Obstacle Avoidance for a Quadrotor

Nikoli Dryden Bryan Plummer

Introduction

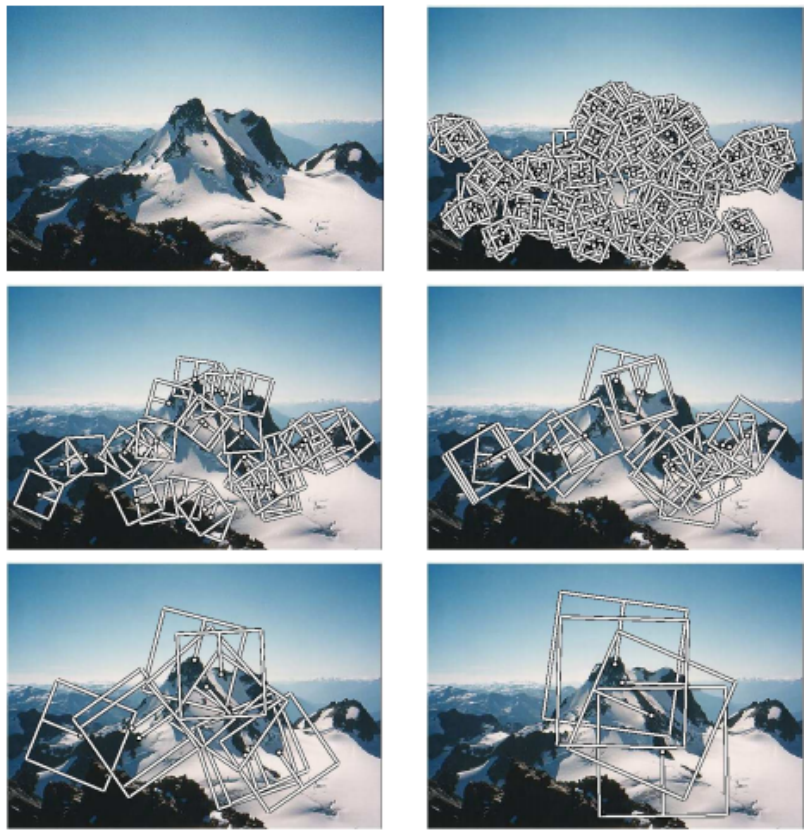
- Obstacle avoidance for an ARDrone 2.0 quadrotor
- Use the approach in *Obstacle avoidance for small UAVs using monocular vision* (Lee et al. 2011)
- Test with real data as opposed to simulations

Proposed Solution

- Extract SIFT and MOPS features from two images
- Match SIFT and MOPS features in images to locate points in 3D
- Use MOPS to get object outlines
- Use SIFT to get internal object structure
- Determine type of object

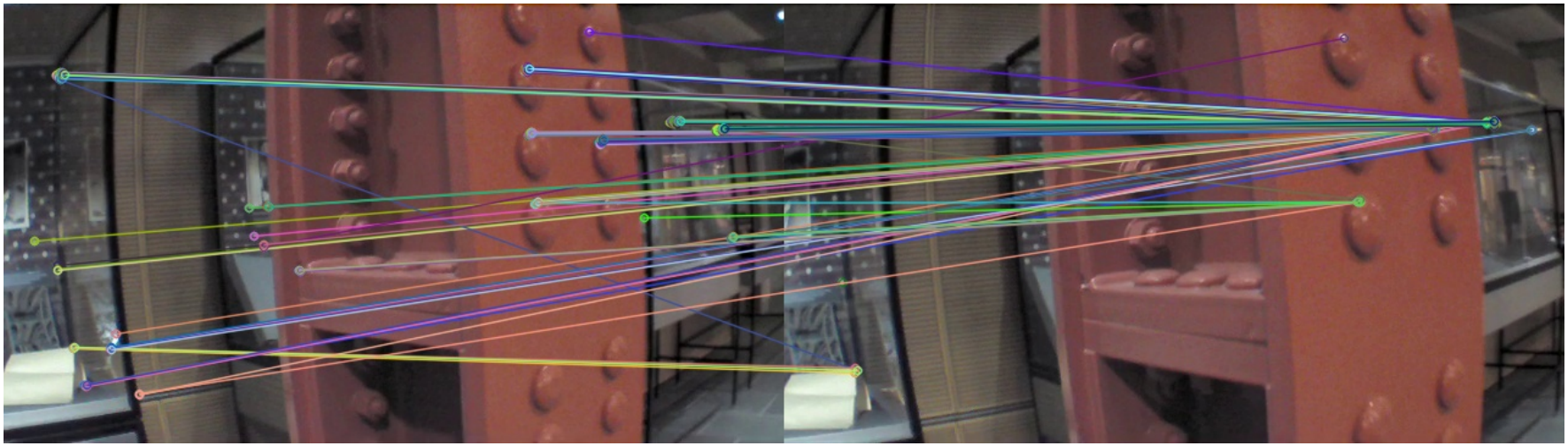
MOPS

- Multi-Scale Oriented Patches (*Image Matching using Multi-Scale Oriented Patches* (Brown et al. 2004))
- Detect features with multi-scale Harris corner detector
- Compute 8×8 patches of bias/gain normalized intensity values
- Orient using a blurred local gradient



Some Results: SIFT

Some Results: MOPS



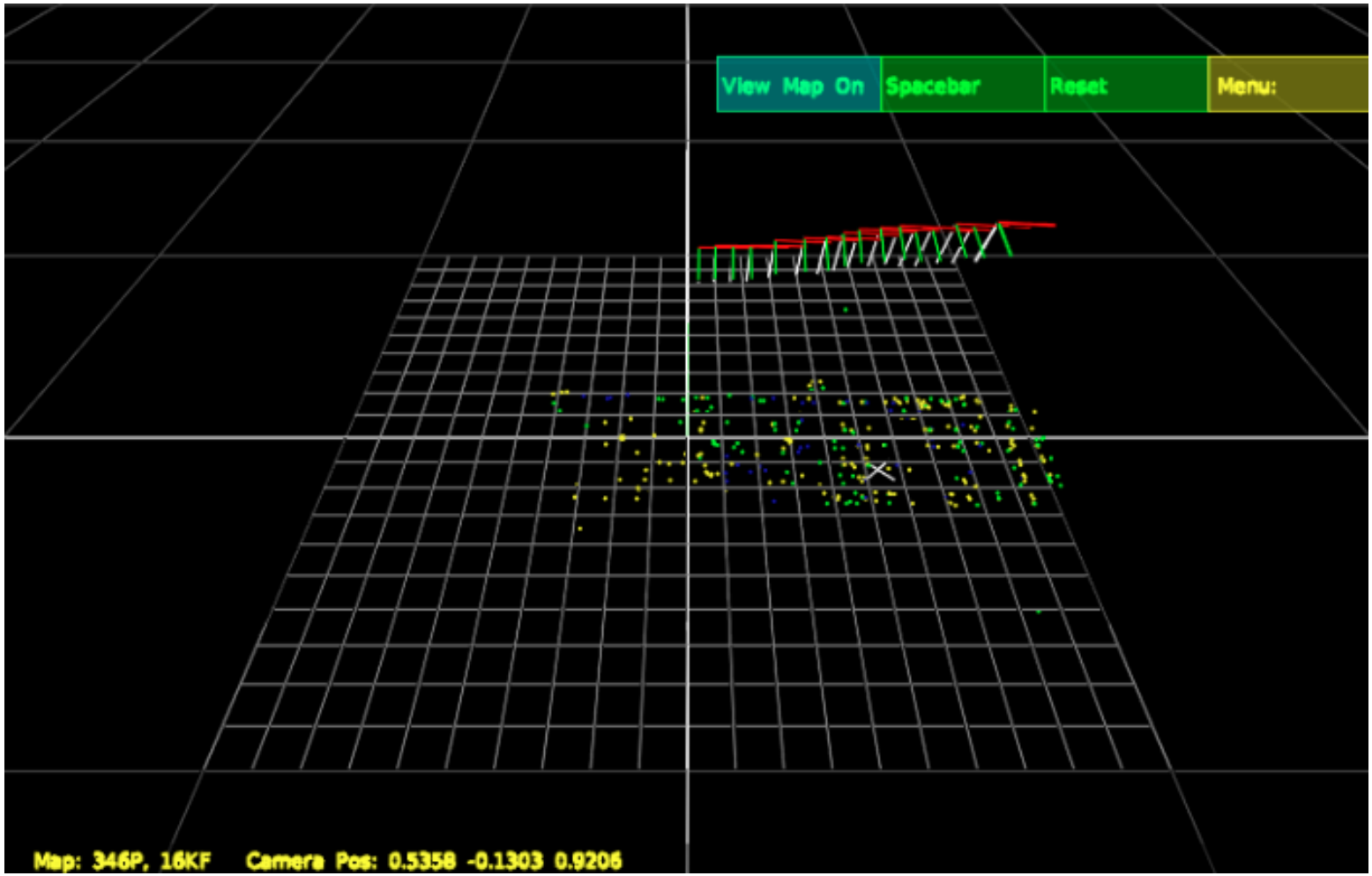
Some Results

- MOPS is not robust on real data:
  - Poor keypoints (multi-scale Harris)
  - Poor matches
  - Computationally intensive
- SIFT is also relatively slow
- Do not have sufficient "good" matches to generate object outlines
- Lee et al. approach is not robust on real-world data

A Better Idea

- Use faster and more robust features than SIFT and MOPS
- PTAM
  - An existing monocular SLAM framework using FAST (and other) features
  - Robust enough to work with real-world indoor and outdoor data
  - Significantly faster than our approach
- Integrate with the quadrotor using ardrone_autonomy and tum_ardrone

Further Results



Conclusions

- MOPS is slow and not robust
- The Lee, et al. approach is not robust on the quadrotor
- PTAM works well