
Student projects

General rules

Project website – due until July 14

Final presentation (10-15 min)

Oral exam (20 min, individual) – last lecture week

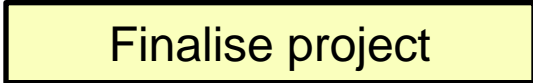
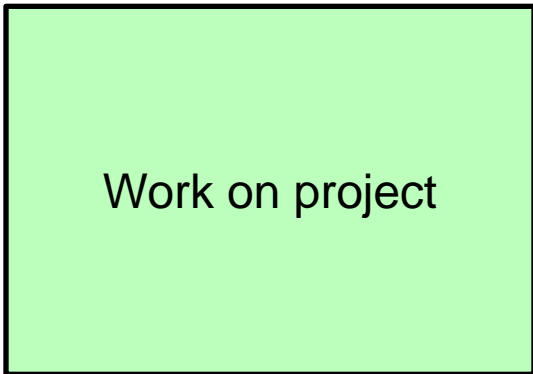
- **Read papers! Know the matter!**
- **Be inventive!**
- **Document what you do, and why.**
- **How far does your approach take you?
What are the limiting factors / failure cases?
How can you get around them?**

Equipment

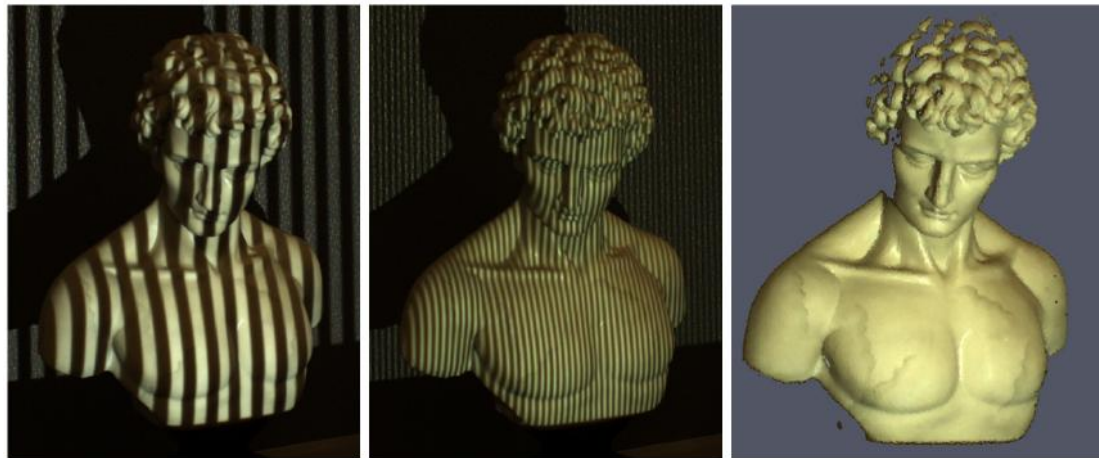
- Video cameras (HDV tape)
- Firewire cameras
- DSLR cameras
- Video projectors
- Daylight lamps
- 3D scanner(s)
- 3D printer
- Online repositories:
light fields from Stanford (Marc Levoy),
light probes from USC/ICT (Paul Debevec)
- Any of your own stuff
- Your computer

Timeline

- **May 3 (Monday)** Send us your top 3 projects and partner wishes
- **May 5** Assignment of groups We will then assign topics to groups, give additional references/hints, and allocate equipment
- **May 12** Research proposal
- May 19
- May 26
- June 2
- June 9
- June 16
- June 23
- **June 30** Intermediate report (e-mail/website) • Preliminary results
• What remains to do?
- July 7
- **July 14** Final report on website
- **July 21** Project presentation in class.



Project 1: 3D scanner



[Lanman/Taubin2009]

Task: Build a 3D scanner from a video projector and a camera

- **Set up basic calibration / reconstruction pipeline**
- **Tweak performance**
- **Experiment with different projection patterns**

1. <http://mesh.brown.edu/byo3d/>

2. <http://gl.ict.usc.edu/Research/3DScanning/>

Project 2: Focal stack photography



[Agarwala 2004]

Task: Reconstruct all-focus image from focal stack

- **Acquire data, or synthesize from light field**
- **Compute focus measure**
- **Reconstruct depth map (and merge images)**

1. <http://people.csail.mit.edu/hasinoff/>

2. <http://grail.cs.washington.edu/projects/photomontage/>

Project 3: Relighting / Reflectance Fields



[Martin Fuchs 2007]

Task: Record real-world reflectance field and relight it

- **Acquire data with hand-held light source**
- **Use light probe in scene to calibrate light pos.**
- **Post-process and render**

<http://www.debevec.org/Research/LS/>

Project 4: HDR camera



Task: Combine multiple LDR cameras into HDR cam

- **Set up cameras with beam splitter, and align**
- **Merge LDR imagery into HDR**
- **Real-time implementation (e.g. using OpenCV)**

1. <http://www.debevec.org/Research/HDR/>

2. <http://www.mpi-inf.mpg.de/resources/hdrvideo/>

Project 5: Photometric geometry of a face



Task: Acquire photometric normals of a human face

- **Illuminate from different directions**
- **Estimate local surface orientation**
- **Emboss fine detail on coarse 3D scan**
- **Render**

<http://gl.ict.usc.edu/Research/FaceScanning/>

Project 6: Flash/no-flash photography



Task: Combine images taken with and without flash

- **Implement “Intrinsic Relighting” [Eisemann04]**

<http://people.csail.mit.edu/fredo/PUBLI/flash/index.htm>

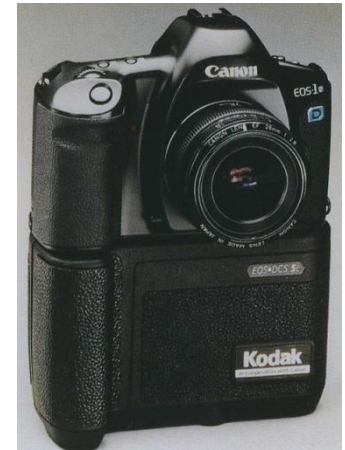
Project 7: Infrared photography



Wikipedia

Task: Hack a vintage DSLR for infrared capture

- **Dust camera off and get it to run again**
- **Remove IR filter**
- **Shoot awesome pictures**
- **In-depth documentation!!!**



http://en.wikipedia.org/wiki/Infrared_photography

Project 8: Panorama stitching

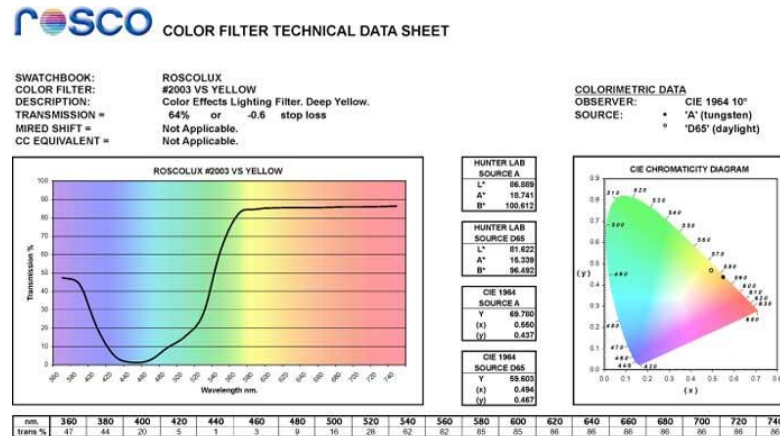


Task: Assemble a panorama from multiple images

- **Detect features**
- **Find homography and warp images**
- **Gradient domain blending**

1. http://en.wikipedia.org/wiki/Scale-invariant_feature_transform
2. Pérez et al., Poisson image editing (SIGGRAPH 2003)
3. <http://www.robots.ox.ac.uk/~vgg/hzbook/>

Project 9: Multispectral camera



Task: Build a multispectral camera using color filters

- Use filter sheets with known transmittance curves
- Transform spectral basis and compute spectrum per pixel

G. Wyszecki and W. S. Styles, Color Science: Concepts and Methods, Quantitative Data and Formulae (2nd ed.), John Wiley & Sons, Inc., New York, 1982.

Project 10: Your idea

Task: Whatever you come up with

- **Discuss ideas with us!**