Lecture 24

Overview of final exam
Review of Assignment 2

April 12, 2018
Evaluation

• Three Assignments (10% each)
• Midterm Exam (20%)
• Final Exam (50%)

You can replace your midterm exam grade with your final exam grade, i.e. final exam would be 70%.
Final Exam

50 points  (28 questions, all short answer)

• 25 points on lectures 1-15 (same material as midterm)

• 25 points on eight lectures 16-23

This gives roughly equal balance to all lectures.
What **do** you need to know?
- everything in gray above: give definitions, do simple calculations & basic reasoning

For all subsequent slides, I will only list what you don’t need to know.
VISUAL IMAGE FORMATION

1. geometry (slides) (notes)
   - origins of spatial vision, visual angle, aperture, image projection, binocular disparity
2. focus and blur (slides) (notes)
   - sampling, thin lens equation, depth of field, accommodation, aging and abnormal vision
3. photoreceptors, color (slides) (notes)
   - spectra: emission, reflectance, absorptance; rods and cones, metamers, color displays, color blindness

What do you **not** need to know?

- f-number
- color displays
- temporal effects in photoreceptors
What do you *not* need to know?

- names of different types of cells in pathway
- XT separable receptive fields
What do you not need to know?

- motion field equation formula – don’t memorize (but you should know qualitatively what the component fields)
- MST model of motion estimation
- vanishing points
- formulas for slant and tilt (but you should know their meaning)
- formulas for shading models (but you should understand them)
- details of “von Kries” adaptation and “grey world” model
What do you *not* need to know?

- formulas for linear cue combination (how to define cue weights?)
What do you *not* need to know?

- proofs that

\[
\cos\left(\frac{2\pi k}{N} x\right) \cdot \delta(x) = a \cos\left(\frac{2\pi k}{N} x\right) + b \sin\left(\frac{2\pi k}{N} x\right)
\]

\[
a \cos\left(\frac{2\pi k}{N} x\right) + b \sin\left(\frac{2\pi k}{N} x\right) = \sqrt{a^2 + b^2} \cos\left(\frac{2\pi k}{N} x - \phi\right)
\]

- formula for Fourier transform of Gaussian
AUDITORY IMAGE FORMATION

18. sound 1 (slides) (notes)
   pressure vs. intensity, dB
19. sound 2 (slides) (notes)
   music and speech sounds, spectrograms

What do you **not** need to know?

- null, you need to know it all
AUDITORY SYSTEM & SPATIAL HEARING

20. head and ear (slides) (notes)
   - head and outer ear (HRIR, HRTF)
21. auditory pathway, sound localization (slides) (notes)
   - cochlea and neural coding, duplex theory, Jeffress model, level and timing differences
22. auditory filters (slides) (notes)
   - spectrograms revisited, critical bands and masking, spike triggered averaging and A1
23. echolocation and recognition by bats and porpoises (slides) (notes)
   - constant frequency, frequency modulation, interference

What do you **not** need to know?

- details about human auditory bandwidths
- formula for Doppler shift
- details of constructive and destructive interference
I will try to clean up this PDF coding stuff next week.
In the meantime, use the lecture notes to resolve ambiguities.
What else?

• Assignments:
  If you didn’t understand some questions, then review solutions.  *See me if you need help.*

• Exercises:
  - There will be several questions on the final exam taken from Exercises
  - good way of testing your understanding
Assignment 2  Question 1

Responses of complex Gabor cells tuned to different disparities
This cell has peak sensitivity to a disparity of say 4 pixels. If the actual disparity is 0, then what happens? If the actual disparity is 4, then what happens? If the actual disparity is $d$, then what happens?
Suppose actual disparity is 0 in some image region. How do responses of cells depend on the disparity $d$ to which they are tuned?
Suppose actual disparity is 0 in some image region. How do responses of cells depend on the disparity $d$ to which they are tuned?
Suppose actual disparity is 0 in some image region. How do responses of cells depend on the disparity \( d \) to which they are tuned?

[Posted solution:]

Curves shifted so mean is 0.
Suppose actual disparity is 0 in some image region. How do responses of cells depend on the disparity $d$ to which they are tuned?
Suppose actual disparity is 0 in some image region. How do responses of cells depend on the disparity \( d \) to which they are tuned?
Suppose actual disparity is 0 in some image region. How do responses of cells depend on the disparity $d$ to which they are tuned?

Curves shifted so mean is 0.
Recall the plots show responses of cells tuned to “normal velocity” (velocity in their “normal” direction).
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Normal speed $= 4$

Family tuned to $(4,0)$

Normal speed $= \sqrt{8}$

Family tuned to $(2,-2)$

Normal speed $= \sqrt{8}$

Family tuned to $(2,2)$

Normal speed $= 0$

Family tuned to $(0,0)$
Question 5

Recall the plots show responses of cells tuned to motion in their “normal” direction to patterns moving with velocity $(v_x, v_y)$.

Same as Q1

Family tuned to (4,0)

Family tuned to (2,-2)

Same as Q2

Family tuned to (2,2)

Family tuned to (0,0)
Question 6

Sum of responses for chosen family of cells is biggest for velocity (4,0). That’s how I chose the cells!

To build a detector for another velocity, you would need to use a different family of cells.

<table>
<thead>
<tr>
<th>True Velocity (vx,vy)</th>
<th>Family 1 (4,0)</th>
<th>Family 2 (2, -2)</th>
<th>Family 3 (2, 2)</th>
<th>Family 4 (0, 0)</th>
<th>Sum Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4, 0)</td>
<td>0.1785</td>
<td>0.1555</td>
<td>0.1590</td>
<td>0.1464</td>
<td>0.6394</td>
</tr>
<tr>
<td>(-4, 0)</td>
<td>0.1277</td>
<td>0.1204</td>
<td>0.1251</td>
<td>0.1464</td>
<td>0.5196</td>
</tr>
<tr>
<td>(0, 4)</td>
<td>0.1171</td>
<td>0.1211</td>
<td>0.1590</td>
<td>0.0990</td>
<td>0.4962</td>
</tr>
<tr>
<td>(0, -4)</td>
<td>0.1172</td>
<td>0.1555</td>
<td>0.1230</td>
<td>0.0990</td>
<td>0.4947</td>
</tr>
<tr>
<td>(0, 0)</td>
<td>0.1000</td>
<td>0.0982</td>
<td>0.0996</td>
<td>0.1769</td>
<td>0.4747</td>
</tr>
</tbody>
</table>
Office Hours

• Friday 10-11, 2-4

• Tuesday April 17, 10-2 + one other day that week

• Tuesday April 24, 10-2:30 + one other day that week
Please do the Course Evaluations.

Your chance to give feedback and let me and the department know what you thought.
Interested in Research or a Project?

Ugrads: COMP 396 or 400

MSc: Project or Thesis

Don’t be shy. Let me know.