Today

• Quick course overview
• What is computer vision?
• Relationships to other fields.
• Goals of computer vision.
Course Overview

• Computer vision as a decision making process under uncertainty.
  – Heavy emphasis on decision making using probability and statistics.
  – General strategies apply to any area of artificial intelligence.
• 7 or 8 problem sets
  – Some reading and prose
  – Some programming
  – Some math
• 2 tests.
• Not everything will be available on line.
  – You need to come to class!
Web Page

- Google me "Learned-Miller"
- Go to Teaching Link
- Top link is CS370.
CS370: Introduction to Computer Vision

- Spring 2011; Monday and Wednesday, 10:35-11:30 • LGRC 310A (See map)

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Prerequisites

Reading Materials
I do NOT recommend buying the textbook unless you want it for your own purposes. We will use it some in this course, but not a lot. You should be able to get by with the the on-line version.

Resources
MATLAB Tutorial

Interesting Links
Movie shown in class on optical illusions
Checker shadow illusion
Early color photographs by S. M. Prokudin-Gorsky
Flower Garden movie
Non-Lambertian reflectance functions
Explanation of hexagonal sampling efficiency
Homework 3 Sample Solution

Problem Sets

Schedule

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<tr>
<th>Date</th>
<th>Lecture topic</th>
<th>New assignments</th>
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<tr>
<td>Jan. 19</td>
<td>Introduction. What is Computer Vision?</td>
<td>Assignment 1: Read Lightness Perception and Lightness Illusions</td>
<td>As. 1 due Jan. 26</td>
<td>Handout: Introduction to Computer Vision</td>
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<td></td>
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<td>Come up with five questions relevant to the paper. These can be things you didn’t understand after a careful reading of the paper, or questions which the paper raises. Turn in the answer written up as a .pdf file. You will be graded on the depth of your questions and how much thought you were judged to have put into them.</td>
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<td>Jan. 24</td>
<td>Introduction to using MATLAB for Computer Vision. Matlab Session Transcript from Lecture</td>
<td>Assignment 2; Colorizing the Prokudin-Gorsky photo collection</td>
<td>As. 2 due Feb. 2</td>
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<td>Jan. 26</td>
<td>Formalizing the decision making process. Minimizing error. Maximizing utility. Review of basic probability theory. You will be responsible for all of the basic probability theory in this handout</td>
<td>Assignment 3; Probability handout (see lecture description)</td>
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Other stuff

• Textbook
  – free, on-line. see web page

• Programming Language: Matlab
  – Very good for images.
  – Will cover in class.
  – Not too difficult to learn if you know Java or C++.
First assignments

- Read paper "Lightness Perception and Lightness Illusions".
  - Follow instructions on web page to do write up.
  - Due in 1 week.
  - Email Manju your write-up.
- Also read: Intro to Comp. Vision, available on web page.
  - Due in next class. Possible quiz.
Dramatic Pause...
The Checker Shadow Illusion
The "Proof"
Takeaways

• The human vision system is not designed to measure absolute values of light.

• It is designed to try to understand "what's there" in the world.
Terminology Interlude

• Reflectance
  – percentage of light reflected by a surface
  – also called albedo

• Radiance
  – how much total light is coming off of a surface
    • What are the factors affecting radiance?

• Illumininance
  – how much light is shining on a surface
Ambiguity: The Necker Cube
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Takeaway

• Images are fundamentally ambiguous:
  – Computer vision is *ill-posed*.

• We cannot be sure about what is there

• We use as many cues as we can to make our best guess as to what is there.

• *Amazingly, the human visual system usually guesses correctly.*
  – Or does it?
  – When do we make a guess?
Related Fields

- Optics, Photography, Photogrammetry
  - Optics: study of light
  - Photogrammetry: practice of determining geometry from images

- Computer Graphics and Art
  - Computer graphics: forward
  - Computer vision: backwards
More Related Fields

• Neuroscience and Physiology
• Psychology and Psychophysics
• Probability, Statistics, and Machine Learning
Goals

• Engineering
• Basic Science
Reminder

• Check web page for current reading assignment and homework assignment.
  – Get started now!