Digital Image Fundamentals

Examples
Example 1

• A person observes a fishing boat out at sea that is approximately 1 mile away. The person claims that they can see a seagull following the boat. Is that possible?
  – Assume for simplicity that the size of the image of the seagull must cover at least two receptors (cones).
Example 1 (continued)

• The bird is at a distance of 1 mile, or $d = 1609$ m.
• Assume that gulls can range in size from 29 cm to 76 cm (I assume this refers to the wingspan).
Example 2

• Using Matlab, read in the “coins.png” image using
  \[ I = \text{imread}(\text{‘coins.png’)}; \]

• Display the image using \text{imshow}(I, []) or \text{imtool}(I, []).

• What is the size of the image (#rows, #columns)? What is the storage class? (You can see the list of all workspace variables using \text{whos}.)

\[ ^1 \text{The empty brackets tell Matlab to stretch the values so that they occupy the entire grayscale range; ie, the lowest value is displayed as black and the highest value is displayed as white.} \]
Example 2 (continued)

• Does the pixel at (row=100, column=50) belong to a coin or the background? What is the pixel value? You can inspect the pixel values interactively using the mouse, using impixelinfo. Alternatively, you can display the image using imtool and use the “pixel region tool”.

• View the histogram of the image using imhist(I). This will show the count, or frequency, of each gray level. What is the range of gray levels for this image, and which gray level (approximately) has the largest count?
Example 2 (continued)

- Threshold the image, to separate the coins from the background. In other words, create a second image such that pixels above a certain value are mapped to white (or 1), and pixels below that value are mapped to black (or 0). You can use the “greater-than” expression, as in \( B = (I > t) \).

Here, \( t \) is a value between 0 and 255. Find the value for \( t \) that best appears to segment the coins from the background.
Example 3

- Read in the “cameraman.tif” image and the “coins.png” image. Extract a rectangular region containing the head of the cameraman, and insert it onto the face of one of the coins. You should be able to do the insertion in one command using Matlab’s colon (:) operators.
Example 4

• Write code that overlays a white circle on top of the cameraman’s head. Use “for” loops to do this.
  
  – Note – for anything that takes more than one or two lines of code, it is best to create it using the Matlab editor and save it in a script file (such as “myprog1.m”), and run the script by typing the name of the file (such as “myprog1”).