Robust Sampling Consensus

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CENTER FOR MACHINE PERCEPTION

Motivation

- Image stitching, 3D reconstruction, tracking,...
- Many algorithms of computer vision use two-view geometries: homography and epipolar geometry
- Need for robust and accurate estimators

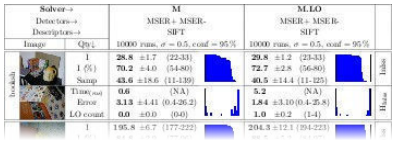
RANSAC algorithm

- RANdom SAmple Consensus
- Robust sampling estimator
- Different cost functions used: thresholding, truncating, log-likelihood,...
- LO-RANSAC: Local Optimisation refines promising samples – stabilises the results, decreases number of samples needed

Major Contributions

LO-RANSAC analysed and tested

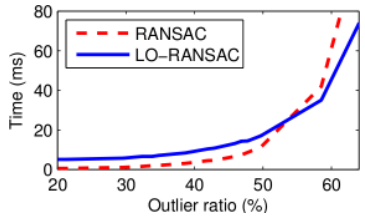
- Created automatic testing framework



- Several unexpected aspects discovered

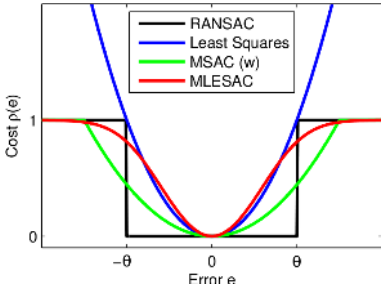
Local Optimisation sped up

- LO decreases number of samples needed, however it has an overhead



- Faster variants developed

Cost functions analysed



- Smooth ones more robust to inlier/outlier error threshold selection
- Proposed best: truncated quadratic, as a fast approximation of MLE

Implementation addressed

- Differences in algebraic software libraries used
- Differences in numerical algorithms for matrix decomposition

Properties of the Improved Algorithm

- High **speed** (miliseconds for most problems)
- High **stability** (almost non-random in nature)
- High **precision** in a road range of conditions
- Low **sensitivity** to the choice of inlier/outlier threshold
- Offers significantly **better starting point** for further optimisation

Conclusions

- New experimental framework created
- Speed problem in Local Optimisation discovered, speed-ups proposed
- Cost functions analysed, the best one found
- Result: robustified to number of points and error threshold selection
- Implementation and used datasets made publicly available (GPL)
- Contributions published: Lebeda, Matas, Chum: **Fixing the Locally Optimized RANSAC**, BMVC 2012.

Links

http://cmp.felk.cvut.cz/software/LO-RANSAC/
http://lebeda.sk/DP/