

Robotics and  
Embedded Systems



# Applied Computer Vision for Robotics

**17.4.2013**

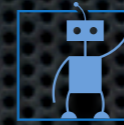
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**Brian Jensen**

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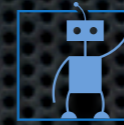
# Features



- Normally split into a detector and descriptor
- The detector only finds points of interests
- The descriptor is extracted around a keypoint to allow comparison and matching
- Usual feature pipeline:
  - Detect features
  - Build descriptor
  - Use descriptors for matching



# Features



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- Exemplary applications
  - Panorama stitching
  - Template tracking
  - Visual Odometry/SLAM



# Features

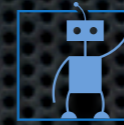
- ✦ Panorama stitching:
  - ✦ Pure rotation of the camera assumed
  - ✦ Correspondences allow homography estimation



Images: Richard Szeliski :Computer Vision: Algorithms and Applications



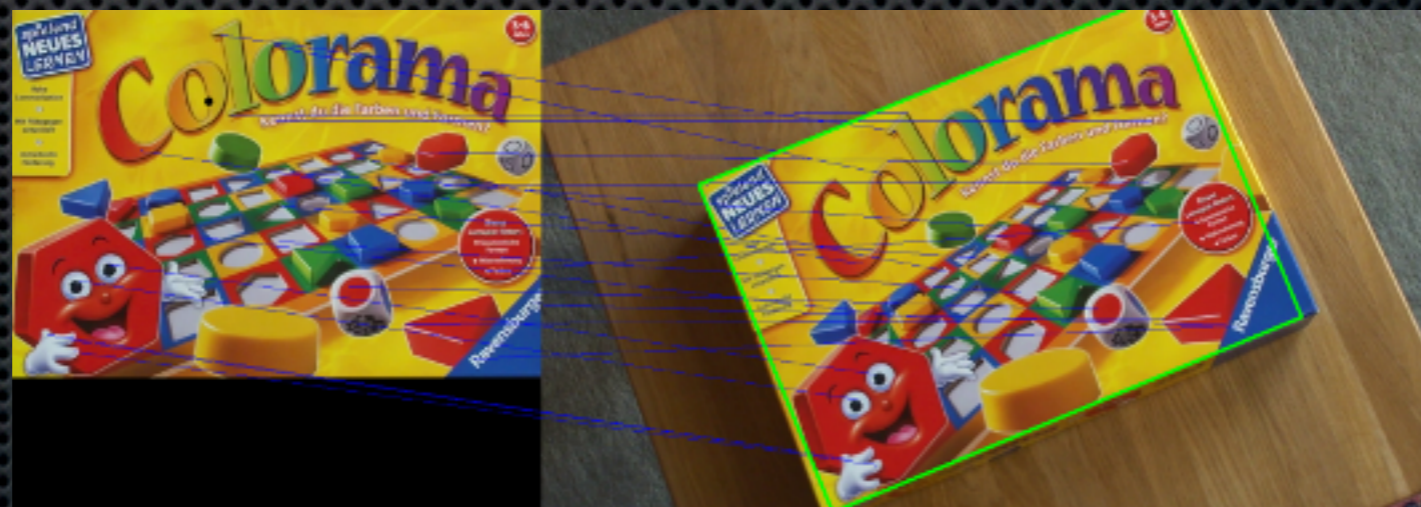
# Features



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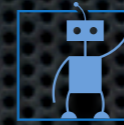


- ✦ Template tracking:
  - ✦ Features of a template are matched to features extracted from video stream
  - ✦ Use correspondences to estimate homography





# Features



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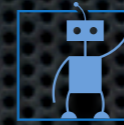


- ✦ Visual Odometry/SLAM
  - ✦ use features to estimate relative movement between frames
  - ✦ build map of 3d features to locate yourself
  - ✦ more details in sheet 3





# Sheet 2



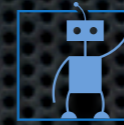
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- ✦ Sheet 2 is mainly about descriptors
- ✦ Goal: find a way to describe the keypoint in order to compare it with other keypoints



# MOPS



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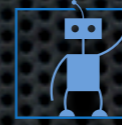


- ✦ Multi-Scale Oriented Patches
- ✦ Rotate the patch using the found orientation and on multiple scales
- ✦ We just use the smoothed intensities for comparison (original: haar coefficients)
- ✦ To compensate for brightness changes it is a good idea to normalize the patch





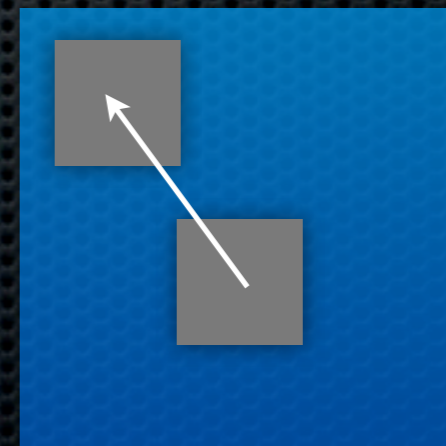
# Binary descriptors



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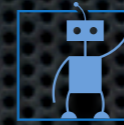


- ✦ Descriptor only contains the result of brightness comparisons of patch areas
- ✦ Many comparisons get combined and form a binary descriptor
- ✦ Distance measured using Hamming distance
- ✦ Orientation also useful to consider





# ROC challenge



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- ✦ Receiver operating characteristic - ROC curve:
  - ✦ is a graphical plot which illustrates the performance of a binary classifier system
  - ✦ plot of the fraction of true positives out of the positives vs. the fraction of false positives out of the negatives
  - ✦ for varying thresholds
- ✦ Challenge between the teams