

Calibration of Nodal and Free-Moving Cameras in Dynamic Scenes for Post-Production

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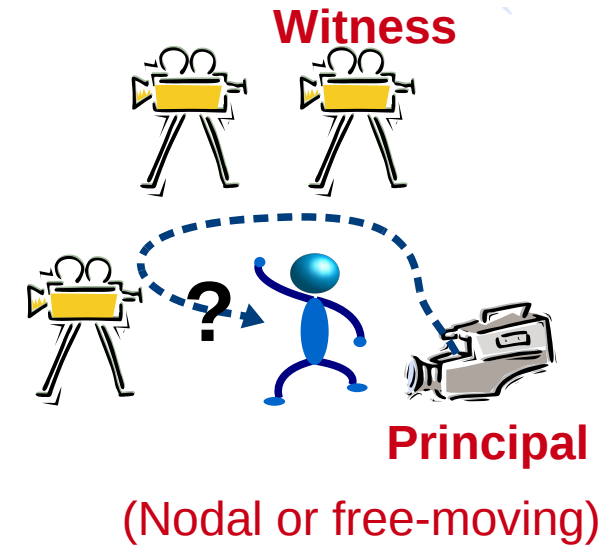
Adrian Hilton

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Introduction

Problem

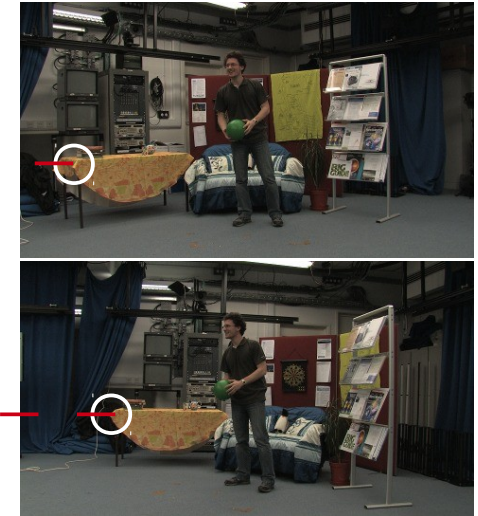
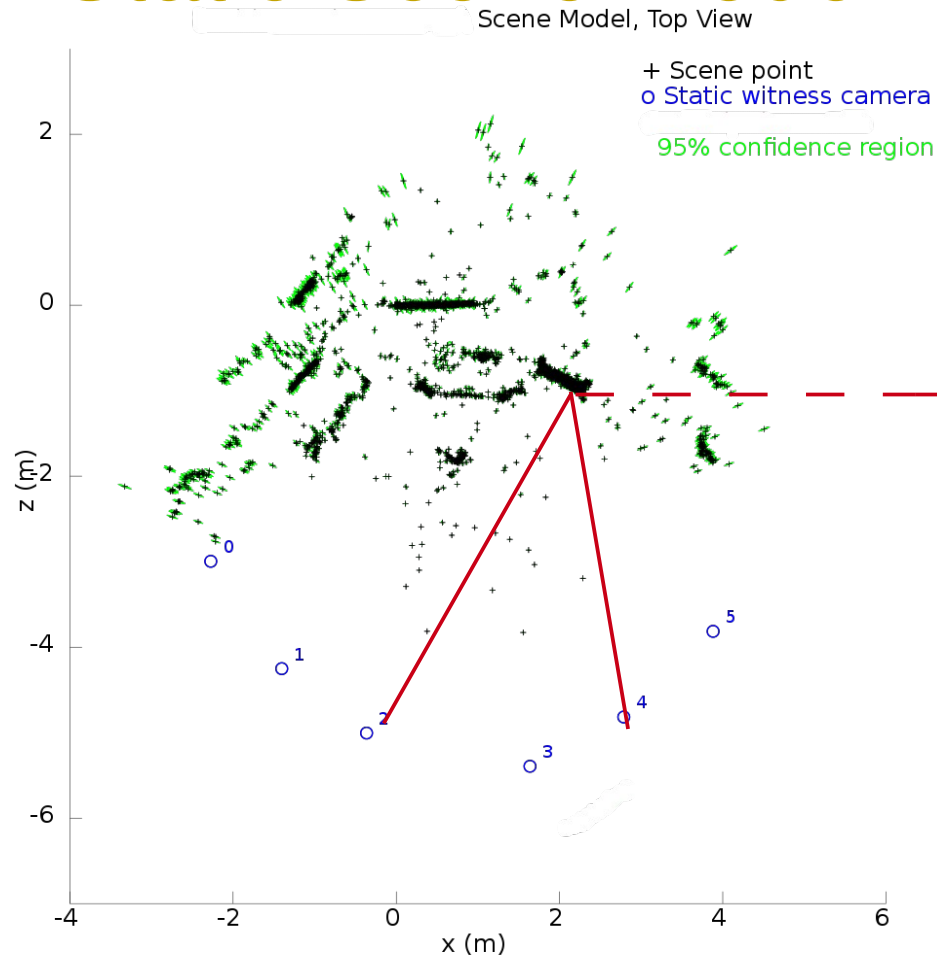
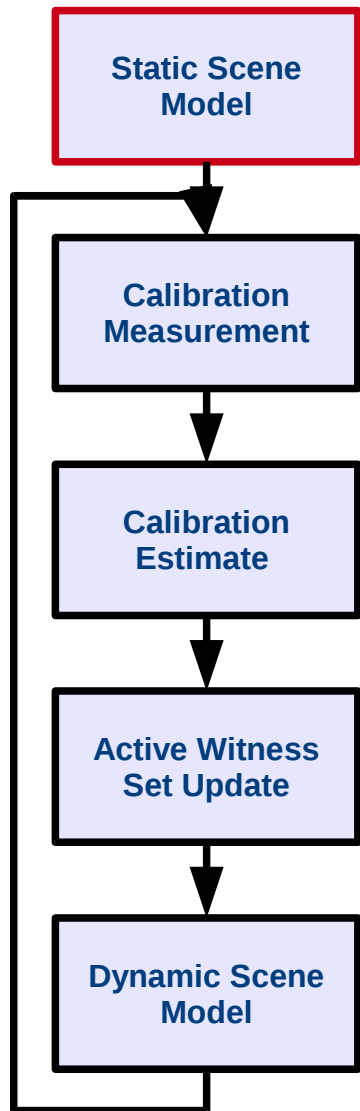
- Calibrate a moving and zooming camera viewing a dynamic scene, given an auxiliary set of calibrated cameras



Significance

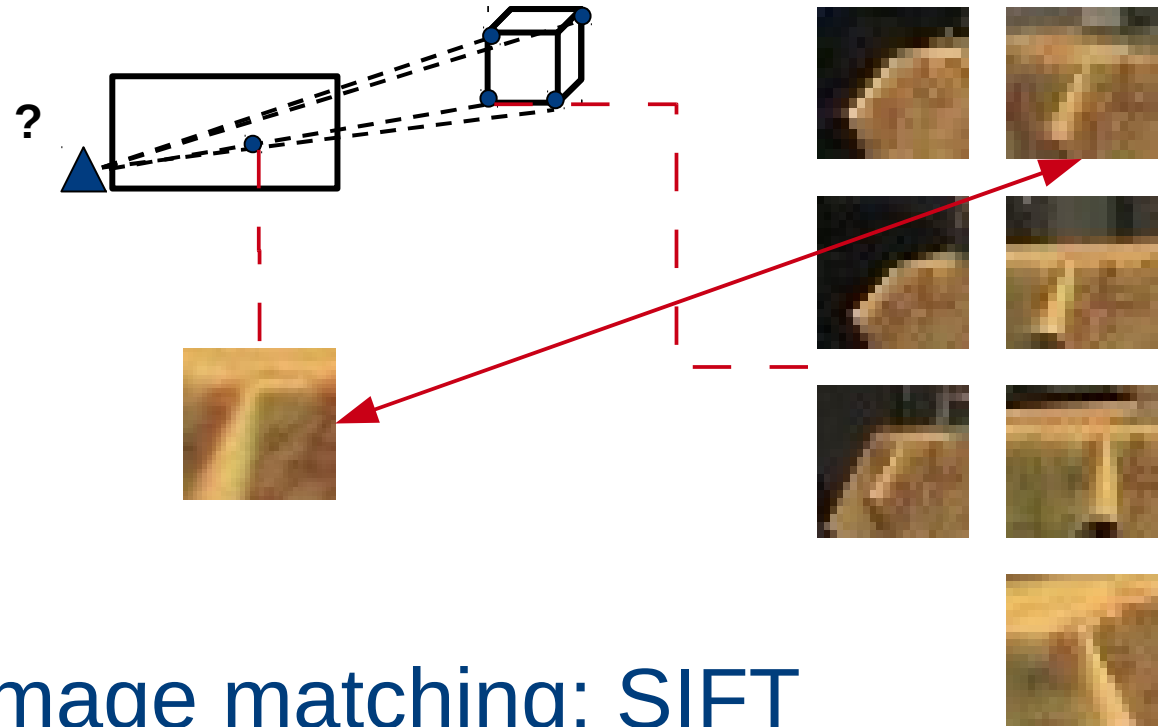
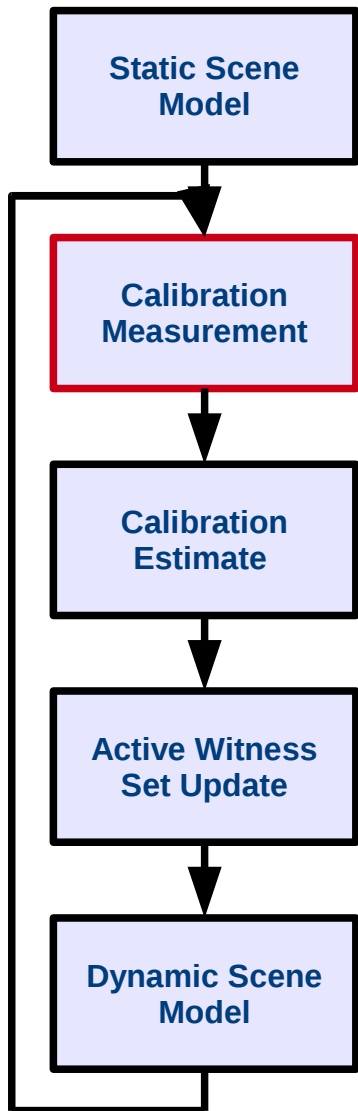
- A common setup in film production and broadcasting
- Accurate calibration is a must for many post-processing tasks

Pipeline- Static Scene Model



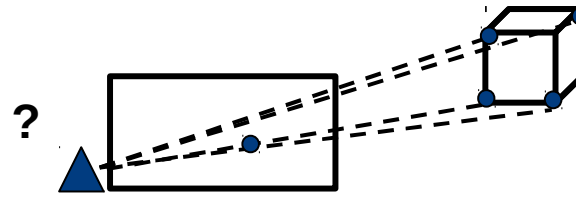
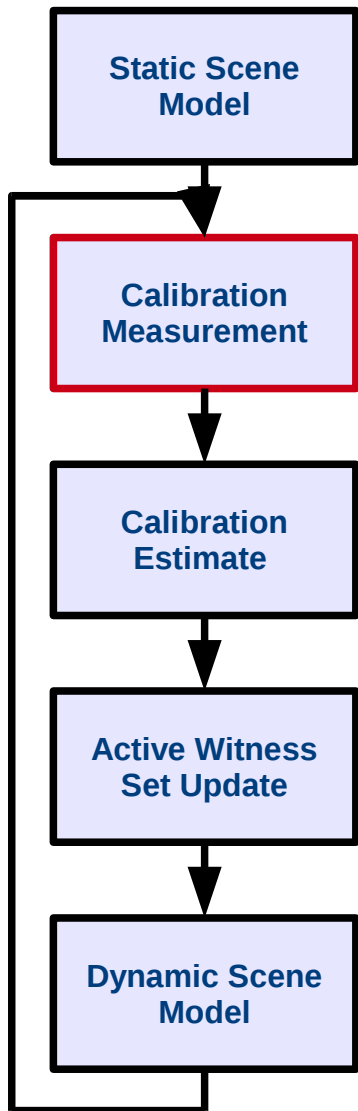
- External, or via multiview triangulation from static cameras
- A scene feature is described by its appearance in the witness cameras

Pipeline- Calibration Measurement



- Scene-Image matching: SIFT matching across all observations of a scene point
- Robust calibration computation from 3D-2D correspondences, via SfM

Pipeline- Calibration Measurement



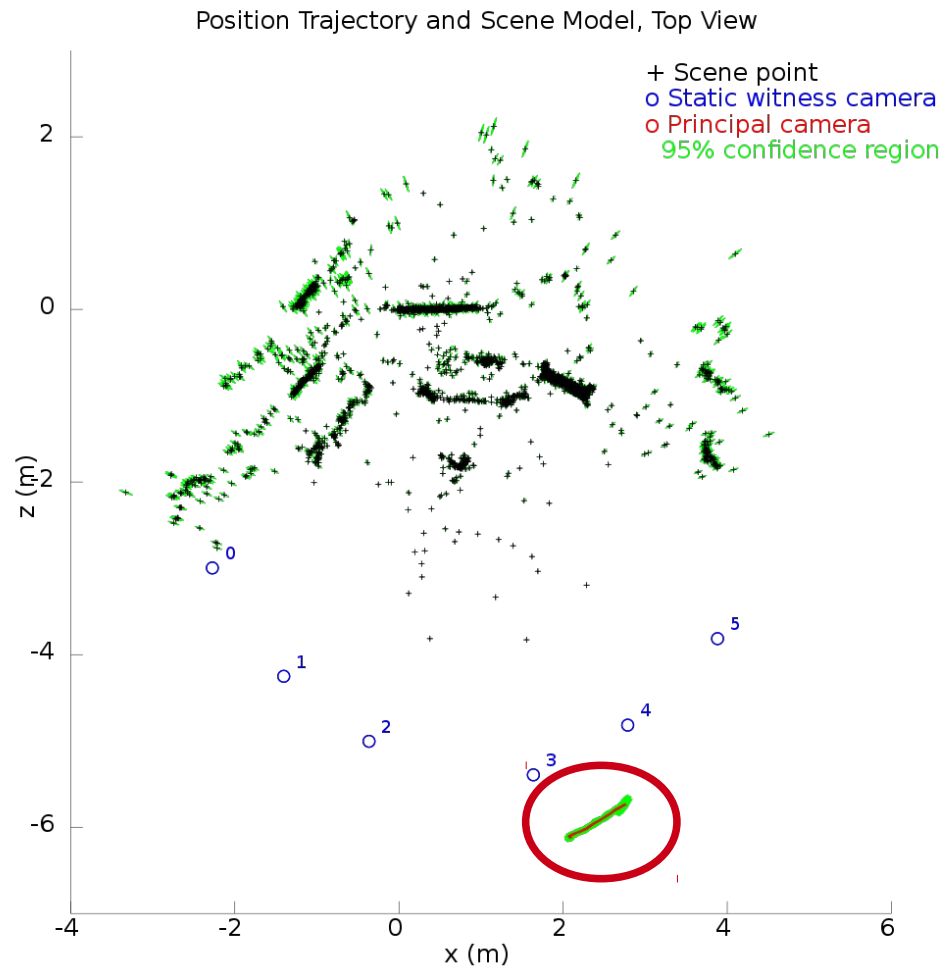
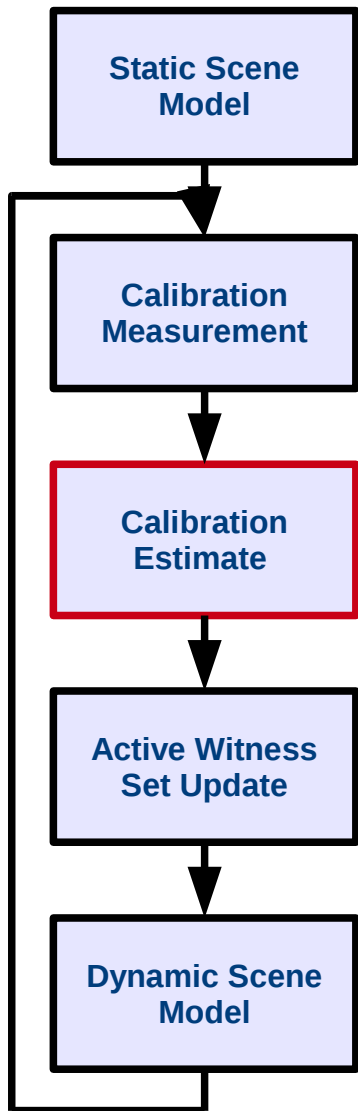
Solves for

Solver	Position	Orientation	Focal Length	Lens Distortion
P2P	N	Y	N	N
P2Pf	N	Y	Y	N
P3P	Y	Y	N	N
P4P	Y	Y	Y	Y

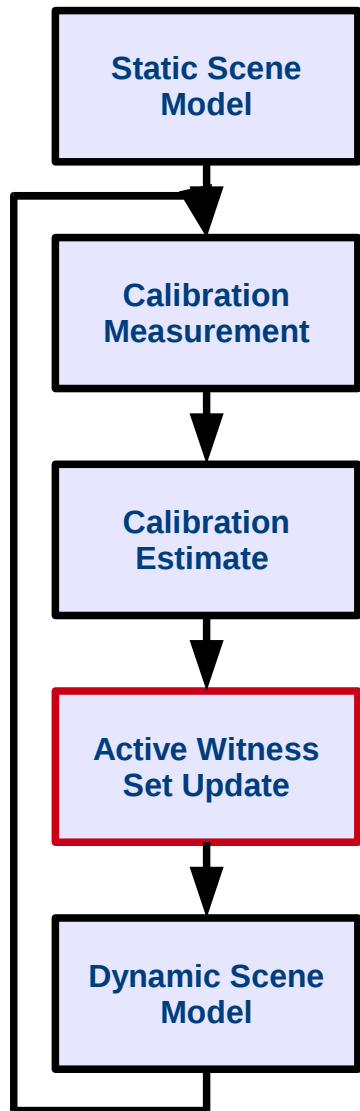
- Internal and external calibration of free-moving and nodal cameras
- Measurement covariance estimation via scaled unscented transformation

Pipeline- Calibration Estimate

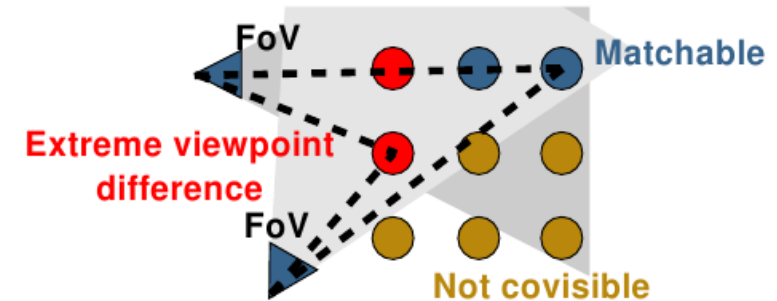
- Jitter removal via UKF, with constant rate-of-change model



Pipeline- Active Camera Set

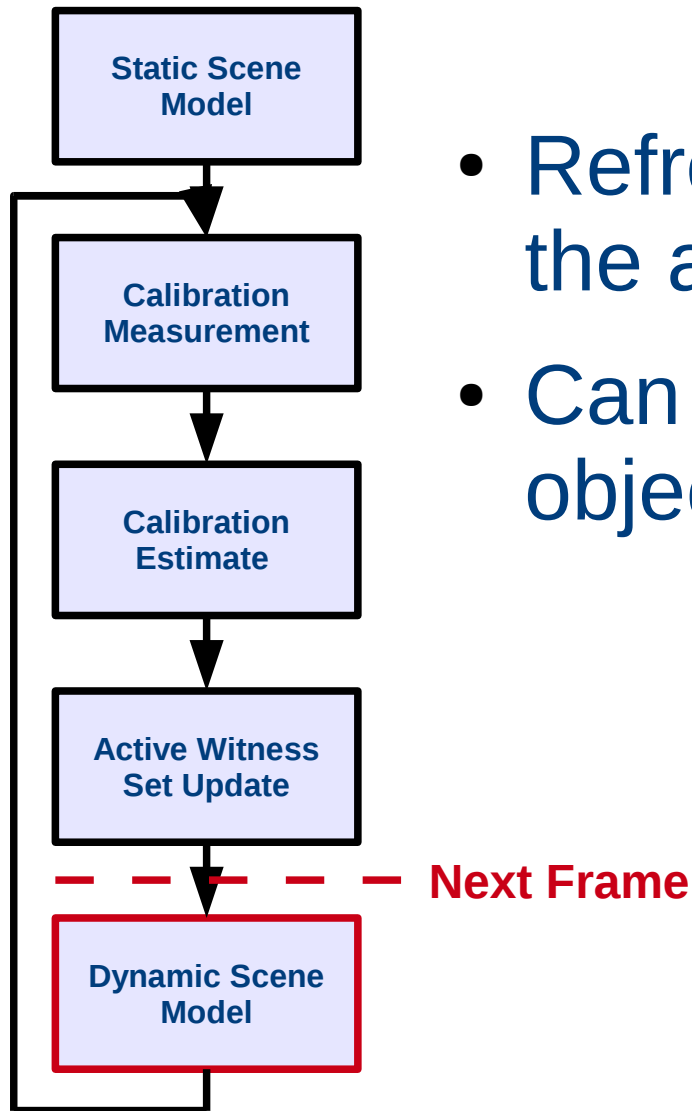


- A subset of cameras that maximize the matchable volume with the moving camera
- Matchable:
 - Visible
 - Similar viewing angle
 - Similar scale
- Evaluate matchability on a discrete lattice covering the capture volume

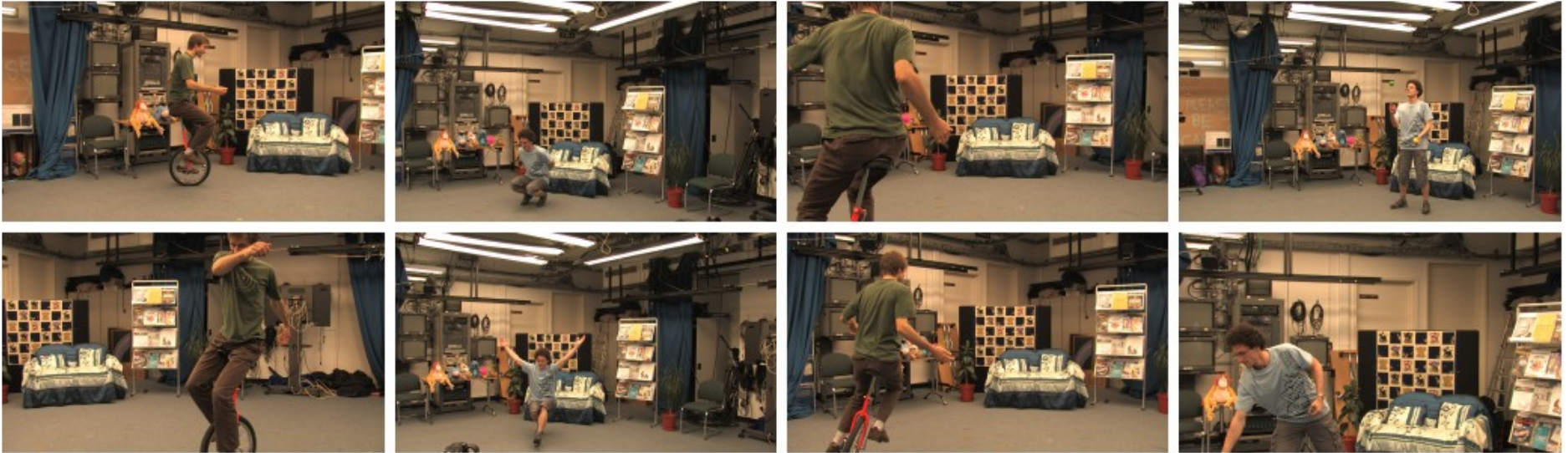


Pipeline- Dynamic Scene Model

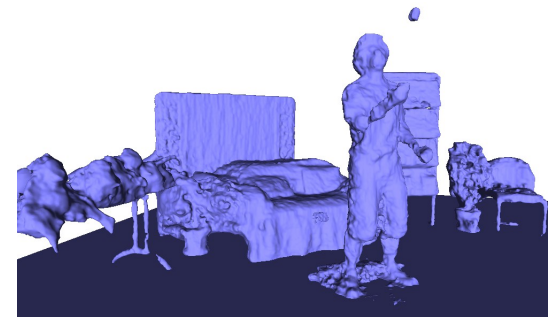
- Refresh the scene model by using the active witness set
- Can work with large foreground objects



Experimental Results



- Augmented reality
- Stereoscopic rendering (poster)
- Quantitative evaluation (poster)



Conclusion

- A camera calibration algorithm that can handle
 - Dynamic scenes
 - A wide variety of calibration problems
- A new 2-point solver for unknown orientation and focal length

Questions

