Applied Computer Vision for Robotics

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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

- 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

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

- 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 is mainly about descriptors

Goal: find a way to describe the keypoint in order to compare it with other keypoints
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

- 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
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