

Robotics and
Embedded Systems



Applied Computer Vision for Robotics

Stereo ***(& RGBD)***

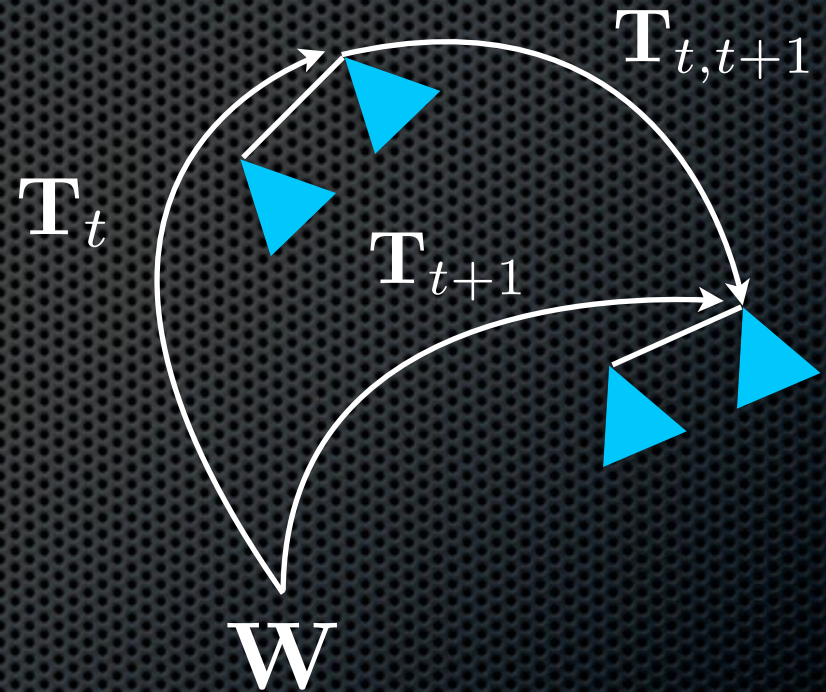
20.11.2013

Philipp Heise

Brian Jensen

Stereo Visual Odometry

- ✦ Input: Calibrated Stereo
- ✦ Output: Motion Estimation
- ✦ Feature-based:
 - ✦ left-right matches => disparity
 - ✦ (t) - (t+1) matches => motion
 - ✦ 3D-3D Pose-From-Points

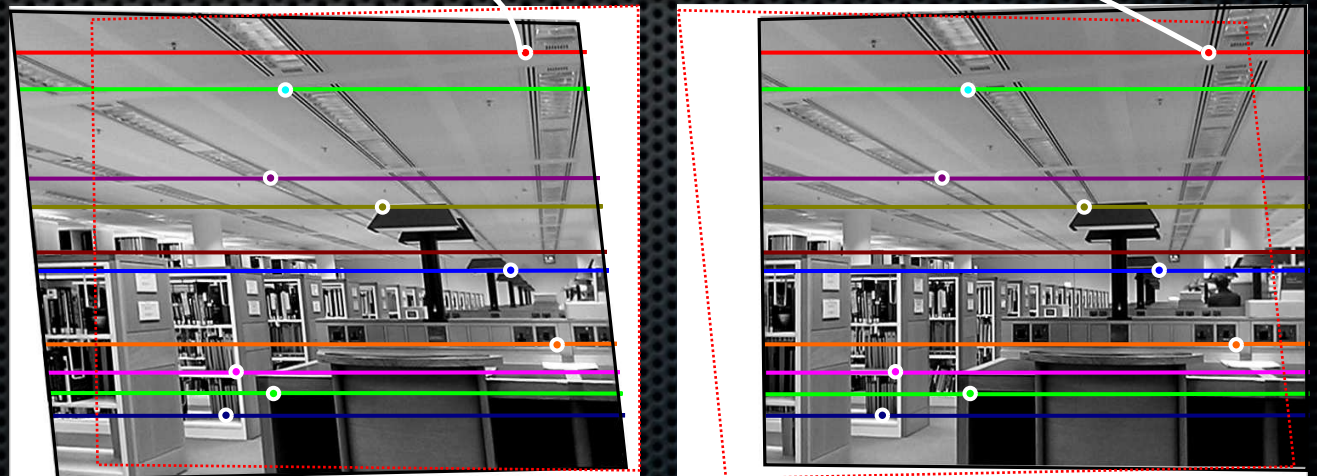


Disparity

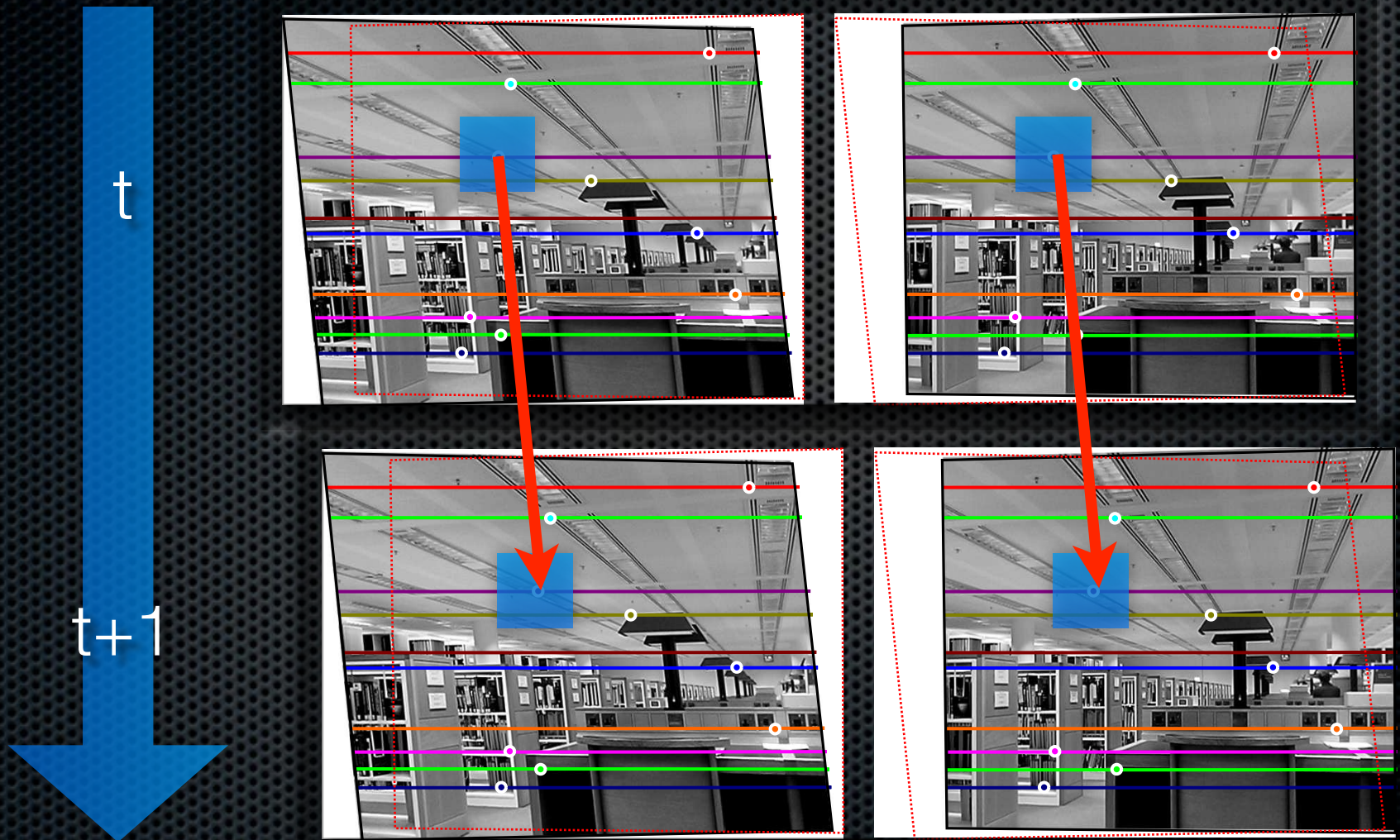
- Rectified Input -> Epipolar Constraint

- Disparity: $d = x_l - x_r$

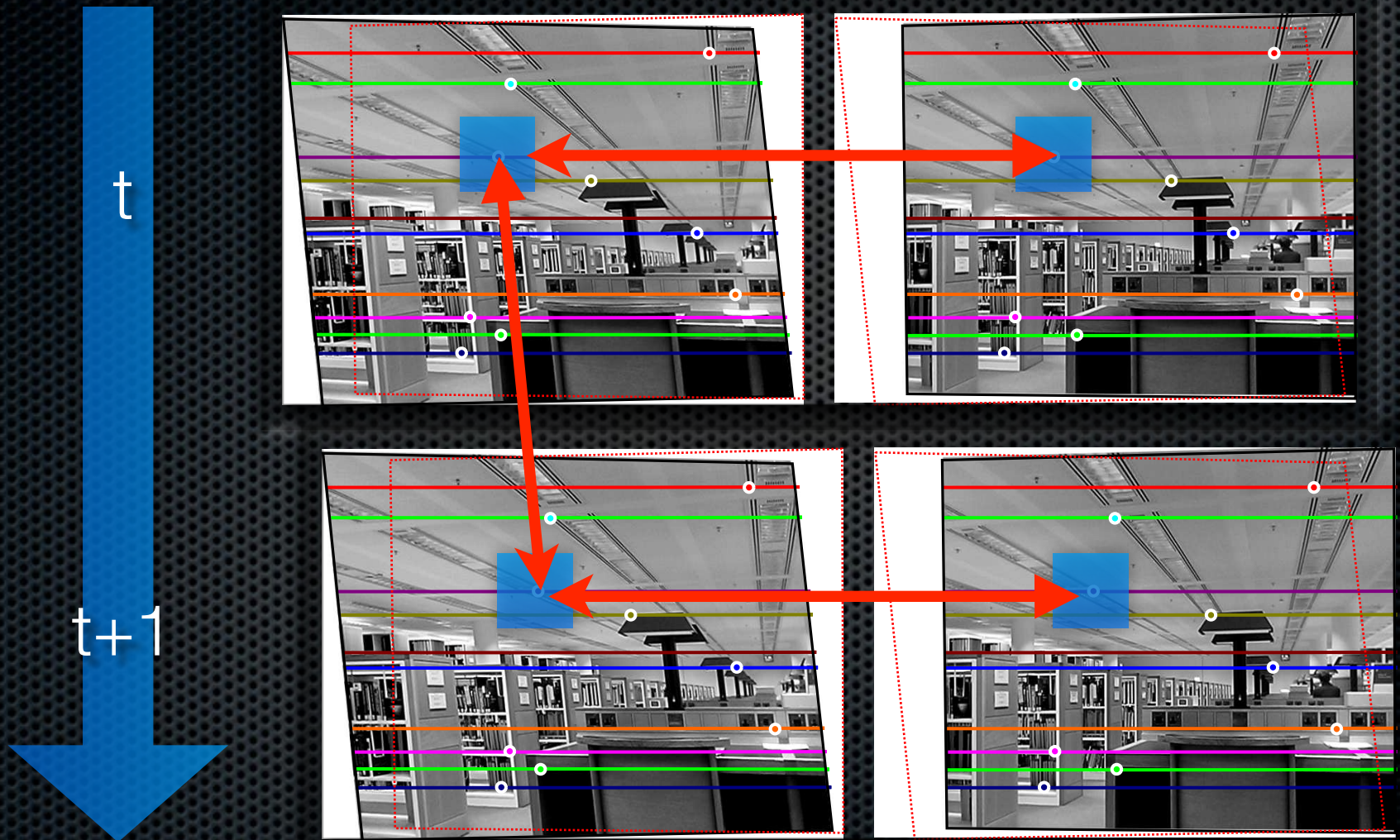
$$Z = \frac{f \cdot B}{d}$$



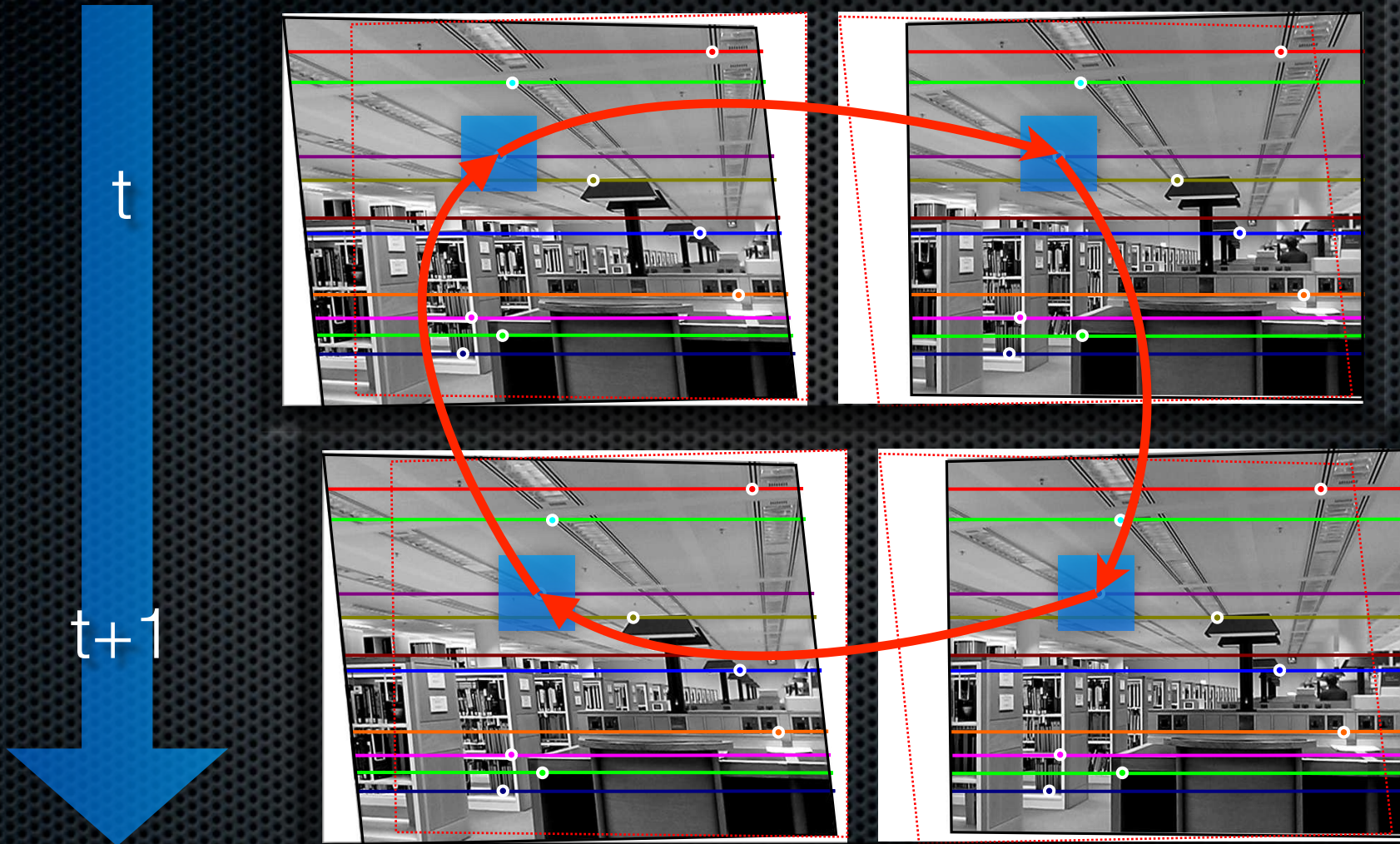
Frame-By-Frame Tracking



Reciprocal Tracking

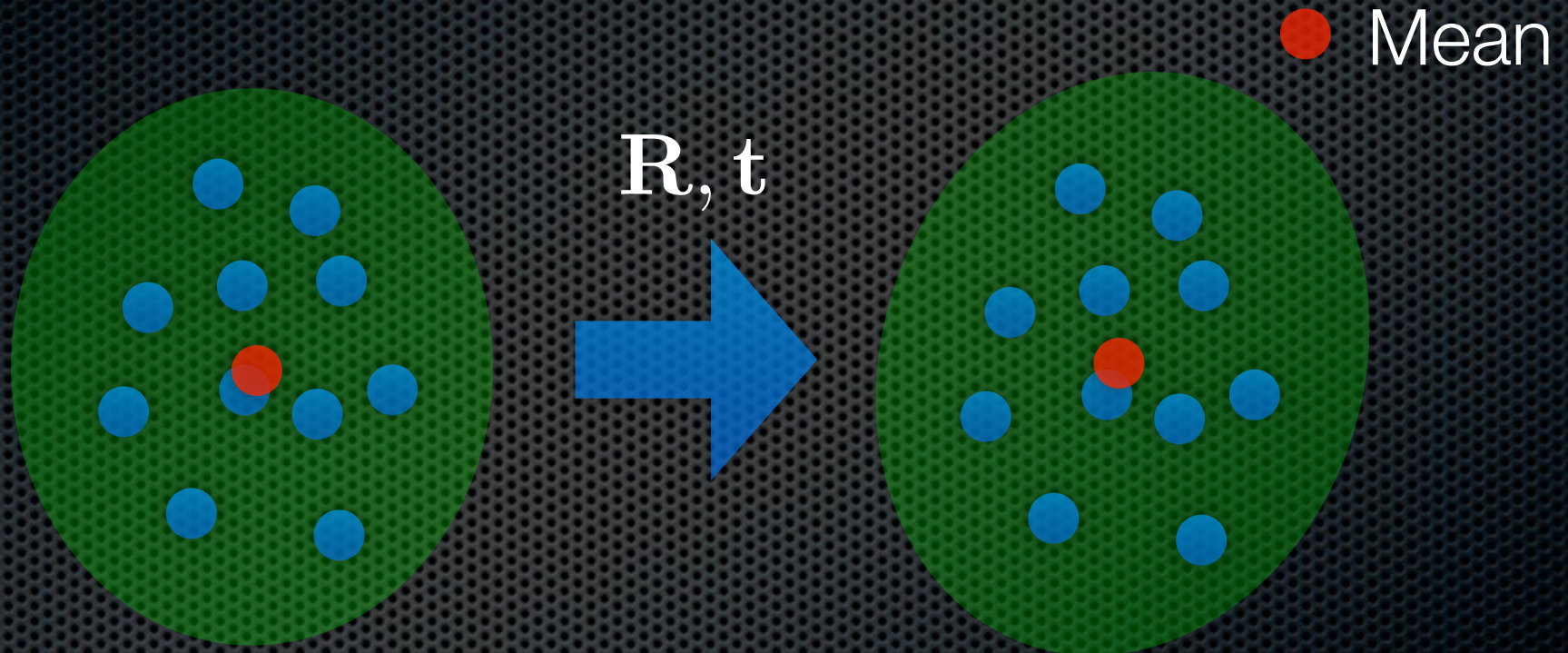


Circular Tracking



Pose from 3D-3D Matches

Umeyama



- Rotation: SVD of correlation matrix of demeaned points
- Translation: $\bar{\mathbf{x}} - \mathbf{R}\bar{\mathbf{y}}$
- <http://cis.jhu.edu/software/lddmm-similitude/umeyama.pdf>



Optional: RGBD



- ✦ Use bag files of RGB-D Datasets:
<http://vision.in.tum.de/data/datasets/rgb-d-dataset/download>
- ✦ Replace “stereo” part by access to the depth image to obtain the depth for a feature



Visualization



Robotics and
Embedded Systems



- ✦ Feature Matches
- ✦ 3D trajectory
- ✦ 3D flow
- ✦ PointClouds
- ✦ checkout rviz Visualization:
<http://www.ros.org/wiki/rviz/DisplayTypes/Marker>