



Sources of error in correspondences

- Low-contrast / textureless image regions
- Occlusions
- Camera calibration errors
- Poor image resolution
- Violations of brightness constancy (specular reflections)
- Large motions











So far: Features and filters

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Transforming and describing images; textures and colors



11/13		Rand Object Detection uning a Boosted Category Vola and M. Jenes, 2001. FP 22 5: SVMs Learning Gender with Support Faces, by B. Modhadam and M. Yan, TFAM 2002, F&G 2003. Unsupervised Learning of Models for Biccognition Unsupervised Learning of Models for Biccognition Uning Previous ECCV 2001. Object Casis Recognition Units Previous Detection Color Casis Recognition Deviation Control Strike Persona, Persona, and A. Steseman, CyteR 2003.	sides luteau (faces part 2, detection, boosting) sides futeau (SVMs, unsupervised model learning)	Past 4.lles
11/20 11/27 11/29 12/4	Motion, optical flow, tracking	Trucco & Vern handout		Pset 4 due 12/4
12/6	Wrap-up			Graduate students' reviews and extensions due



Outline

- Motion field and parallax
- Optical flow, brightness constancy
- Aperture problem
- Constraints on image motion

Uses of motion

- Analyzing motion can be useful for
 - Estimating 3d structure
 - Segmentation of moving objects
 - Tracking objects, features over time



Types of motion in video

- Considering rigid objects they can rotate and translate in the scene.
- Motion may be due to
 - Movement in scene
 - Movement of camera (ego motion)
- Geometrically equivalent, however illumination effects can make one appear different than the other.





















Motion vs. Stereo: Similarities

- Both involve solving
 - Correspondence: disparities, motion vectors
 - Reconstruction

Motion vs. Stereo: Differences

- Motion:
 - Uses velocity: consecutive frames must be close to get good approximate time derivative
 - 3d movement between camera and scene not necessarily single 3d rigid transformation
- Whereas with stereo:
 - Could have any disparity value
 - View pair separated by a single 3d transformation















 To recover optical flow, we need some constraints (assumptions)

> Brightness constancy: in spite of motion, image measurement in small region will remain the same Spatial coherence: assume nearby points belong to the same surface, thus have similar motions, so estimated motion should vary smoothly.

- *Temporal smoothness*: motion of a surface patch changes gradually over time.

































Good conditions for solving flow

- Recall Harris corner detection
- Good feature windows to track in time can be detected independently in a single frame.









Example use of optical flow: Motion Paint

Use optical flow to track brush strokes, in order to animate them to follow underlying scene motion.



http://www.fxguide.com/article333.html

Coming up

• Problem set 4 due 12/4

More on motion

- Multiple motions and segmentation
- Tracking
- SfM