

Project Discussion

CS 231a Spring 2015-2016

April 15th, 2016

Overview

- ▶ Project Logistics
- ▶ Class Coverage and Ideas
 - ▶ Geometry
 - ▶ Recognition
- ▶ Example Projects
- ▶ Helpful Resources

Project Logistics

- ▶ Teams of 1-4: Number of people is taken into account when grading project
- ▶ Suggestions for project direction
 - ▶ Replicate an interesting paper
 - ▶ Compare different methods to a benchmark
 - ▶ Use a new approach to an existing problem
 - ▶ Implement an interesting system
 - ▶ Original research

Sharing a Project with Another Class

- ▶ Sharing projects is generally allowed
- ▶ Must be approved by both our staff and the other course staff
- ▶ Project must be big enough that you can clarify which parts of the project were done for which class
 - ▶ Each part must be substantial enough to hold as a single project
- ▶ Will need a separate writeup for each class

Project Grading

- ▶ Course project is 38% of your final grade
 - ▶ Project Proposal: Required
 - ▶ Midterm Progress Report: 5%
 - ▶ Presentation: 8%
 - ▶ Final Report: 25%

Project Proposal

- ▶ Maximum of 4 pages
- ▶ Submit the report as a PDF document through Gradescope
- ▶ Include the following:
 - ▶ Title and authors
 - ▶ Sec. 1. Introduction: Problem you want to solve and why
 - ▶ Sec. 2. Technical Approach: How do you propose to solve it?
 - ▶ Sec. 3. Milestones (dates and sub-goals)
 - ▶ References
- ▶ You will be assigned a project mentor

Project Midterm Progress Report

- ▶ Maximum of 4 pages
- ▶ Submit the report as a PDF document through Gradescope
- ▶ Include the following:
 - ▶ Title and authors
 - ▶ Sec. 1. Introduction: Problem you want to solve and why
 - ▶ Sec. 2. Technical Approach: How do you propose to solve it?
 - ▶ Sec. 3. Milestones achieved so far
 - ▶ Sec. 4. Remaining Milestones (dates and sub-goals)
 - ▶ References

Project Presentations

- ▶ Short presentation with time for a brief Q&A
- ▶ Include the following:
 - ▶ Problem Motivation/Description
 - ▶ Technical Approach
 - ▶ Results

Project Final Report

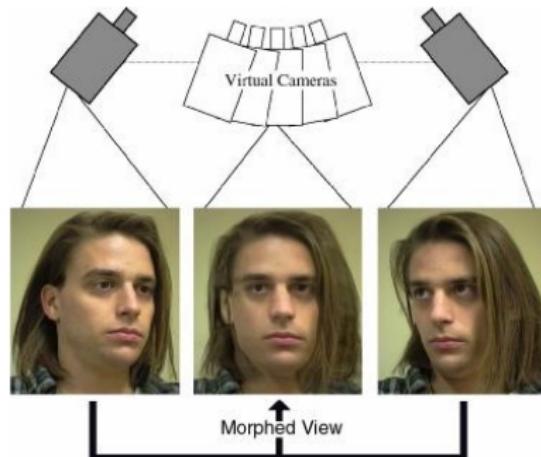
- ▶ Maximum of 10 pages
- ▶ Submit the report as a PDF document through Gradescope
- ▶ Email your code to `cs231a.staff+code@gmail.com`
- ▶ Include the following:
 - ▶ Title and authors
 - ▶ Abstract
 - ▶ Sec. 1: Introduction
 - ▶ Sec. 2: Previous work
 - ▶ Sec. 3: Technical Approach
 - ▶ Sec. 4: Experiments
 - ▶ Sec. 5: Conclusions
 - ▶ References

Class Coverage: Geometry

- ▶ Camera models and calibration
 - ▶ Single camera and how we model it
- ▶ Single view metrology
 - ▶ Estimating geometry from a single view
- ▶ Epipolar Geometry (Stereo Vision)
 - ▶ Estimating geometry from two viewpoints
- ▶ Structure from Motion
 - ▶ Using motion/several viewpoints to estimate structure
- ▶ Volumetric Stereo
 - ▶ Using multiple views to map 3D points

View Morphing

Seitz, S. M. and Dyer, C. R., "View Morphing", SIGGRAPH 1996.



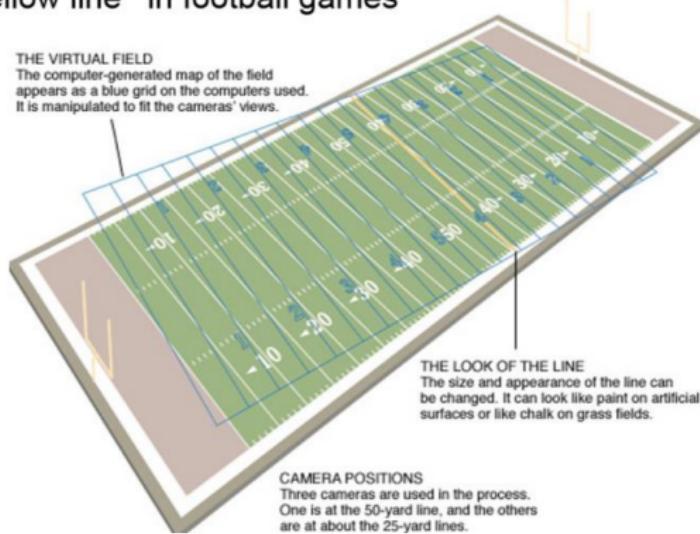
Automatic Photo Pop-Up

Hoiem, D., Efros, A. A., and Herbert, M, "Automatic Photo Pop-Up", SIGGRAPH 2005.



Scene Augmentation

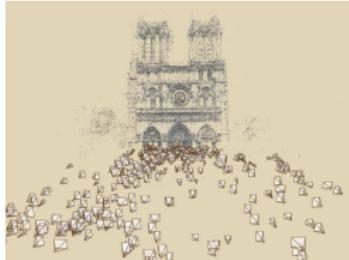
The ‘yellow line’ in football games



Requires identifying the ball, players, referees, etc. in the image/video in order to mimic occlusion

Photo Tourism

Snavely, N., Seitz, S. M., Szeliski, R. "Photo Tourism: Exploring Photo Collections in 3D", SIGGRAPH 2006.



Novel Hardware



Mobile Devices

Can you take an existing vision algorithm and adapt it to a mobile device to make it more useful?



Course Coverage: Recognition

- ▶ Fitting and matching
- ▶ Detectors and descriptors
- ▶ Object classification
- ▶ 2D/3D object detection
- ▶ 2D/3D scene understanding

Recognizing Panoramas

Brown, M. and Lowe, D. G., "Recognizing Panoramas", ICCV 2003.



Image Segmentation

Partition an image into multiple segments (sets of pixels) in order to make it easier to analyze

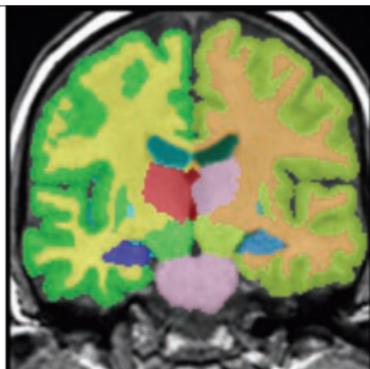
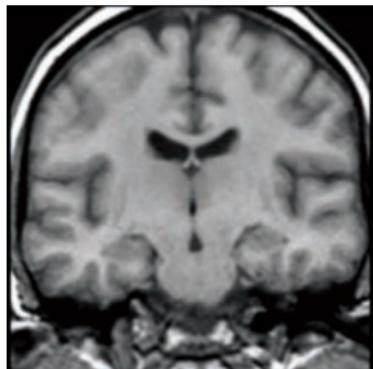
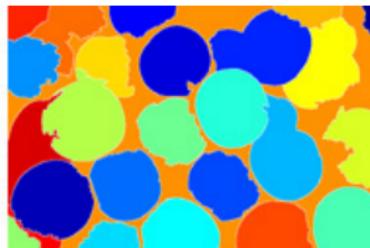
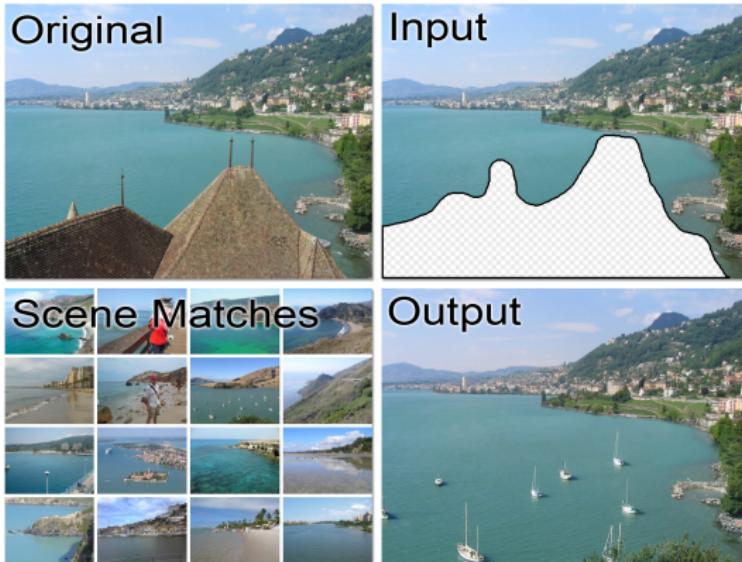


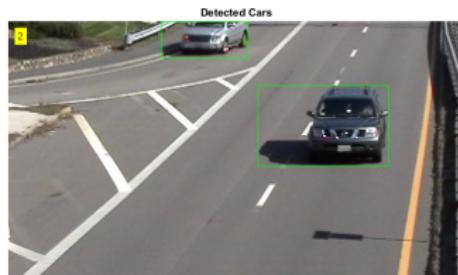
Image Completion

Hays, J and Efros, A. A., "Scene Completion Using Millions of Photographs", SIGGRAPH 2007.

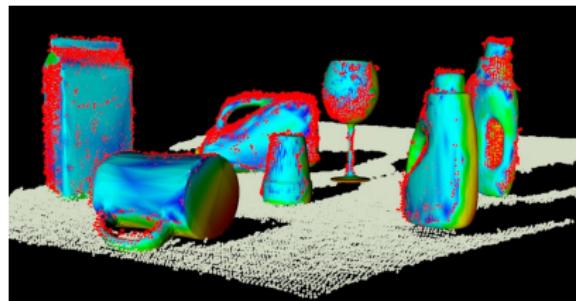


2D/3D Object Recognition

Can you recognize an object in a 2D image?



Or a 3D point cloud?



Face Detection

Detect the faces in an image: Used by Facebook for tagging images and digital cameras for autofocus.



Other Topics

- ▶ Pose Estimation: Estimate the skeleton angles for a person from an image/video
- ▶ Action and Gesture Recognition: Is a person standing, walking, or sitting in an image/video? Is he/she waving?
- ▶ Scene Understanding: Can you classify a scene? Can you recognize and/or segment each component of the scene?

Where to get Project Ideas

- ▶ Course Staff: Posted on website and/or Piazza
- ▶ Computer vision papers
- ▶ Computer vision research groups at Stanford
 - ▶ Silvio Savarese
 - ▶ Fei-Fei Li
- ▶ Last year's projects: See course website
- ▶ Come up with your own!

Datasets

- ▶ Many are available on the web
- ▶ See the following aggregators:
 - ▶ [CV Datasets on the Web](#)
 - ▶ [Yet Another Computer Vision Index To Datasets \(YACVID\)](#)
 - ▶ [Computer Vision Datasets](#)

Project Advice

- ▶ Choose your team well
- ▶ Make sure the scope of your project fits a quarter
 - ▶ Set a minimum goal, desired goal, and a moonshot
- ▶ Constrain your problem smartly
- ▶ See what datasets are available if you are doing a recognition project
- ▶ You may need to plan ahead/learn outside materials
- ▶ Use software when available: OpenCV, PCL, MATLAB
- ▶ Come ask questions – We're happy to talk!