

# Applied Computer Vision for Robotics

## *Stereo*

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# Stereo Visual Odometry

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

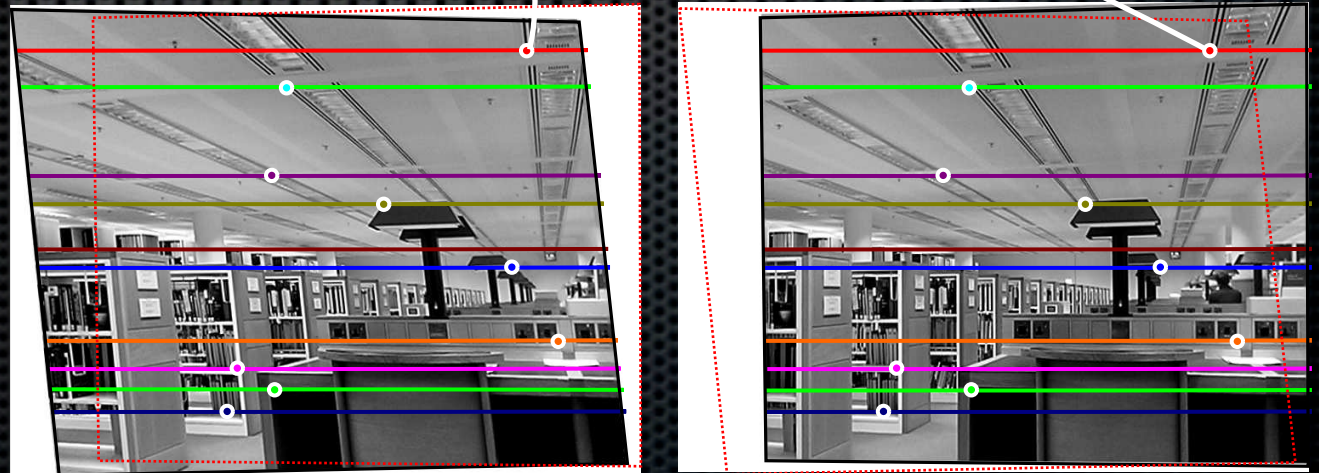




# Disparity

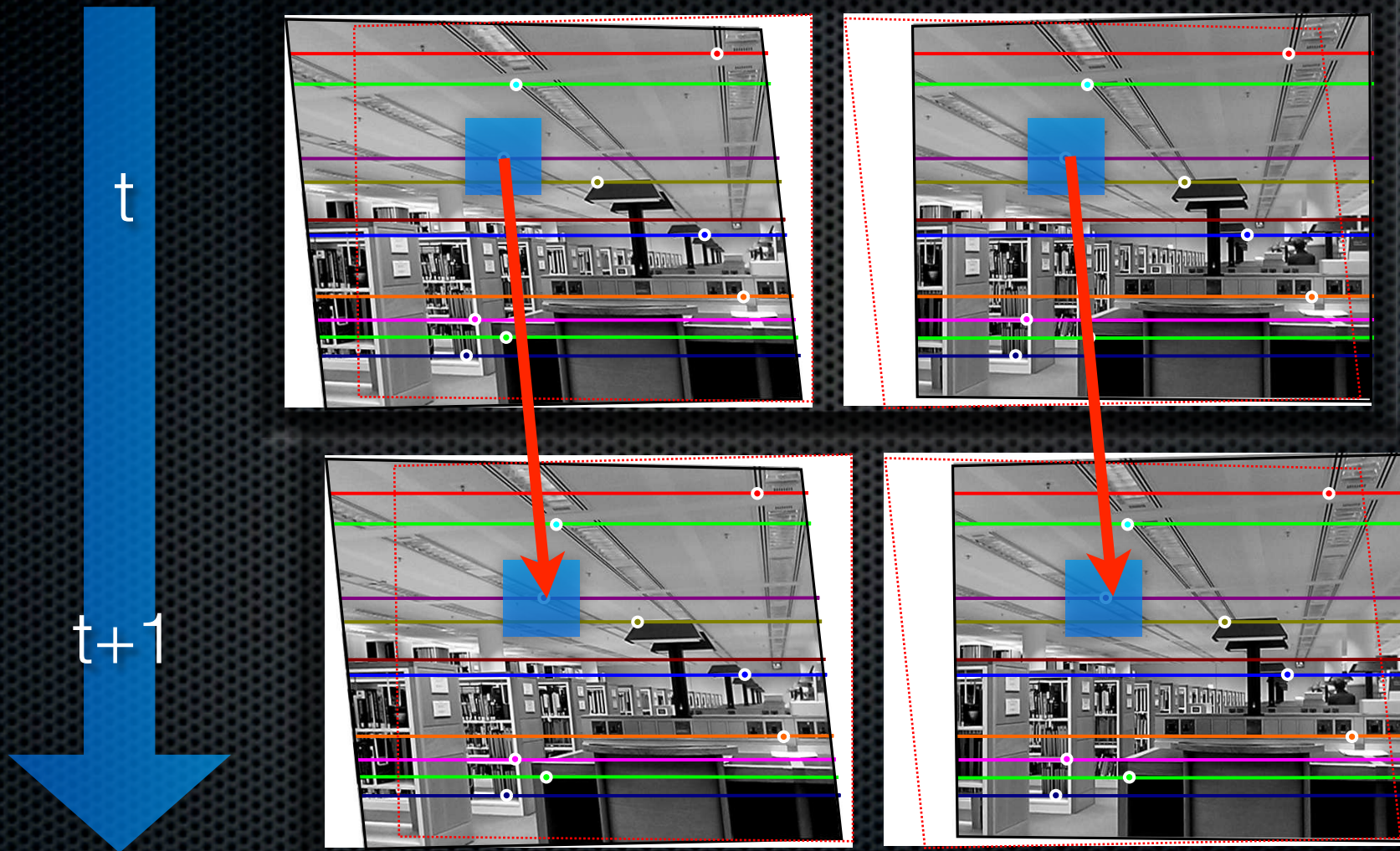
- Rectified Input -> Epipolar Constraint
- Disparity:  $d = x_r - x_l$

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





# Frame-By-Frame Tracking

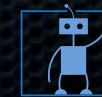
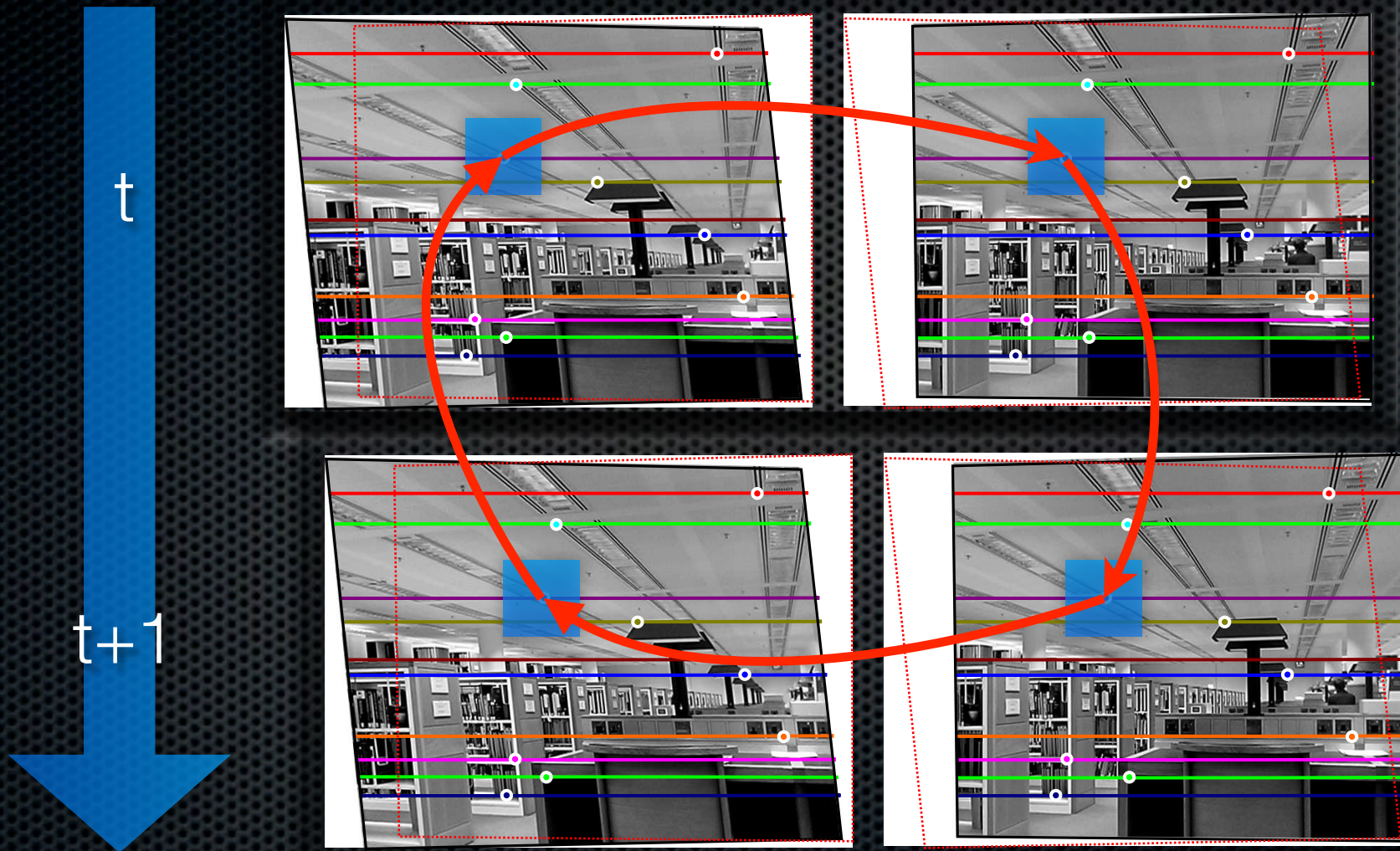


Robotics and  
Embedded Systems





# Frame-By-Frame Tracking

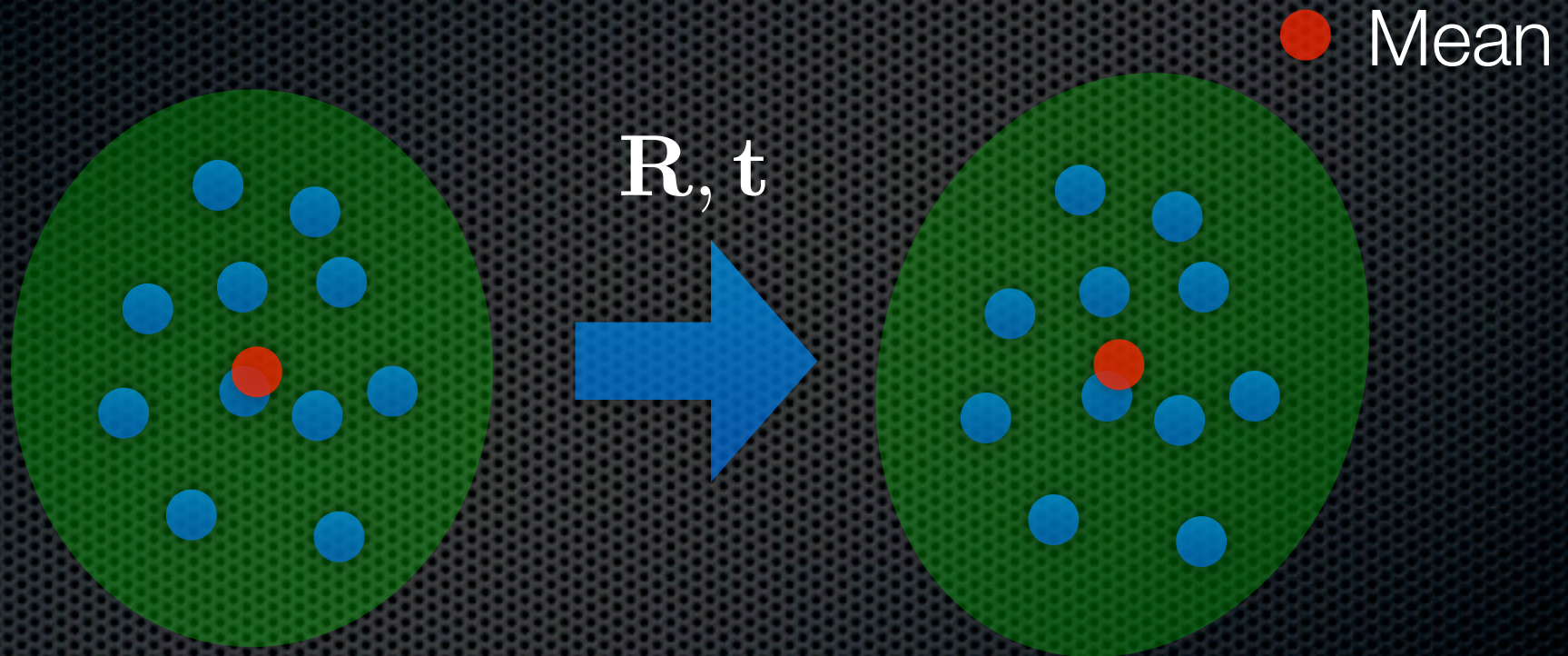


Robotics and  
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# Pose from 3D-3D Matches



- ✦ Rotation: SVD of correlation matrix of demeaned points
- ✦ Translation:  $\bar{\mathbf{x}} - \mathbf{R}\bar{\mathbf{y}}$





# Visualization

- ✦ Feature Matches
- ✦ 3D trajectory
- ✦ 3D flow
- ✦ Error plots against ground truth
- ✦ ...