Structure-from-motion pipeline
Orienting close-range images

• The cookbook recipe

• find correspondences
  • extract scale-invariant interest points (LoG, DoG, Harris-Laplace,...)
  • compute robust descriptors (SIFT, SURF, ...)
  • match the descriptors to find corresponding points

• recover approximate orientation parameters
  • robust estimation (RANSAC) using a combination of
    – five-point relative orientation
    – three-point camera resection

• refine orientation parameters
  • bundle block adjustment with blunder detection
  • often requires self-calibration (amateur cameras)
  • note: adding new images and bundle adjustment should be interleaved to avoid error build-up
Example

- San Marco Square (Venice)
  - 14,079 Flickr images, 4,515,157 tie-points

- more examples at http://grail.cs.washington.edu/rome/
High frame rate video

• Easier than general case

• scale-/rotation invariance not required
  • small changes between consecutive frames
  • can use standard interest points (e.g. corners)

• orientation
  • depending on speed of motion, it may be possible to use the orientation of the previous frame as initial value
  • directly orient new frame with bundle adjustment

• real-time applications
  • computing initial values may still pay off to speed up convergence
  • restricted adjustment over a short time interval to stay within constant time budget
Example

• Camera-based self-localisation

https://www.youtube.com/watch?v=Q3EMgGI6E5s


https://www.youtube.com/watch?v=JyG1EeqCmHY