

Applied Computer Vision for Robotics

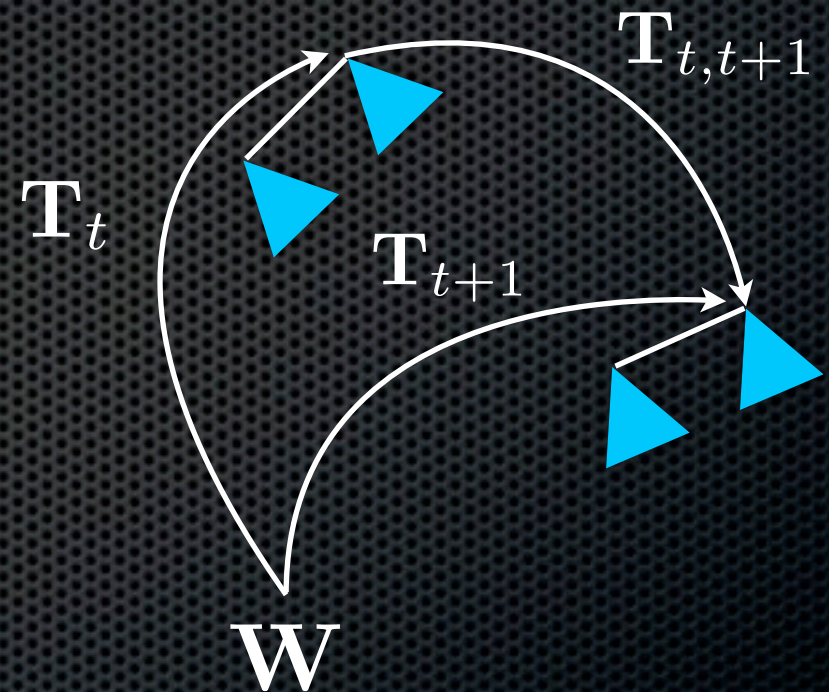
Stereo ***(& RGBD)***

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Stereo Visual Odometry

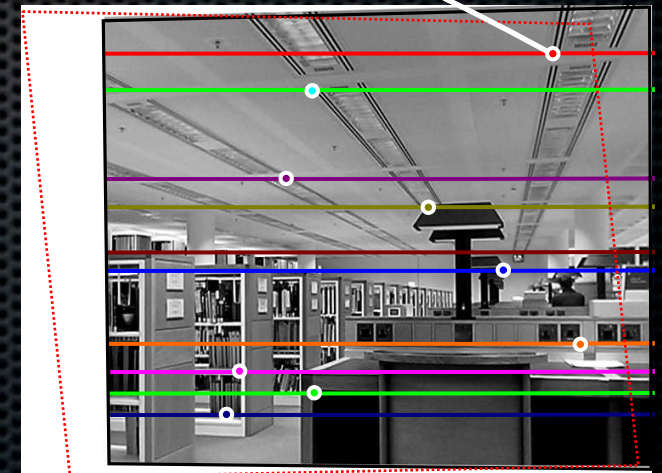
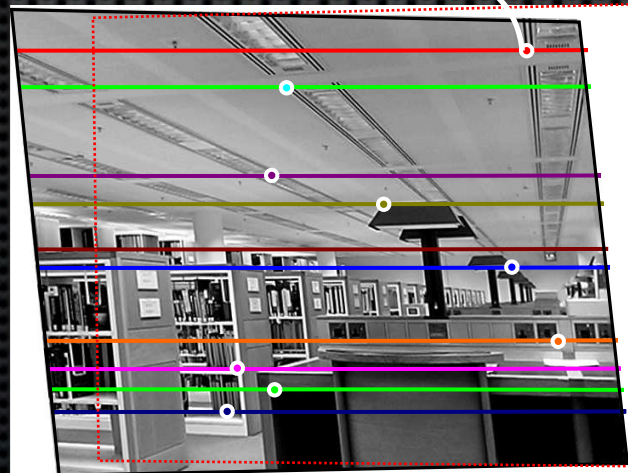
- Input: Calibrated Stereo
- Output: Motion Estimation
- Feature-based:
 - left-right matches => disparity
 - (t) - (t+1) matches => motion
 - 3D-3D Pose-From-Points



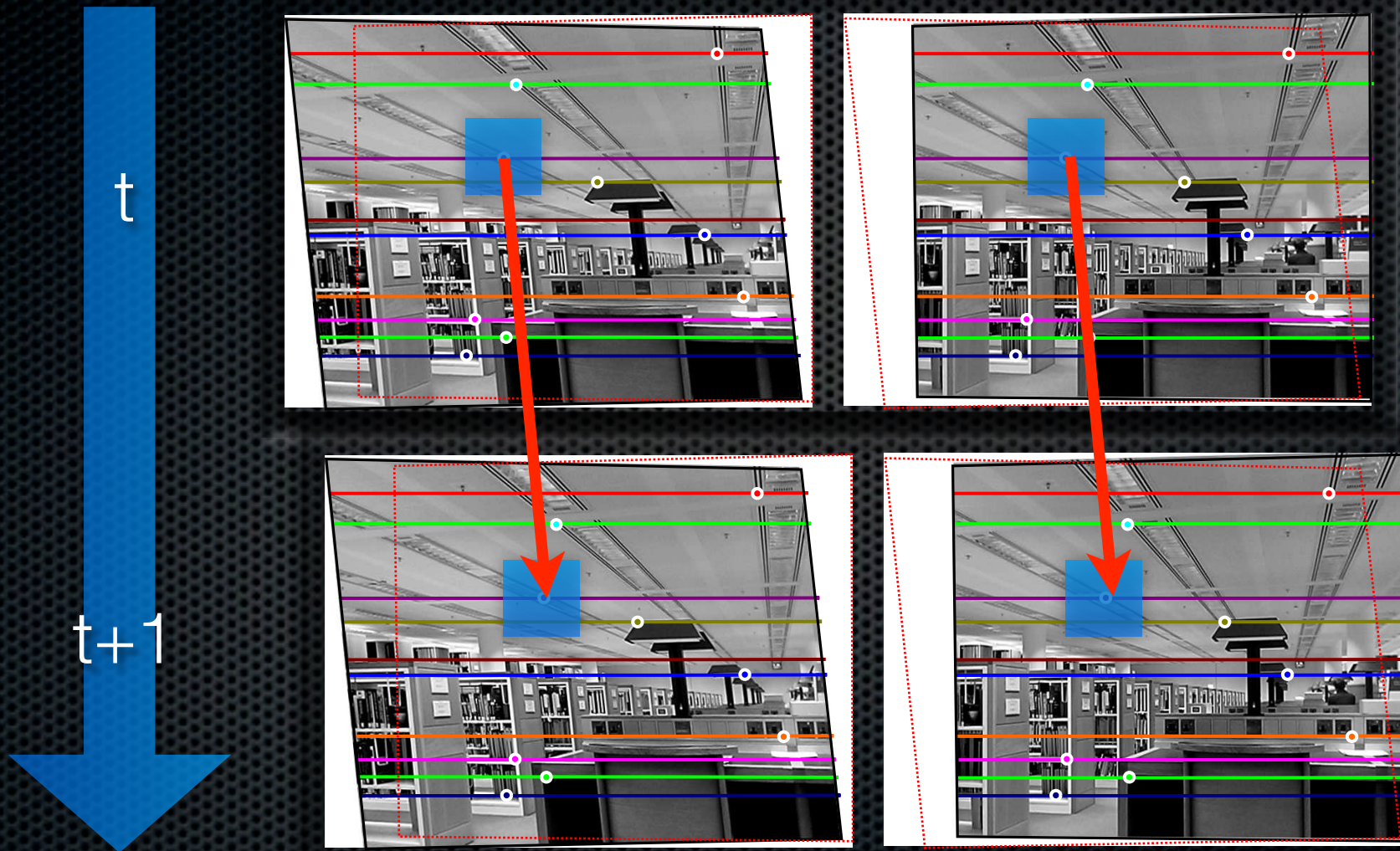
Disparity

- Rectified Input -> Epipolar Constraint
- Disparity: $d = x_l - x_r$

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



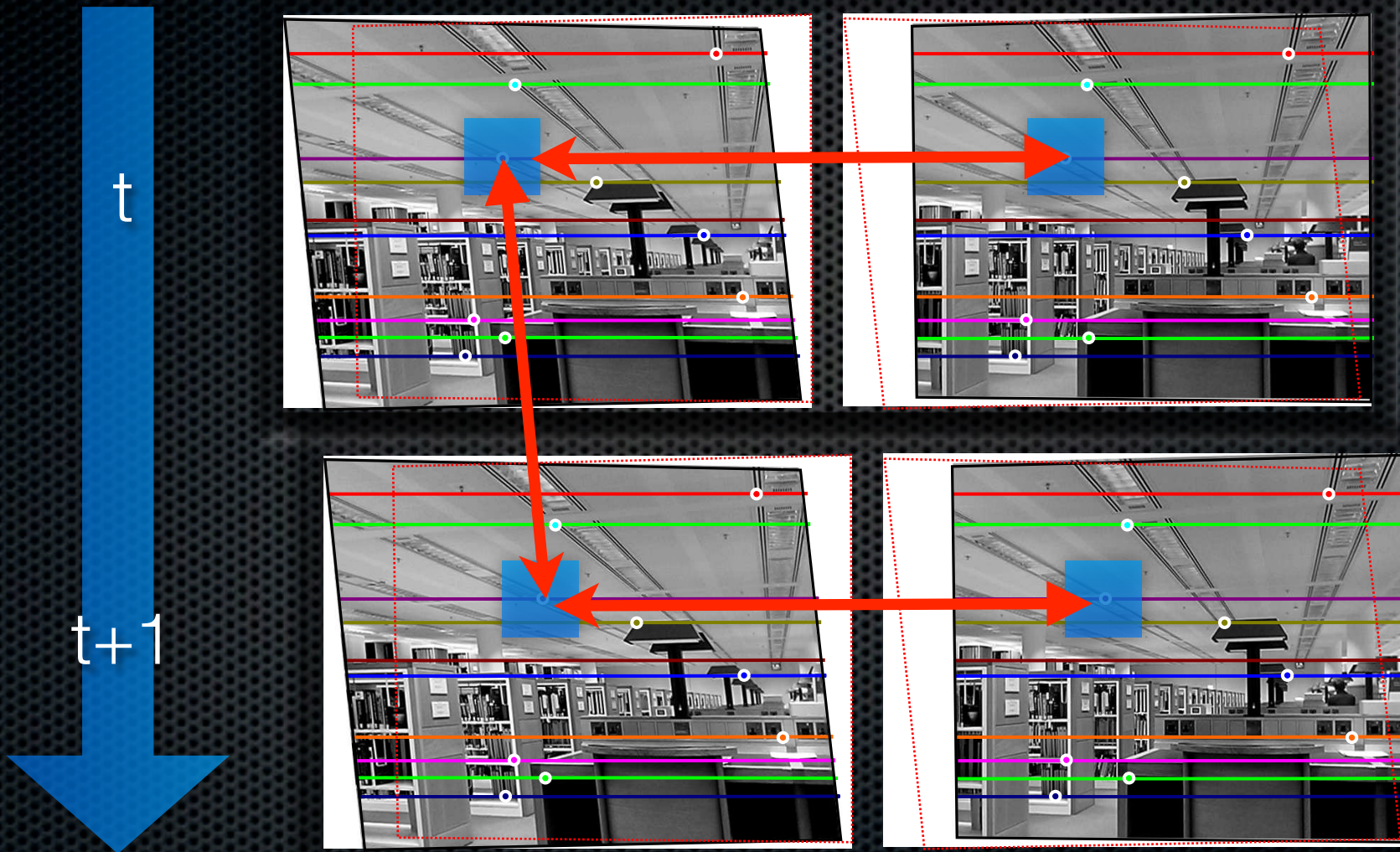
Frame-By-Frame Tracking



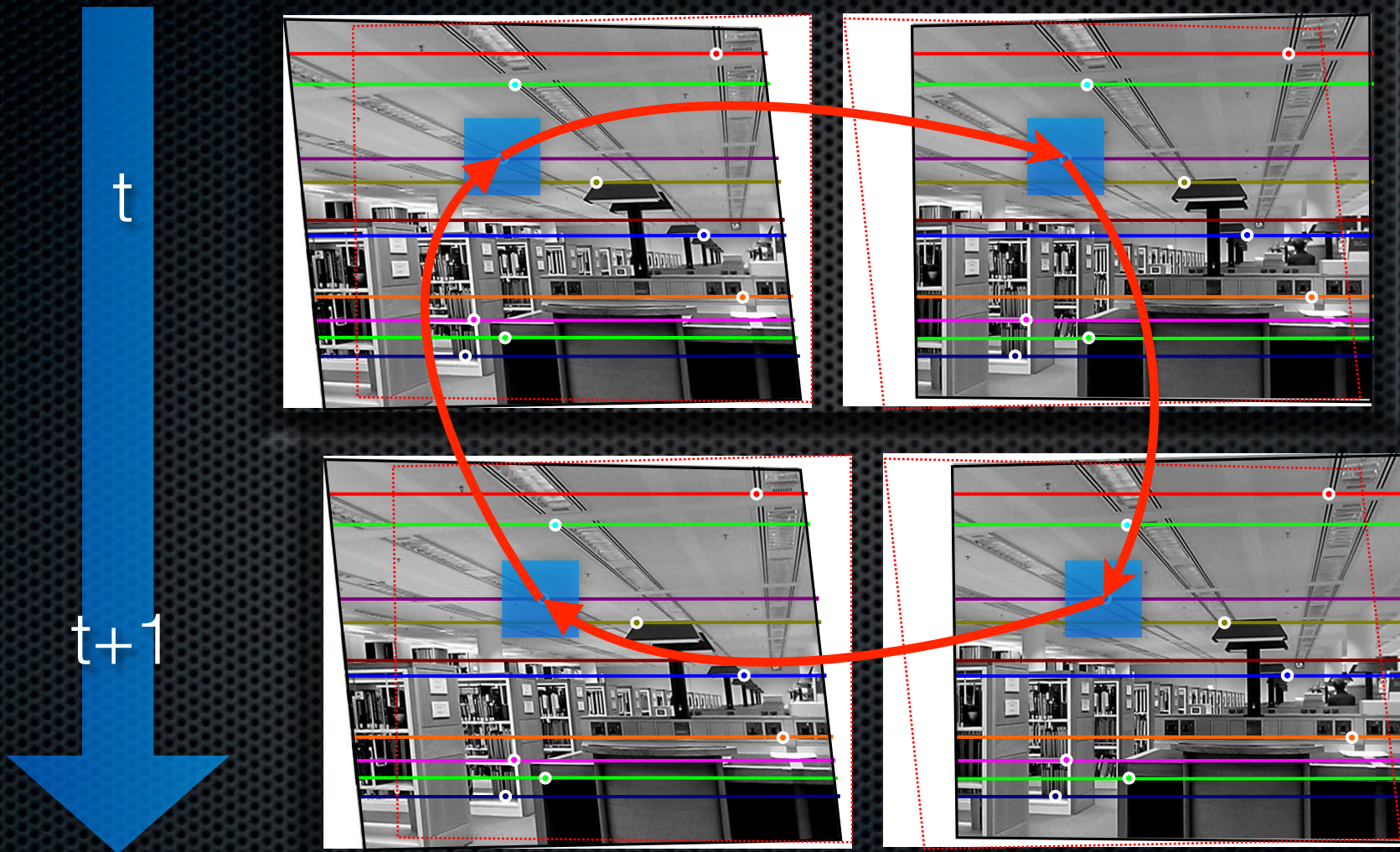
Robotics and
Embedded Systems



Reciprocal Tracking



Circular Tracking

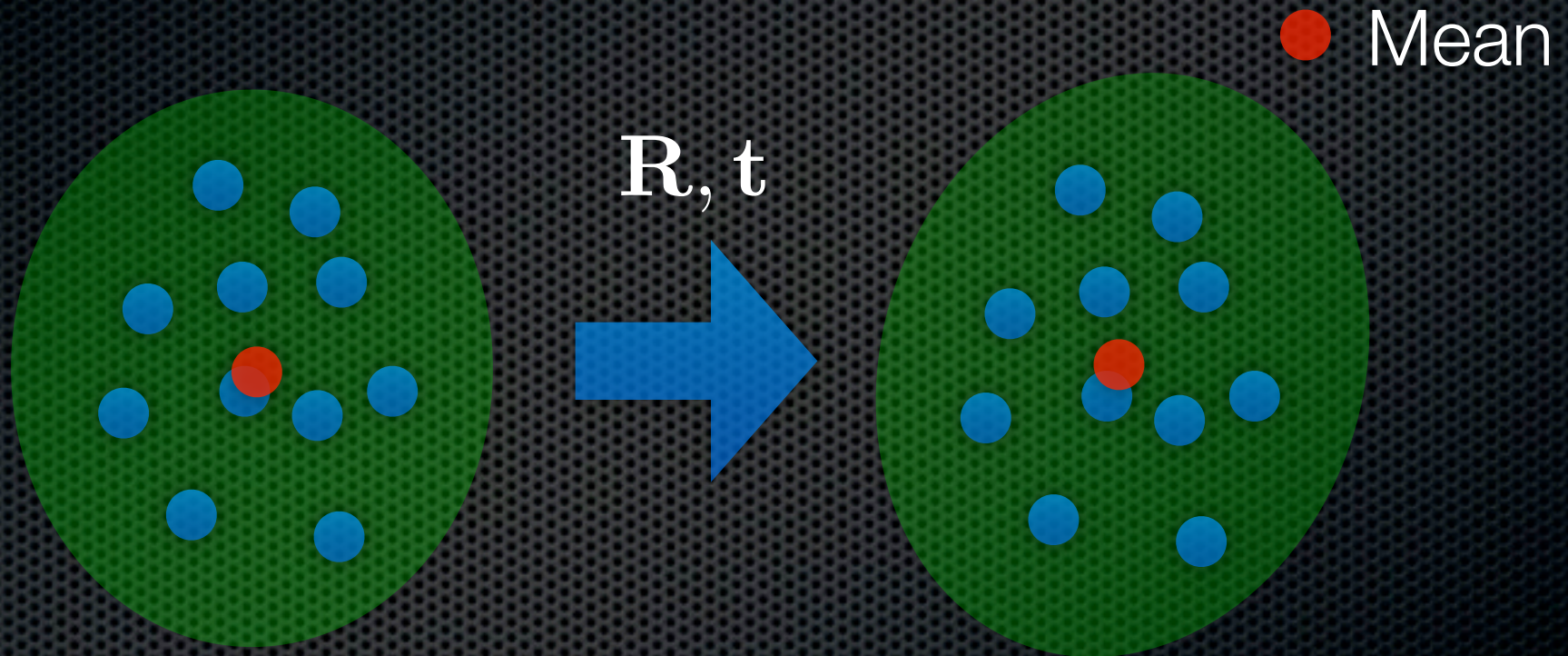


Robotics and
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Pose from 3D-3D Matches

Umeyama



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



Robotics and
Embedded Systems



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

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