CSE Distinguished Alumni Lecturer

Programming Video Games

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AP&M 4301

See Don Likeness’s profile at http://www.jacobsschool.ucsd.edu/alumni/profiles/winter03_likeness.shtml

Binocular Stereopsis: Mars
Given two images of a scene where relative locations of cameras are known, estimate depth of all common scene points.

Two images of Mars

Need for correspondence

Triangulation
Two Approaches

• A) From each image, process “monocular” image to obtain cues.
• B) Establish correspondence between cues.
• Directly compare image regions between the two images.

Random Dot Stereograms

A Cooperative Model (Marr and Poggio, 1976)

Where does a point in the left image match in the right image?

Epipolar Geometry

• Epipolar Plane
• Epipoles
• Epipolar Lines

Epipolar Constraint

• Potential matches for \( p \) have to lie on the corresponding epipolar line \( l' \).
• Potential matches for \( p' \) have to lie on the corresponding epipolar line \( l \).
Calibration
Determine intrinsic parameters and extrinsic relation of two cameras

Epipolar Geometry

Rectification
Given a pair of images, transform both images so that epipolar lines are scan lines.

Rectification
All epipolar lines are parallel in the rectified image plane.

Input Images

Rectified Images
See Section 7.3.7 for specific method
Features on same epipolar line

Mobi: Stereo-based navigation

Epipolar correspondence

Symbolic Map

Multiple Interpretations

Each feature on left epipolar line match one and only one feature on right epipolar line.

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Problem of Occlusion

Ordering Constraint

Dynamic Programming (Ohta and Kanade, 1985)