ISTA 352

Lecture 17

Middle of term retrospective

(Grades, similar triangles, review of some quiz questions, review of some A2 questions, A3A comments)

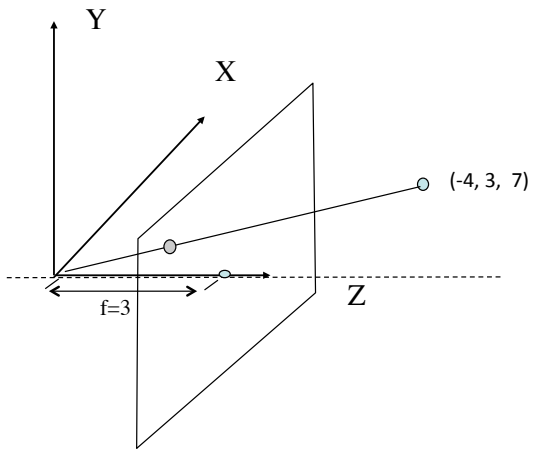
Administrivia

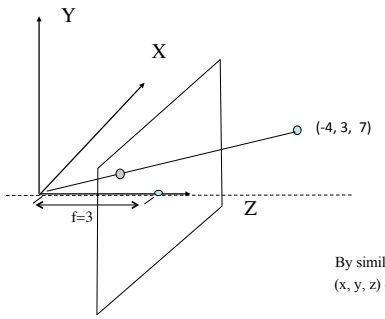
- Homework 3A due date extended (still soon!)
  - Now due late Tuesday, October 09

Quiz one

- Mean was 12.8
  - Not too bad, but a bit adjustment is in order
  - Overall, people struggled most with problem #3, and the true/false multiple-choice questions (particularly #6 and #7)
- Important hints for future quizzes
  - There will often be one question for each guest lecture
  - There will often be questions from key issues from previous quizzes or homework
    - Hence what follows might be featured!

Q1, #3





By similar triangles (see Lecture 12, around slide 10)
(x, y, z) -> (f • x/z, f • y/z, f)

$$x' = f \bullet \left(\frac{x}{z}\right) = x \bullet \left(\frac{f}{z}\right) = \underbrace{(-4) * \left(\frac{3}{7}\right)}_{\text{no need to simply more}} = -\frac{12}{7}$$

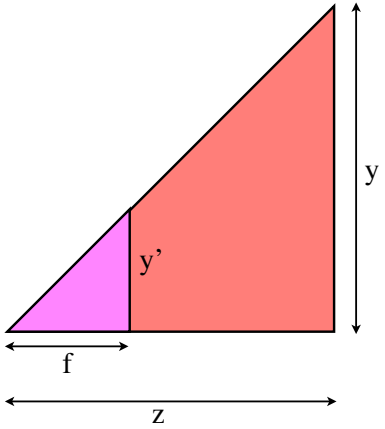
$$y' = f \bullet \left(\frac{y}{z}\right) = y \bullet \left(\frac{f}{z}\right) = \underbrace{(3) * \left(\frac{3}{7}\right)}_{\text{no need to simply more}} = \frac{9}{7}$$

$$z' = f = 3$$

Note that if we were to apply the same scale factor to z, we get the same answer.

$$z' = f \bullet \left(\frac{z}{z}\right) = z \bullet \left(\frac{f}{z}\right) = f \quad \text{(things cancel)}$$

Reminder where the formula comes from (2D version)



The pink triangle is the orange one scaled by the ratio (f/z)

So the y-ordinate of the intersection is y'=y*(f/z)

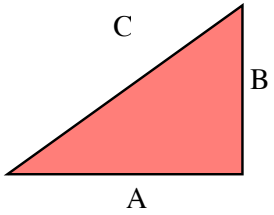
Reminder where the formula comes from (2D version)

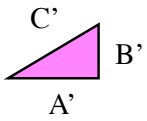
Alternatively, the two triangles are *similar* (angles are the same)

General principle worth remembering

For corresponding edges (opposite the same angle) we have

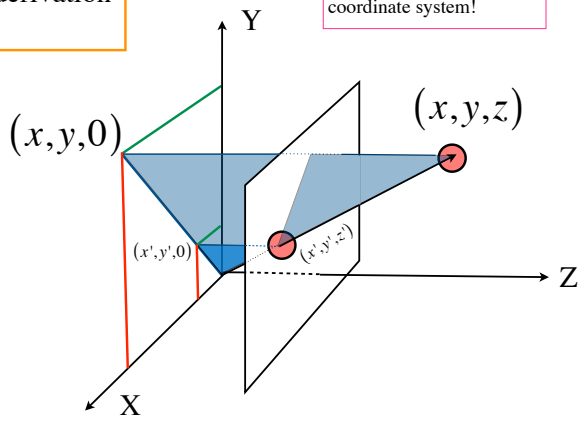
$$\frac{A'}{A} = \frac{B'}{B} = \frac{C'}{C}$$





3D version of the derivation (not done earlier)

Please excuse the left hand coordinate system!



Geometric solution. The two blue triangles are similar and show that the ratio of the segments of the thick blue line in the XY plane is z'/z (or f/z).

The two green segments also have that ratio, so x'/x=f/z. Similarly the red segments can be used to argue y'/y=f/z.

Algebraic derivation
(not done earlier)

Algebraic solution

$$(x',y',z') = k*(x,y,z)$$

But we know that $z' = k \bullet z = f$, so $k = \left(\frac{f}{z}\right)$

So, $(x',y',z') = \left(\frac{f}{z}\right)*(x,y,z)$

Q1, #4

4. Consider a standard three sensor RGB (color) camera looking at a white surface. Because it is "white" the energy spectra the comes from it is much like that from the light shining on it. Under one light, the white surface has a value of (R1,G1,B1). Suppose that someone changes the light so that the spectra changes dramatically. For example they might change it from a tungsten light to a fluorescent light. The surface now is recorded as (R2,G2,B2) by the camera. Choose one of the following (**1 mark**):

a) (R1,G1,B1) is equal to (R2,G2,B2)

b) (R1,G1,B1) is **not** equal to (R2,G2,B2)

[c)] Equality of (R1,G1,B1) and (R2,G2,B2) cannot be determined.

Q1, #5

5. Consider a black and white image made of pixel values of 256 shades of gray from 0 (black) to 255 (white). Now suppose that someone mixes up the locations of all the pixels, perhaps by picking pairs at random and then swapping them. Which of the follow are necessarily preserved (i.e., do **not** change)? Circle either T or F for each (1/2 mark each, **2 marks total**):

i) [(T)/ F) The mean brightness of the image will not change.

ii) [(T)/ F) Its histogram of gray values will not change.

iii) (T / [F)] The amount it can be compressed without loosing information will not change.

iv) (T / [F)] The amount it can be compressed using specific jpeg settings will not change.

Q1, #6

6. Which of the follow can provide depth information? Circle either T or F for each. Further, for each one you circle as T, provide a single word or a short phrase that tells us which image or example was used to illustrate this (1/2 mark each, **2 marks total**):

i) [(T)/ F) Active stereo. 

ii) [(T)/ F) Shading. 

iii) [(T)/ F) Multiple views. 

iv) [(T)/ F) Texture consistency. 

Q1, #7

7. Which of the following are both properties of the human vision system, **and** help explain why yellow text on a white background is a bad idea? (1/2 mark each, **2 marks total**).

a) (T / F) There are not very many short wavelength cones compared to the others (**and** this helps explains the issue with yellow text).

b) (T / F) There are not very many cones as compared to rods (**and** this helps explains the issue with yellow text)

c) (T / F) The pupil adjusts its size depending on how bright things are (**and** this helps explains the issue with yellow text).

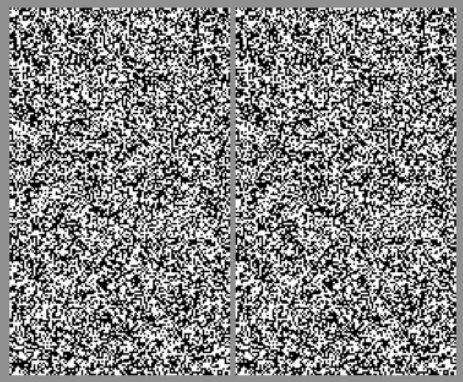
d) (T / F) There are fewer neurons connected each short wavelength cones compared with the others (**and** this helps explains the issue with yellow text).

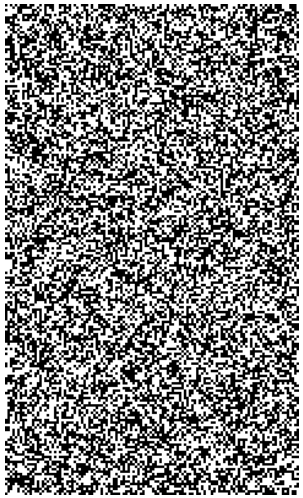
Homework II

- Many questions unanswered or not answered completely
  - Programming continues to be a challenge for many
  - Possibly points to inadequate pre-requisites (?)
  - Programming assignments are often time consuming!
- Read Kyle's tips carefully
  - Start sooner, follow instructions, and check answers
    - Always ask yourself how you know a solution is correct
- Homework III-A is shorter but due sooner
  - Start soon!

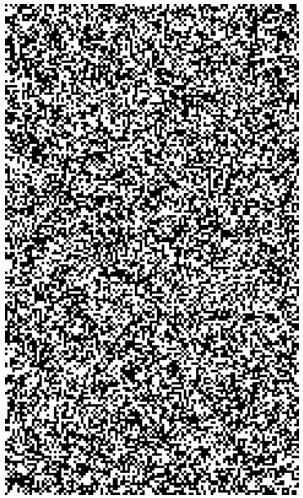
Homework III-A

- First part continues our camera model story to include projection as part of the camera matrix
  - Not too much programming
- Second part requires you to write some code that determines point correspondences so you can do stereo

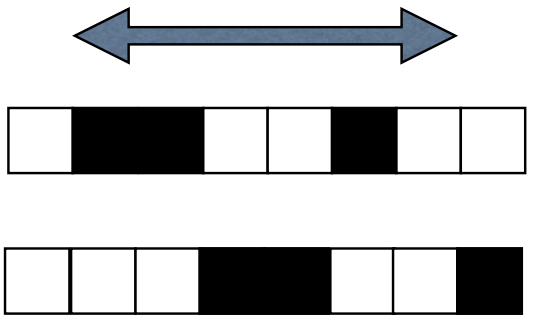




Left image



Right image



Test similarity at each candidate disparity and keep the best one.

Suggested similarity is the dot product of the normalized vectors