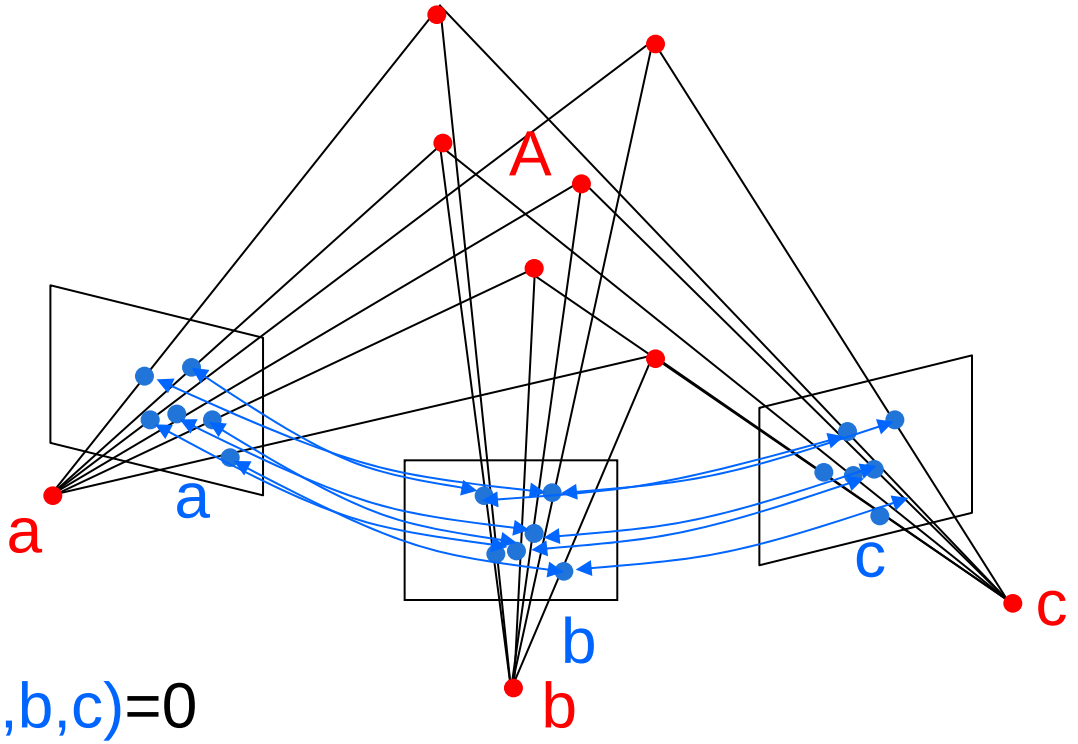
Multiple View Geometry
in Computer Vision

Multiple View Geometry



$f(a,b,c)=0$

$(a,b) \rightarrow A$ reconstruct geometry of scene

$(a,b,c) \rightarrow (a,b,c)$ calibrate cameras

$(a,b) \rightarrow c$ Transfer an image point from one camera to the other

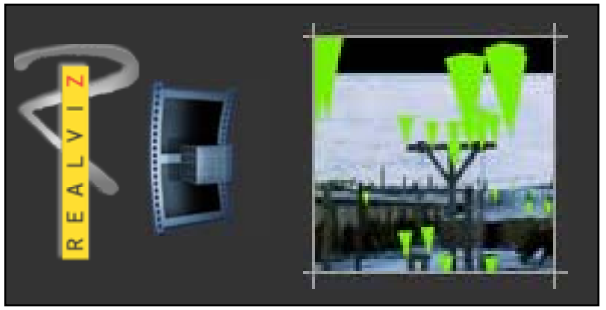
Course objectives

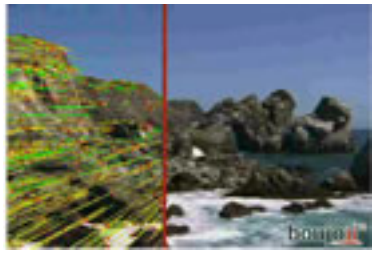
- To understand the geometric relations between multiple views of scenes.
- To understand the general principles of parameter estimation.
- To be able to compute scene and camera properties from real world images using state-of-the-art algorithms.

Applications

- **MatchMoving** In cinematography, **match moving** is a visual-effects technique that allows the insertion of computer graphics into live-action footage with correct position, scale, orientation, and motion relative to the photographed objects in the shot.
  Compute camera motion from video

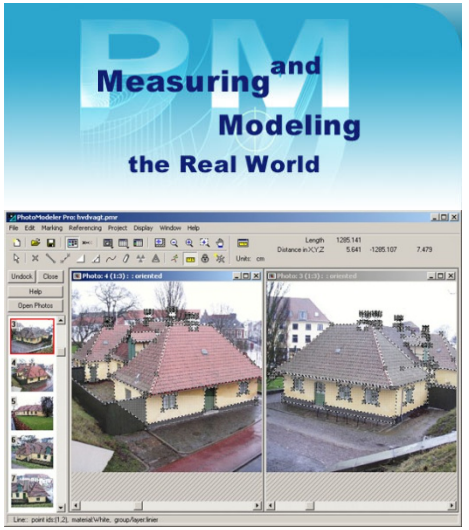
  (to register real and virtual object motion)





Applications

- 3D modeling



Content

- **Background**: Projective geometry (2D, 3D), Parameter estimation, Algorithm evaluation.
- **Single View**: Camera model, Calibration, Single View Geometry.
- **Two Views**: Epipolar Geometry, 3D reconstruction, Computing F, Computing structure, Plane and homographies.
- **Three Views**: Trifocal Tensor, Computing T.
- **More Views**: N-Linearities, Multiple view reconstruction, Bundle adjustment, auto-calibration, Dynamic SfM, Cheirality, Duality

Administration

- Office hours: Tuesdays 11 to 12
- Grades:
  - 10% class participation
  - 20% Matlab homeworks (pending on finding a grader)
  - 70% project
    - Proposals due 4 weeks into the semester
    - Mid term progress report 8 weeks into the semester
    - Final report and presentation: end of the semester

Relevant textbooks

- Computer Vision: A modern approach by Forsyth and Ponce
- Multiple view geometry in computer vision by Hartley and Zisserman
- An invitation to 3-D Vision; from images to Geometric models by Ma, Soatto, Kosecka and Sastry
- The geometry of multiple images by Faugeras and Luong
- Introductory techniques for 3D computer vision by Trucco and Verri
- Marc Polleyfeys tutorial on 3D reconstruction
- http://www.cs.unc.edu/~marc/tutorial.pdf