

Computer Vision

Shree K. Nayar

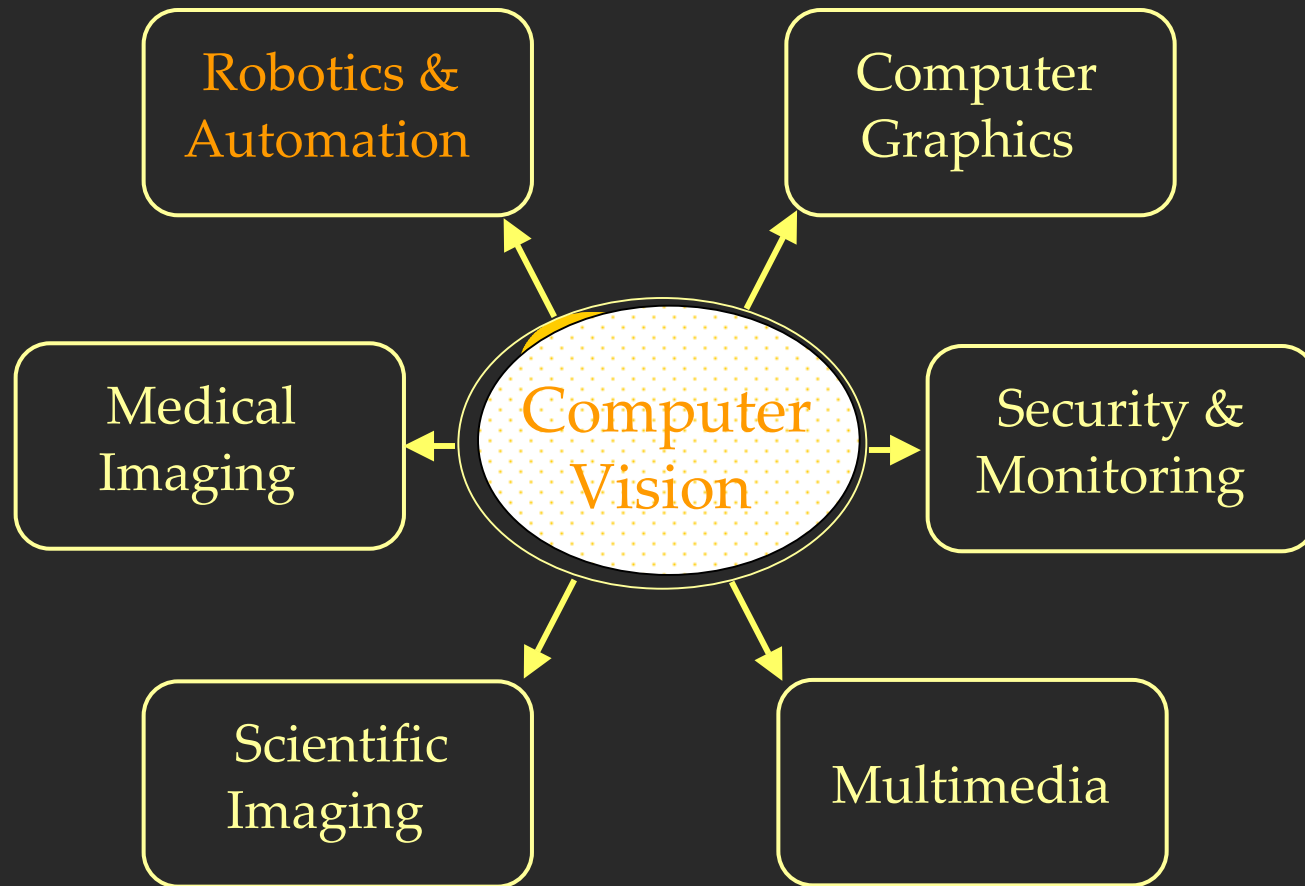
Computer Science
Columbia University

Greg Hager
Nikos Papanikolopoulos

David Forsyth

Jitendra Malik
Bill Freeman
Shree Nayar
Takeo Kanade
Jean Ponce

The Bigger Picture

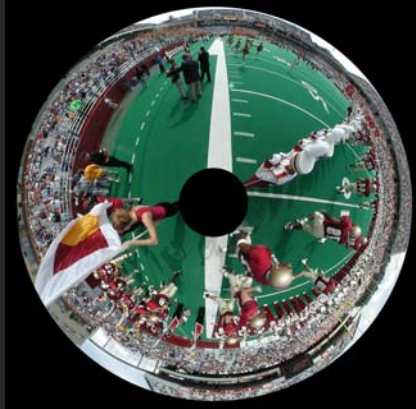


Selected Highlights

- Computational Cameras
- Hallucinating Resolution
- Visual Servoing and Control
- Registration and Model Building
- Modeling and Detecting Faces
- Understanding Articulated Motion
- Segmentation and Object Recognition
- Grand Challenges

Computational Cameras

Panoramic Imaging:



Video Conferencing



(with Hagen Schempf, CMU)

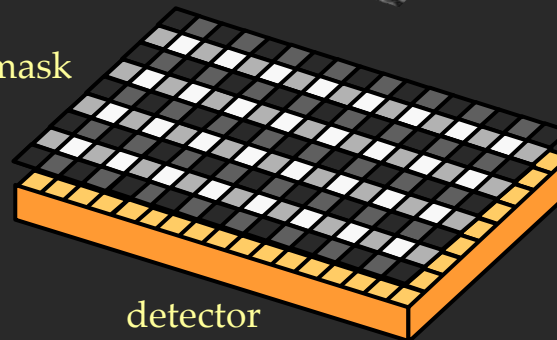
High Dynamic Range Imaging:



scene



mask

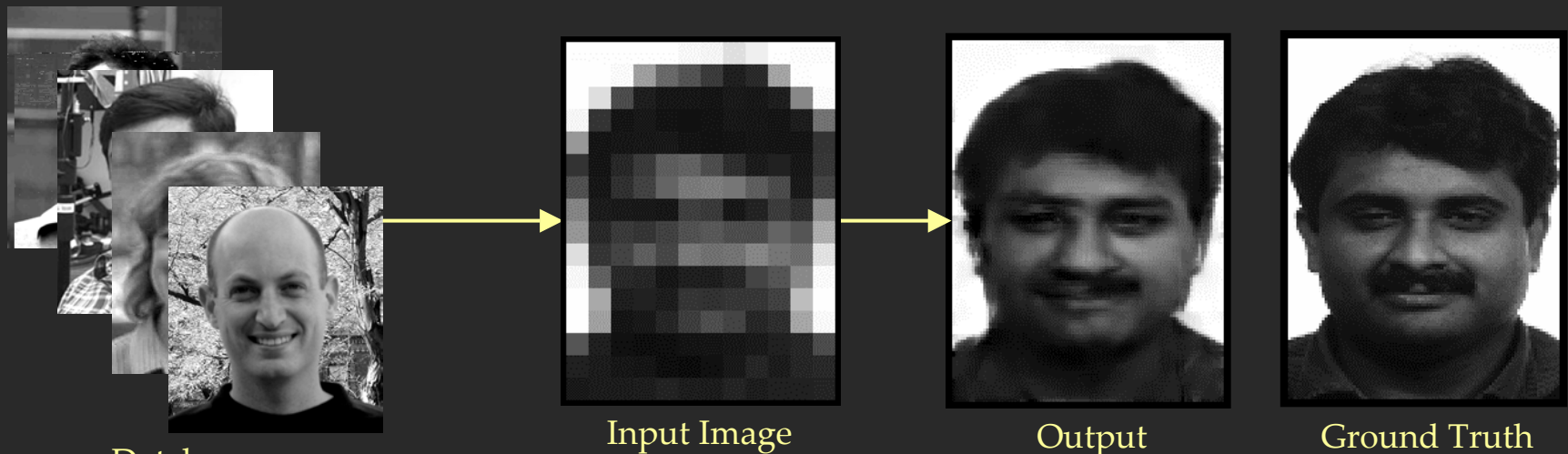
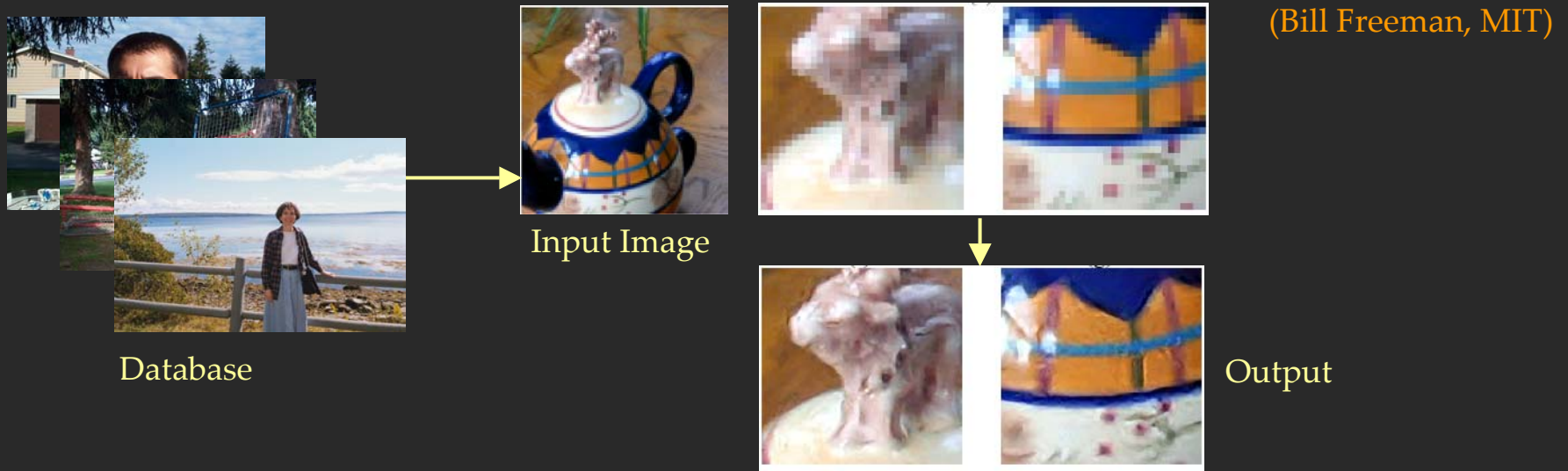


detector



(Shree Nayar, Columbia University)

Hallucinating Resolution



(Baker and Kanade, Carnegie Mellon)

Visual Servoing, Control, Driving

Tracking



(Papanikolopoulos, Univ. Minnesota)

Insertion



(Greg Hager, Johns Hopkins Univ.)

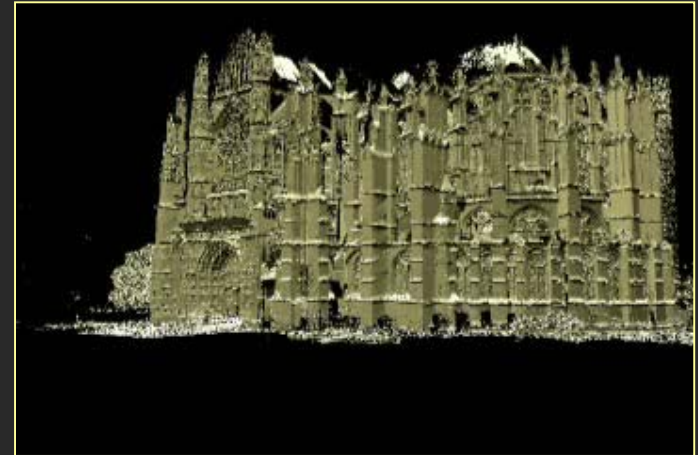
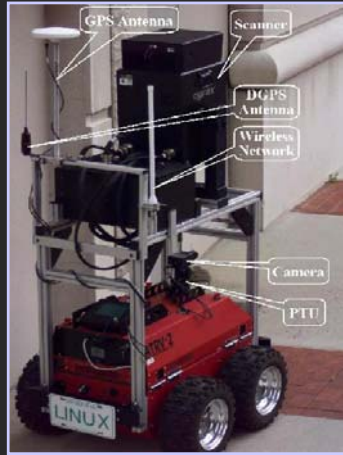
Navigation



(Chuck Thorpe, Carnegie Mellon)

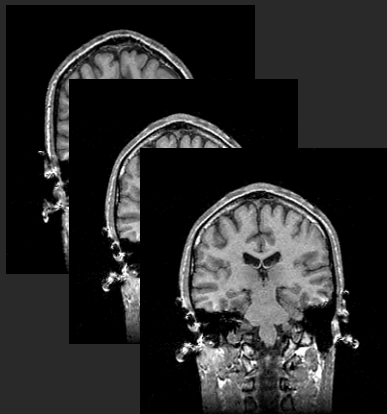
Registration and Model Building

(Peter Allen, Columbia University)

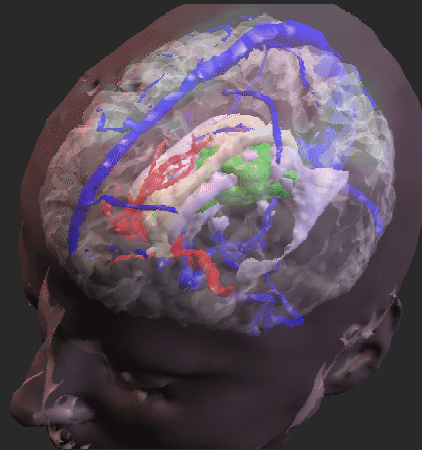


Cathedral of Saint Pierre

Input Scans



Reconstruction



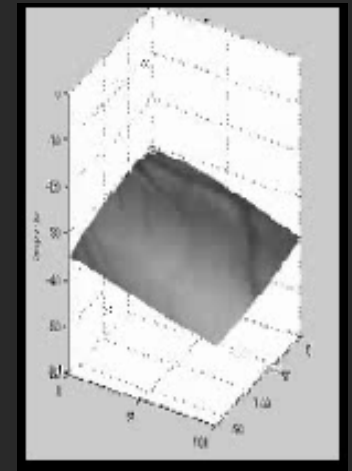
(Eric Grimson, MIT)

Heart Video



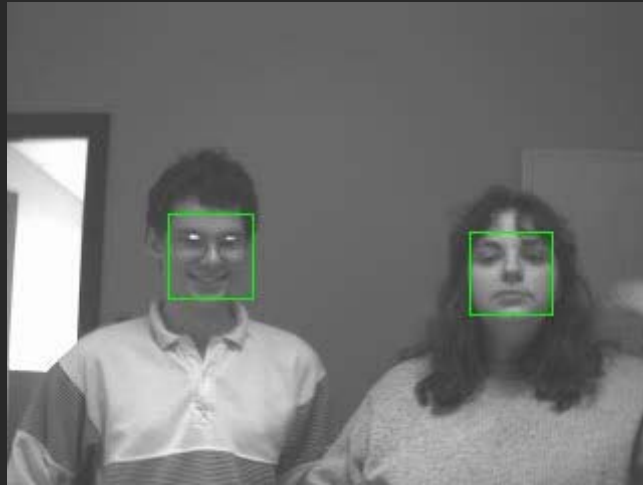
(Greg Hager, Johns Hopkins University)

Reconstruction



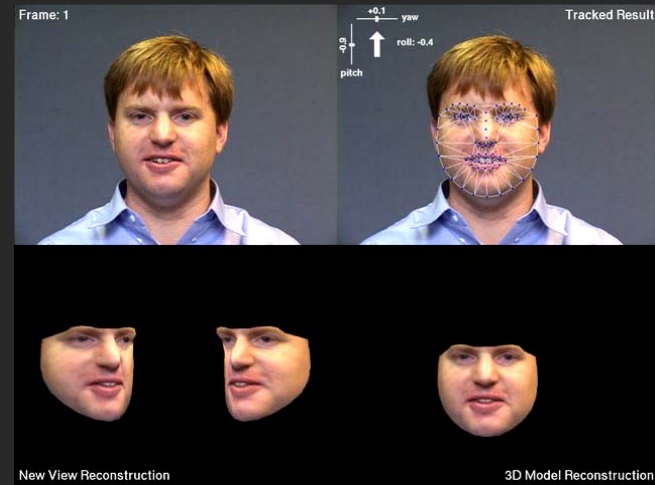
Modeling and Detecting Faces

Finding Faces



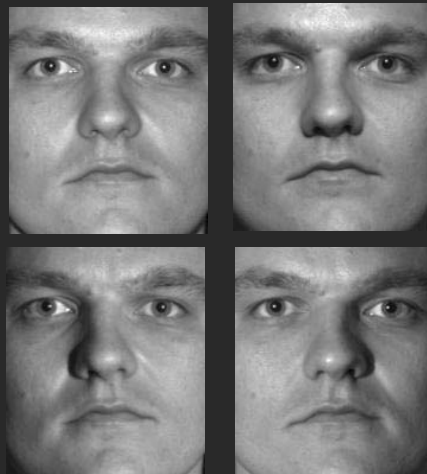
(Rowley, Baluja, Kanade, CMU)

Analyzing Expressions



(Simon Baker, CMU)

Handling Illumination



Input Images

Synthesized Images

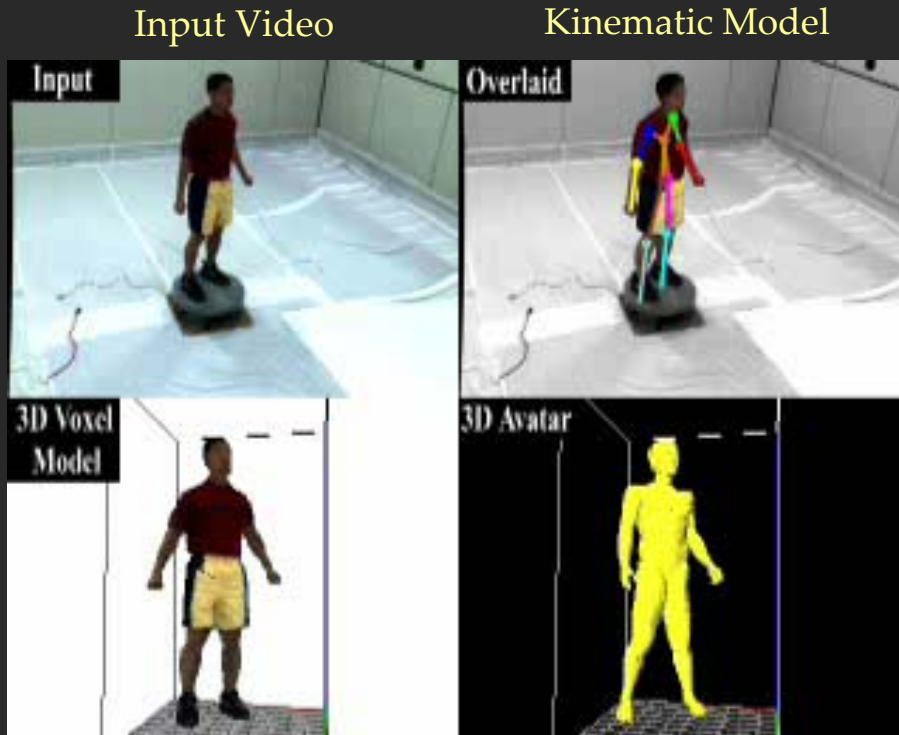


Ground Truth

(Peter Belhumeur, Columbia Univ.)

Understanding Articulated Motion

Kinematic Model from Silhouettes



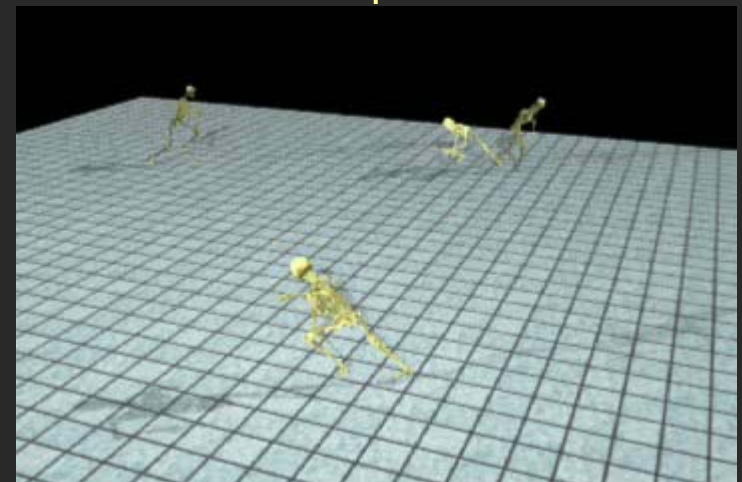
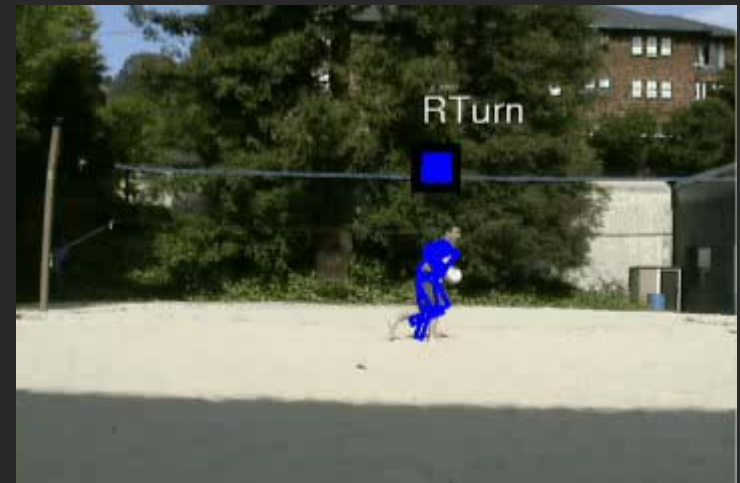
3D Voxel Model

Geometric Model

(Cheung et al. Carnegie Mellon)

Automatic Activity Recognition

Input Video with Activity Labels



Human Motion Generator

(David Forsyth, UC Berkeley)

Segmentation and Object Recognition

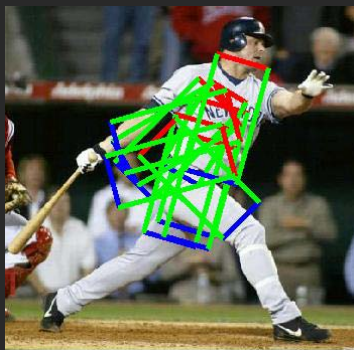
Input Image



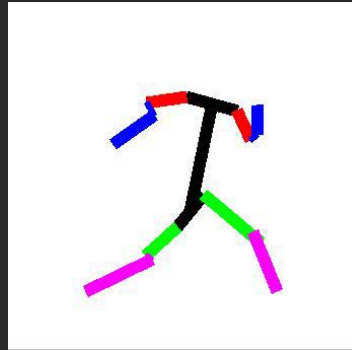
Segmentation



Hypothesized Configurations



Likely Configuration



Object Regions

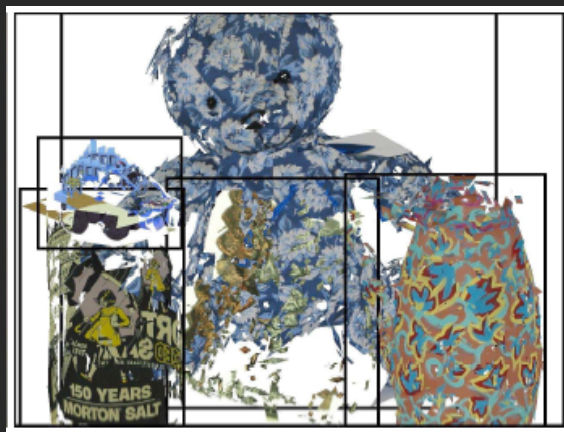


(Jitendra Malik, UC Berkeley)

Input Image



Objects and their Patches



More Examples



(Jean Ponce, Univ. of Illinois)

A Few Grand Challenges

Challenge: Advanced Visual Manipulation and Navigation

Complex Geometry



Deformable Objects



Dynamic Objects



Natural Environments



Challenge: Recognition in Complex Environments

Complex
Clutter



Categories



Materials



Challenge: Interpreting Highly Dynamic Environments

Recovering Geometry, Egomotion, Individual/Group Trajectories, and Activities



Challenge: Outdoors and the Weather

Steady Weather Effects:

Haze



Mist



Fog



Dynamic Weather Effects:

Rain



Snow



Summary

- Most of Vision is Relevant to Robotics
- Vision has made Enormous Progress
- Many Hard and Important Problems Remain

