

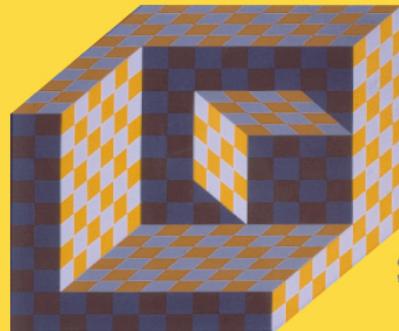


INTERDISCIPLINARY APPLIED MATHEMATICS

IMAGING, VISION, AND GRAPHICS

An Invitation to 3-D Vision

From Images to Geometric Models



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Springer



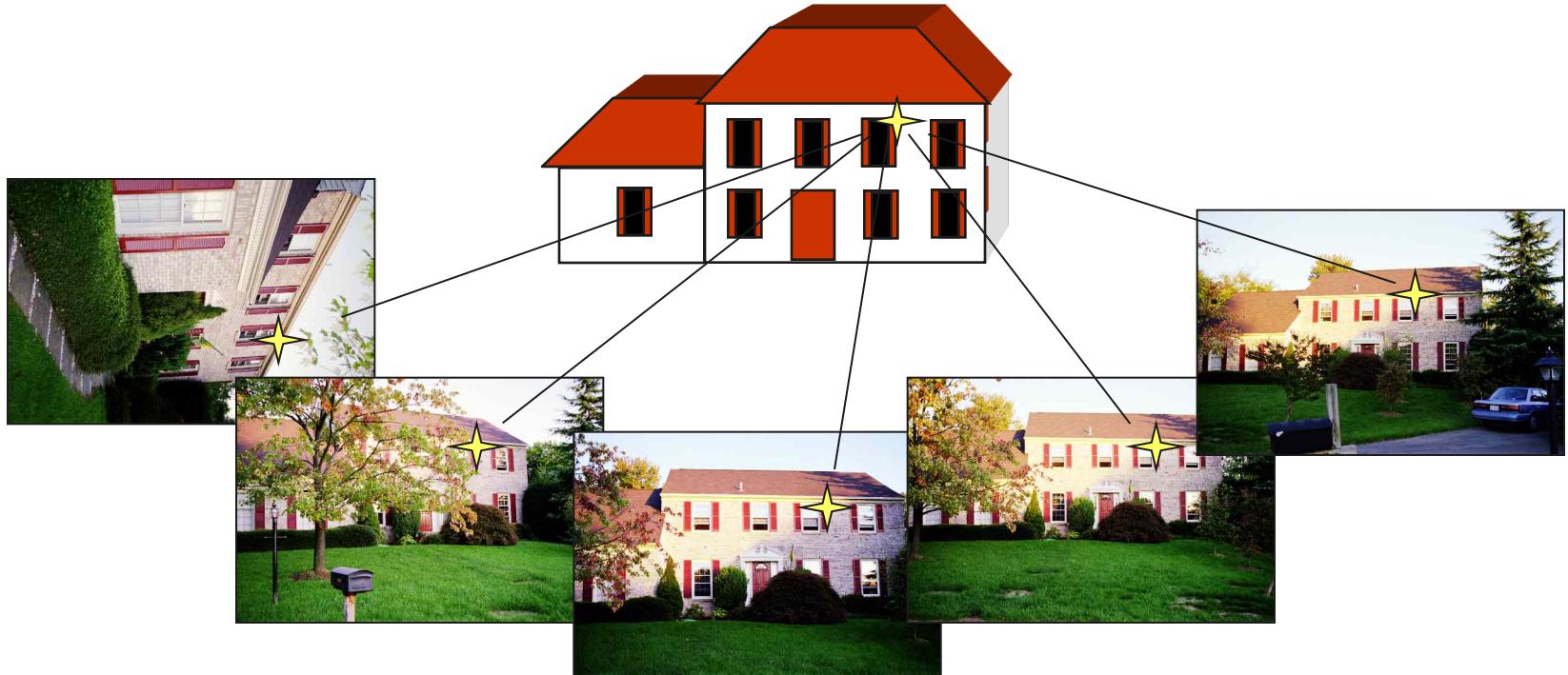
Lecture 1

Overview and Introduction



Reconstruction from images – The Fundamental Problem

Input: Corresponding “features” in multiple perspective images.
Output: Camera pose, calibration, scene structure representation.





APPLICATIONS – Autonomous Highway Vehicles

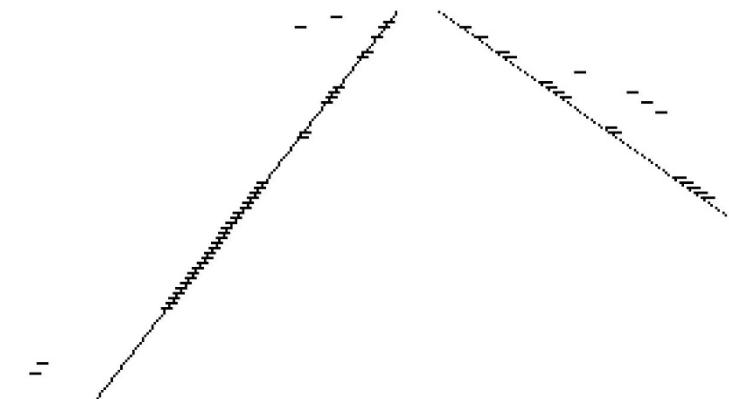
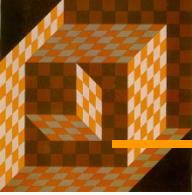
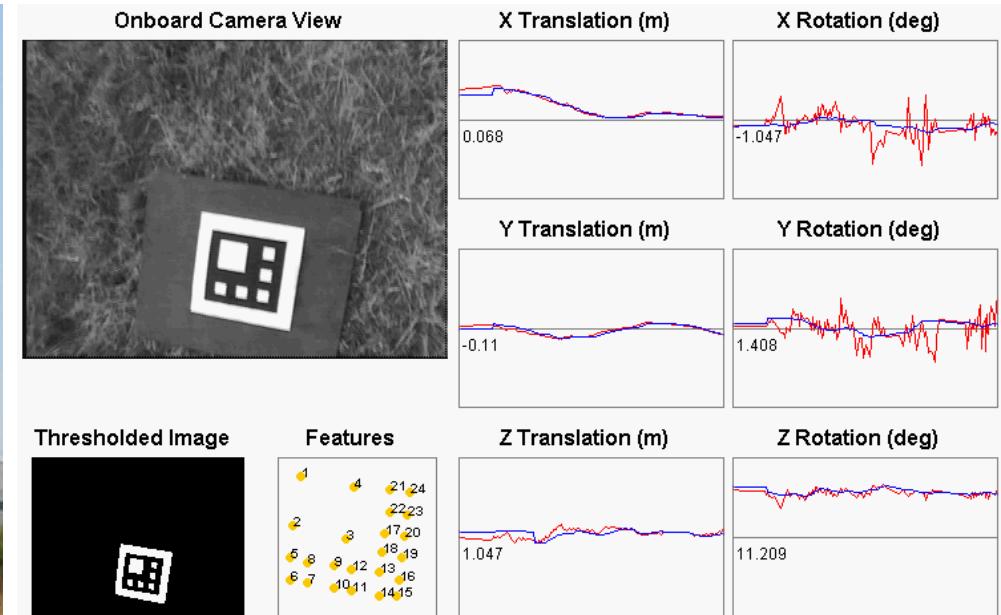


Image courtesy of California PATH



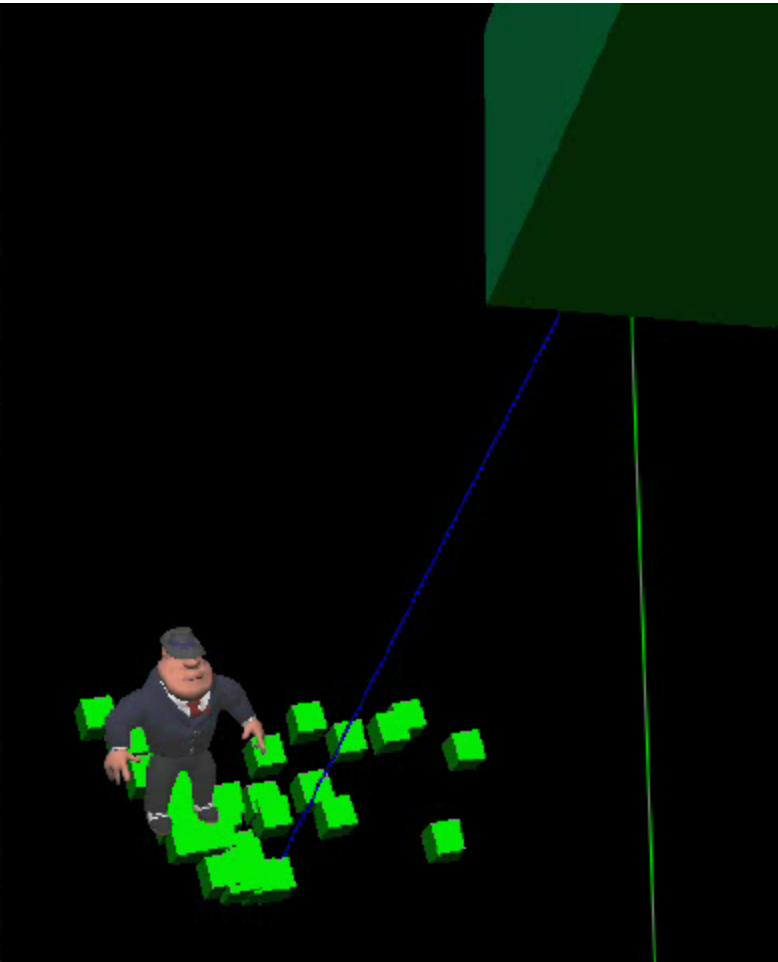
APPLICATIONS – Unmanned Aerial Vehicles (UAVs)

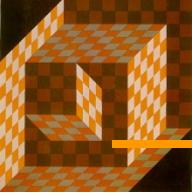


Rate: 10Hz; Accuracy: 5cm, 4°



APPLICATIONS – Real-Time Virtual Object Insertion

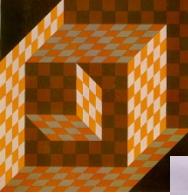




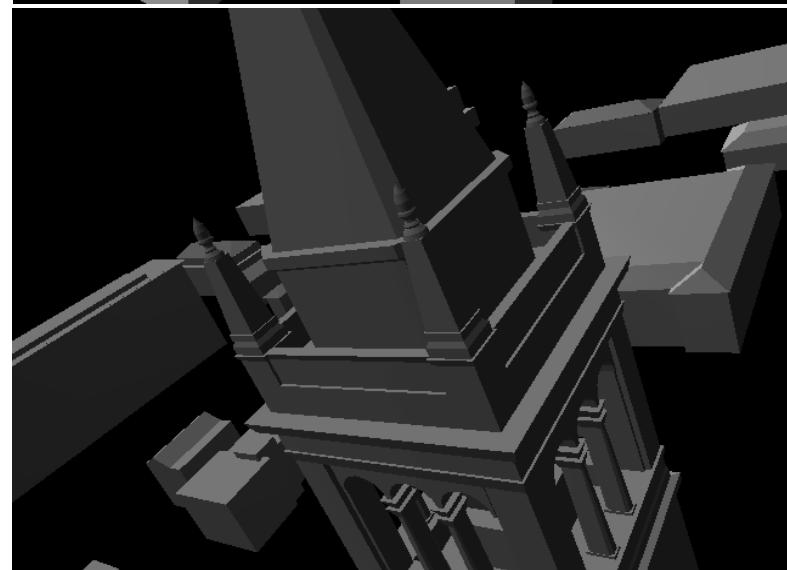
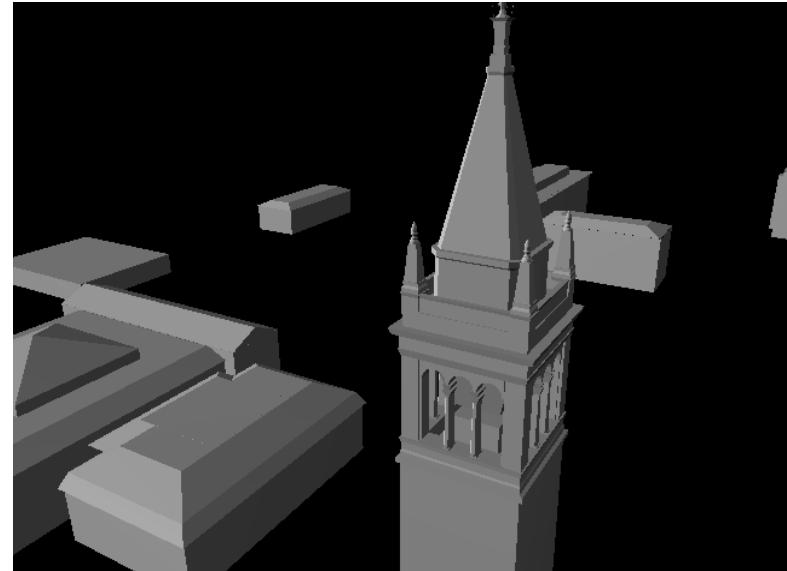
APPLICATIONS – Real-Time Sports Coverage

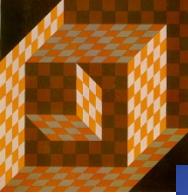
First-down line and virtual advertising





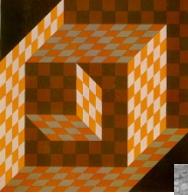
APPLICATIONS – Image Based Modeling and Rendering





APPLICATIONS – Image Alignment, Mosaicing, and Morphing





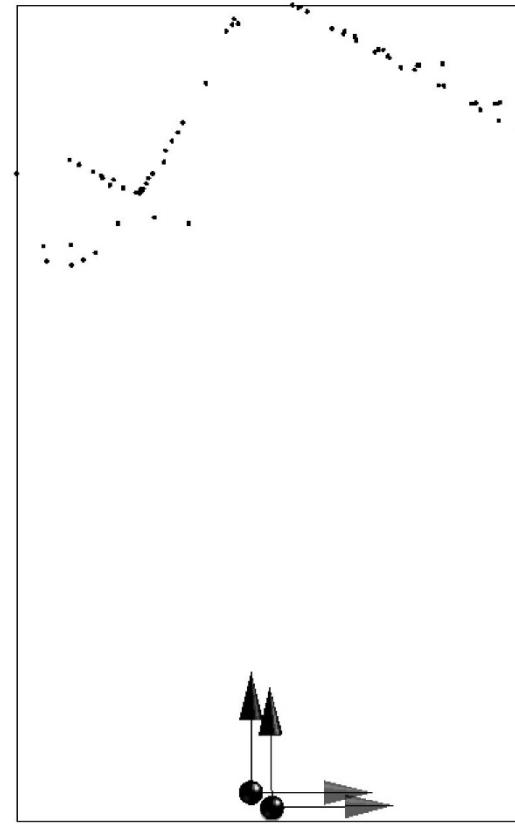
GENERAL STEPS – Feature Selection and Correspondence



1. Small baselines versus large baselines
 2. Point features versus line features
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GENERAL STEPS – Structure and Motion Recovery

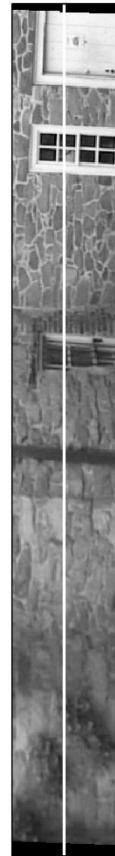


1. Two views versus multiple views
2. Discrete versus continuous motion
3. General versus planar scene
4. Calibrated versus uncalibrated camera
5. One motion versus multiple motions



GENERAL STEPS – Image Stratification and Dense Matching

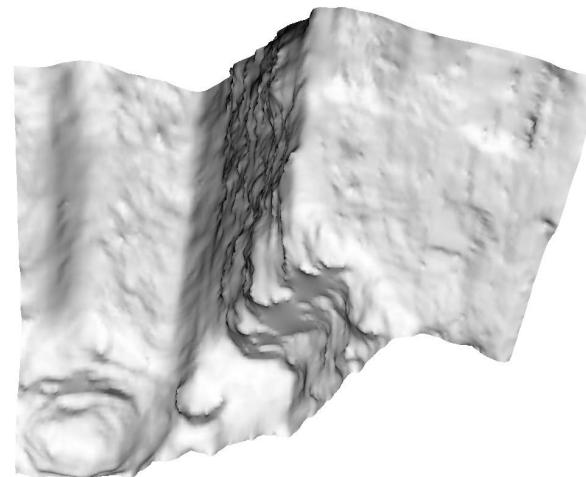
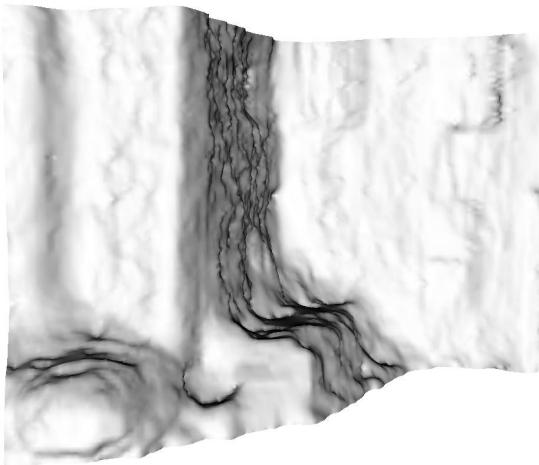
Left



Right



GENERAL STEPS – 3-D Surface Model and Rendering



1. Point clouds versus surfaces (level sets)
 2. Random shapes versus regular structures
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