Introduction to Computer Vision

CS370

Lecture 1

Erik Learned-Miller

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

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CS370: Introduction to Computer ... +

CS370: Introduction to Computer Vision

• Spring 2011; Monday and Wednesday, 10:35-11:50 • LGRC 310A ([See map](#))

Instructor	[Erik Learned-Miller](#) elm at cs.umass.edu (413) 545-2993
Teaching Assistant	[Manjunath Narayana](#) narayana at cs.umass.edu (413) 545-0528
Prerequisites	
Reading Materials	Textbook: Algorithms and Applications, by Richard Szeliski: [On-line copy available here](#) 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 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](#)
Problem Sets	[Homework 3 Sample Solution](#)
Description	
Schedule	

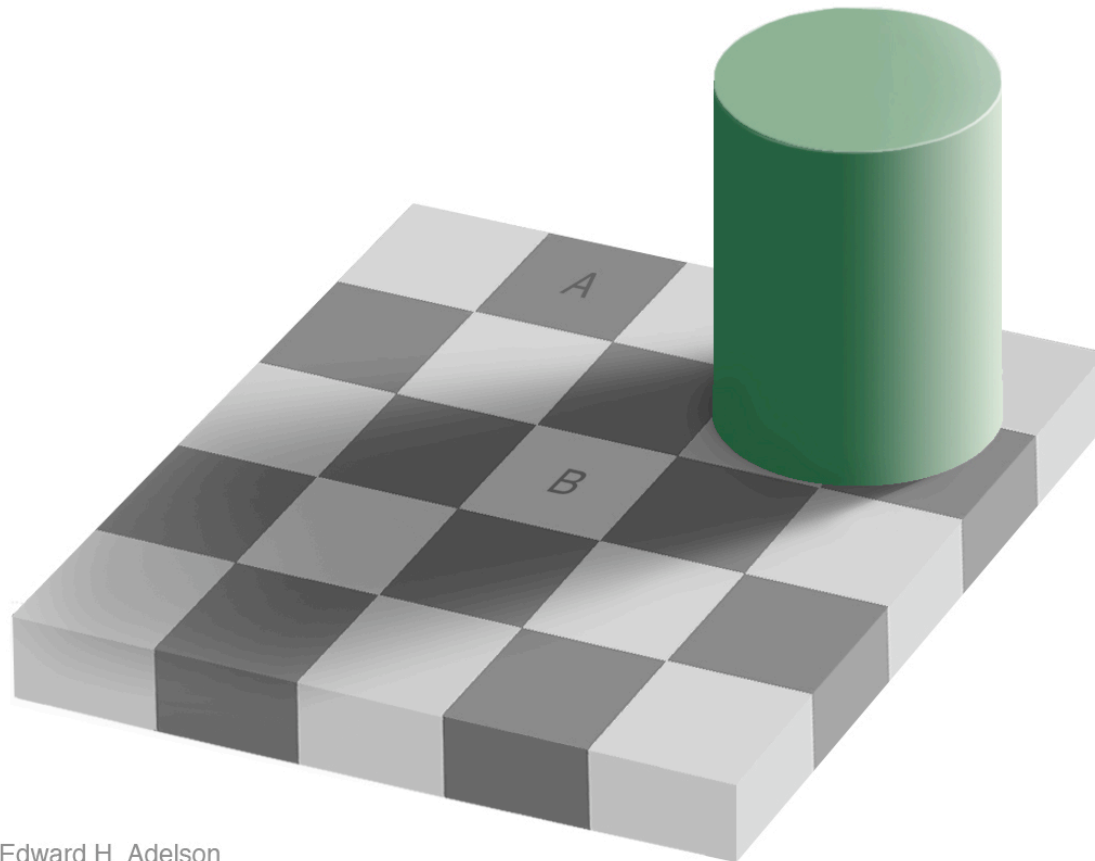| Date	Lecture topic	New assignments	Assignments due	Reading
Jan. 19	Introduction. What is Computer Vision?	Assignment 1: Read [Lightness Perception and Lightness Illusions](#) Come up with five questions relevant to the paper. These can be things you didn't understand after a careful reading of the 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.	As. 1 due Jan. 26	Handout: [Introduction to Computer Vision](#)
Jan. 24	Introduction to using [MATLAB](#) for Computer Vision. [Matlab Session Transcript from Lecture](#)	[Assignment 2:](#) Colorizing the Prokudin-Gorsky photo collection	As. 2 due Feb. 2	
Jan. 26	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](#).			Probability handout (see lecture description).

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.
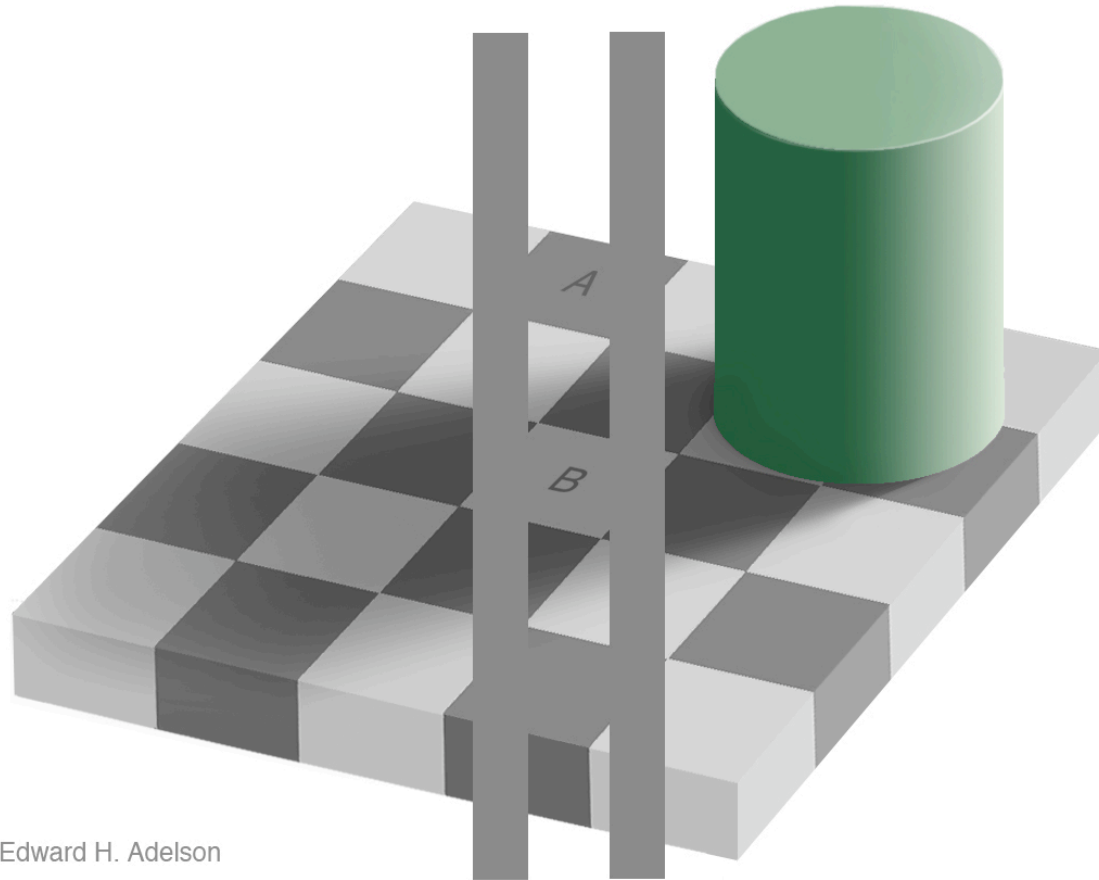 - Due in next class. Possible quiz.

Dramatic Pause...

The Checker Shadow Illusion

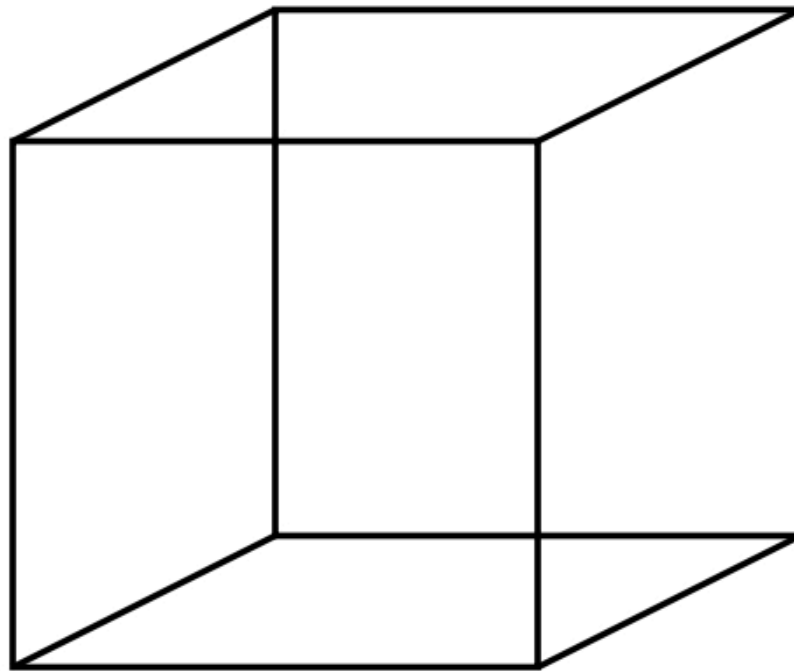

Edward H. Adelson

The "Proof"

Edward H. Adelson

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.
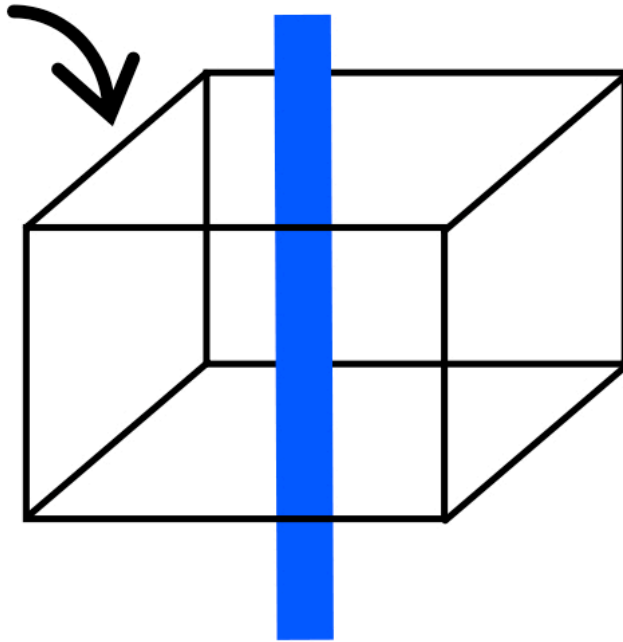
Terminology Interlude

- *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?

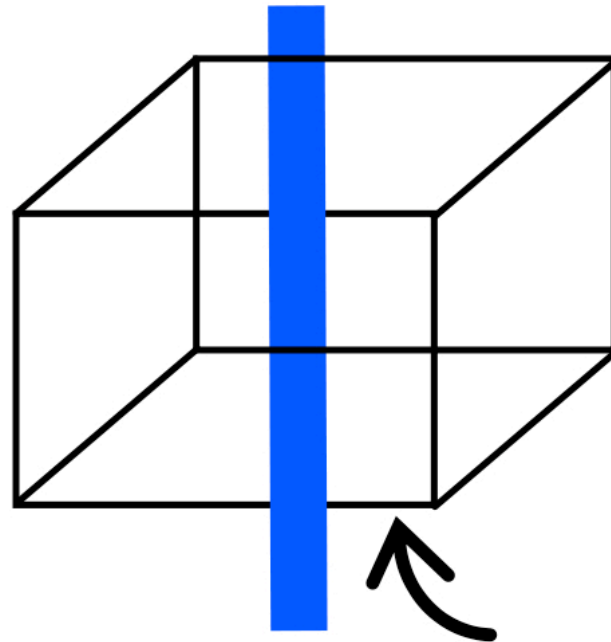- *Illuminance*
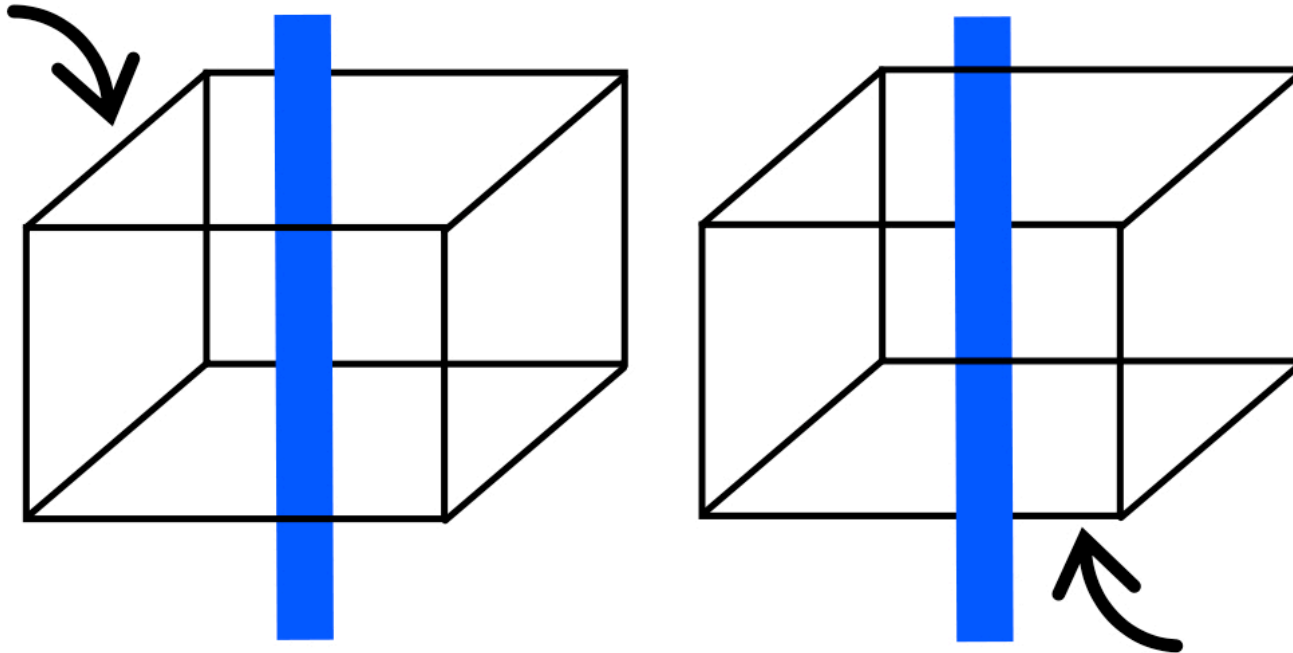 - how much light is shining on a surface

Ambiguity: The Necker Cube

Ambiguity: The Necker Cube

Ambiguity: The Necker Cube

Ambiguity: The Necker Cube

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!