

Monocular 3D Scene Reconstruction

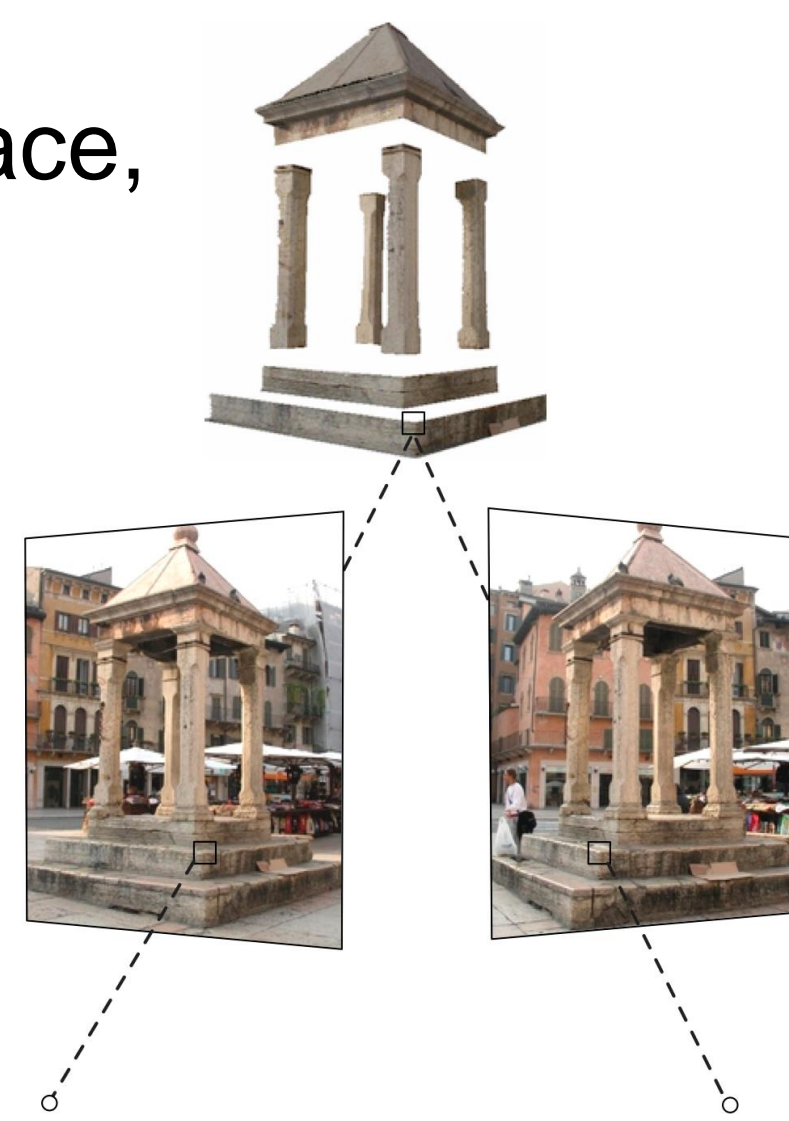
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Motivation

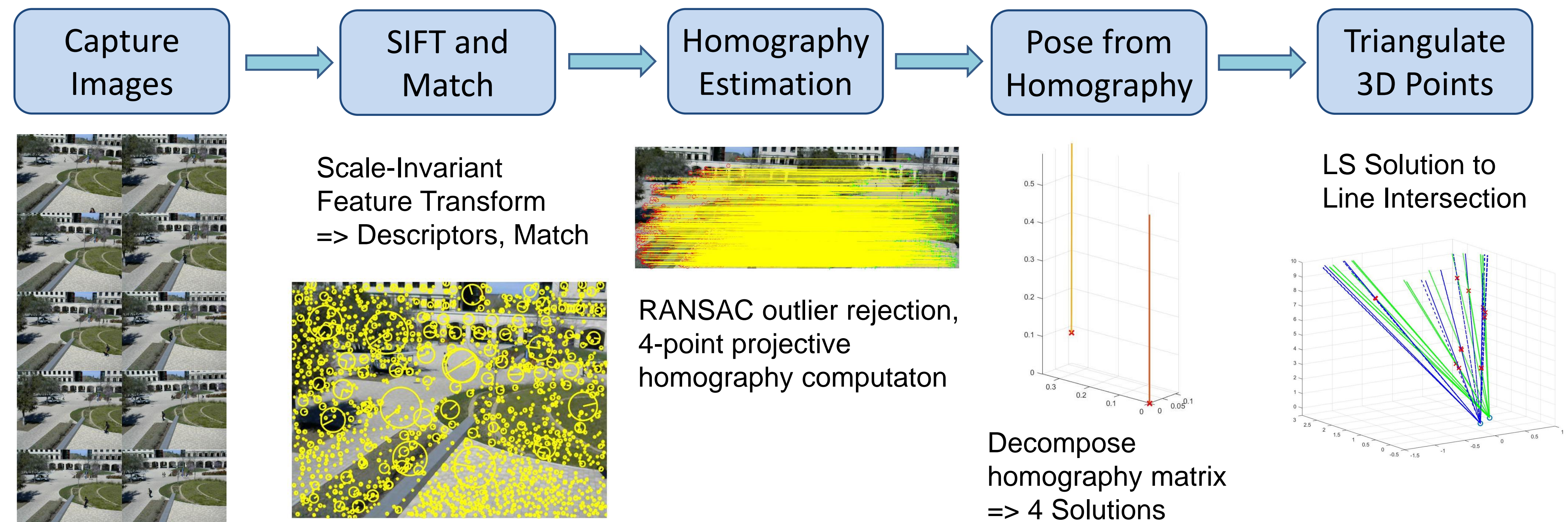
- Perceive Scene in 3D, Localization and Mapping
- Use keypoint detection
- Track camera motion in space, triangulate 3D keypoints:

$$x'_i = K \cdot R_i \cdot (X - t_i)$$



- Evaluate performance
- Understand problems
- Recommend solutions

Monocular Approach

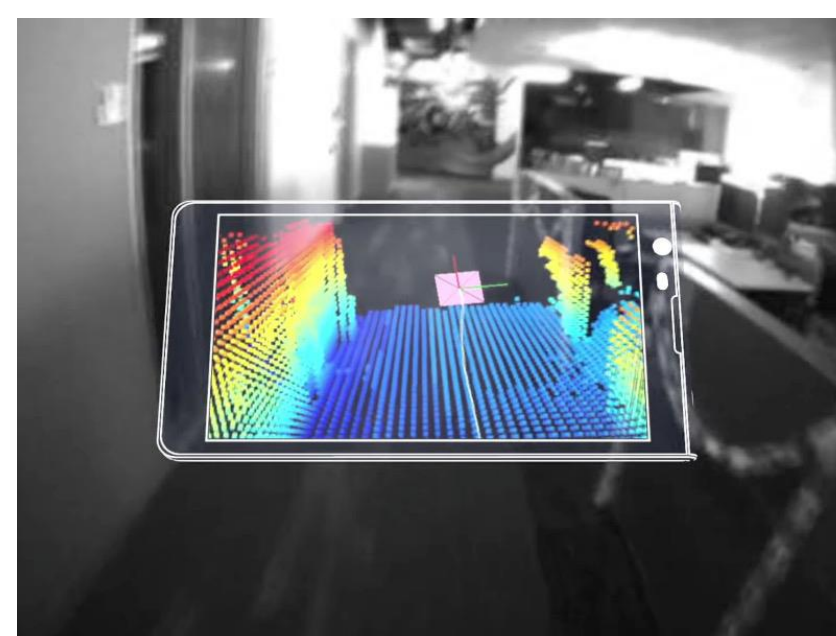


Related Work

- Stereo/ Multiple Cameras
- Structure from Motion => Bundle Adjustment
- Depth Cameras
- Light Field Cameras

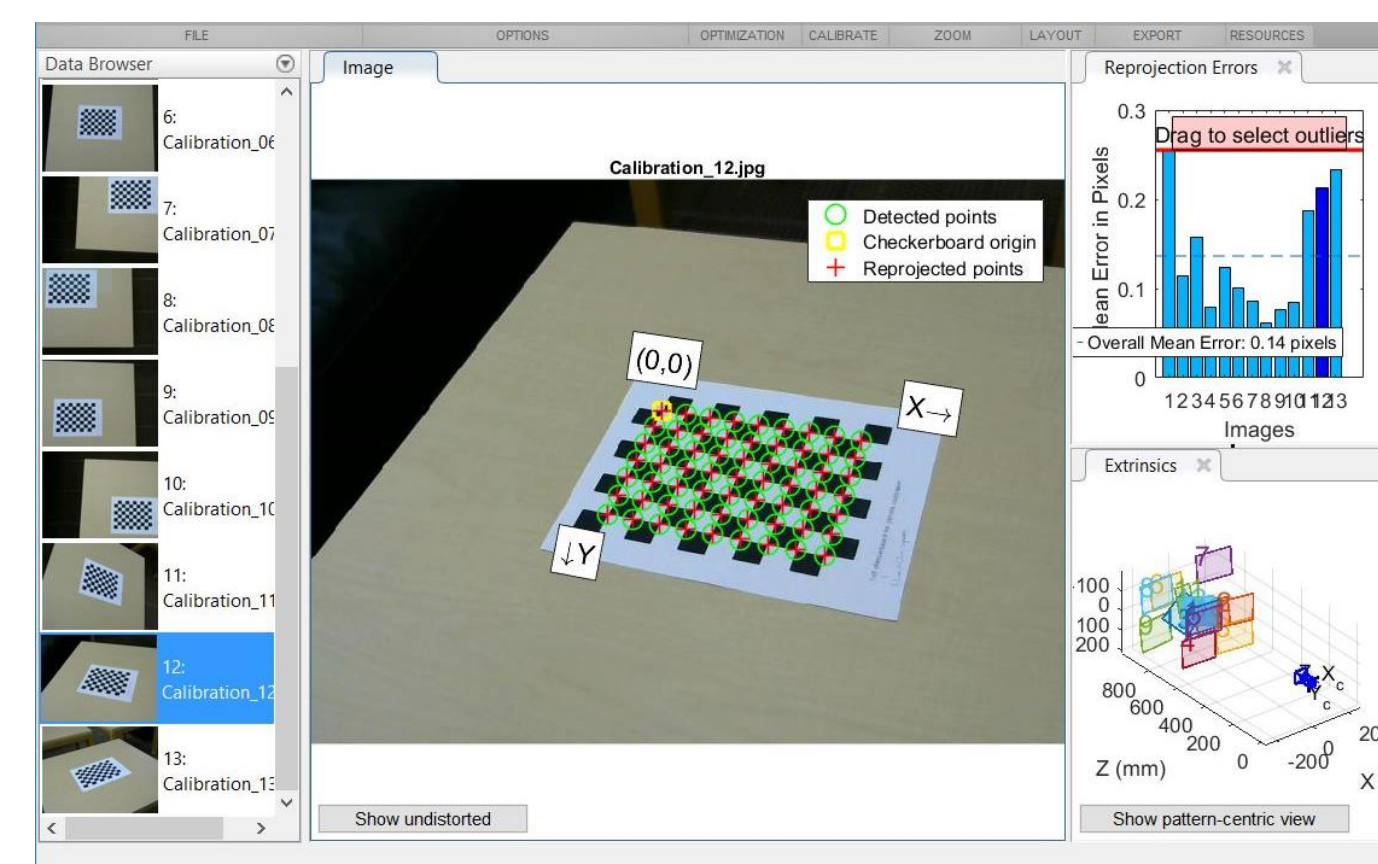


- Google Project Tango:
 - Keypoint Tracking
 - IMU support
 - Depth Camera

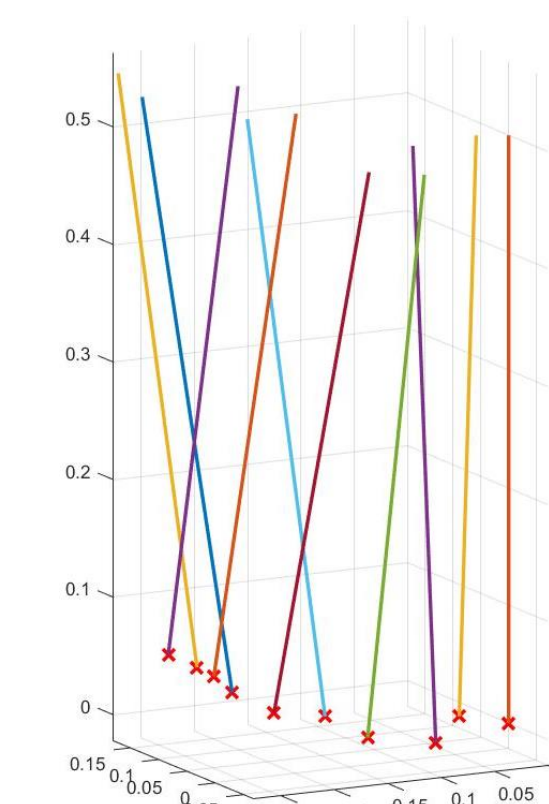


Tools/Hardware

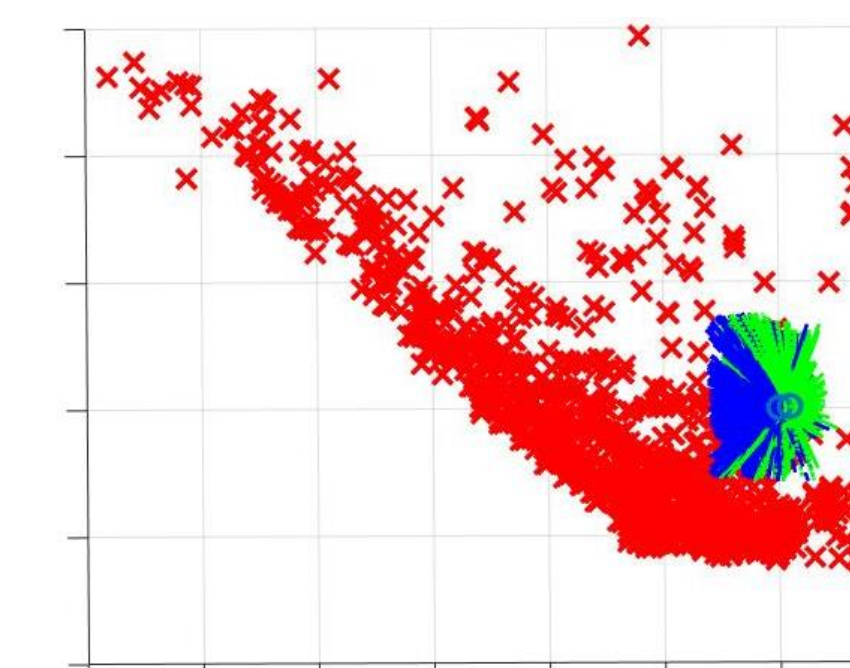
- Written in MatLab with mexopencv
- Used single, cheap 720p webcam, mobile
- Calibration:



Experimental Results



Triangulation Results
(Can make out a surface)



Odometry Results
(Moving in a line)

=> Limited quality so far

Future improvements:

- Image Sets
- Use better Preprocessing
- Stabilize pose estimation result
- Use Bundle Adjustment
- Gain dense depth map from two views