameters. Implement L2 norm and/or other regularizers.

Week 10: Analyze results and draw conclusions for poster.

References

- [1] Arwen Bradley et al. “Cinematic L1 Video Stabilization with a Log-Homography Model”. In: *WACV*. 2020. URL: <https://arxiv.org/pdf/2011.08144.pdf>.
- [2] Matthias Grundmann, Vivek Kwatra, and Irfan Essa. “Auto-directed video stabilization with robust L1 optimal camera paths”. In: *CVPR 2011*. 2011, pp. 225–232. DOI: [10.1109/CVPR.2011.5995525](https://doi.org/10.1109/CVPR.2011.5995525).
- [3] Marcos Roberto e Souza, Helena de Almeida Maia, and Helio Pedrini. “Survey on Digital Video Stabilization: Concepts, Methods, and Challenges”. In: *ACM Comput. Surv.* 55.3 (Feb. 2022). ISSN: 0360-0300. DOI: [10.1145/3494525](https://doi.org/10.1145/3494525). URL: <https://doi.org/10.1145/3494525>.