Handout #2
Jan 09, 2007

ECE 178 HW #1
Due: Wednesday, Jan 17, 2006.

1. Compare and contrast the human eye with a modern digital camera. In your analysis, consider issues such as brightness adaptation (i.e., the sensitivity of the sensor to a wide range of background illumination), motion detection and tracking, color perception, and field of view. Chapter 1 and Chapter 2 of your reference book, available in the library, provide some details. You may also use the web and the internet to explore more.
2. We can approximate the fovea of the eye as a rectangular patch of size 1.5 mm x 1.5 mm. Assume that the density of the photoreceptors in the fovea is about 150,000 receptors per square mm. Estimate the diameter of the smallest printed dot that the eye can resolve if the page on which it is printed is about 1 meter away from the eye. For simplicity, assume that the dot is not detected if its image on the fovea becomes smaller than that of the diameter of the photoreceptor.
3. Compare the detectable resolution in the above problem with that of a CCD sensor of size 5 mm x 5mm with about 2 million pixels uniformly distributed on the CCD array.
4. This is a MATLAB programming question. You need to familiarize yourself with the MATLAB environment first. It is strongly encouraged that you go through one of the many online MATLAB tutorials (see, for example, the book's web site). Write an M-function with the following specifications:

```
function H = imcircle(R, M, N)
%IMCIRCLE Generates a circle inside a rectangle.
%   H = IMCIRCLE(R, M, N) generates a circle of radius R centered
%   on a rectangle of height M and width N. H is a binary image with
%   1s on the circle and 0s elsewhere. R must be an integer >= 1.
```

   Your program must check the validity of `R` and also it should check to make sure that the specified circle fits in the given rectangle dimensions. Use of `for` or `while` loops is not permitted. *Hint:* Review function `meshgrid` and become familiar with function `floor.`