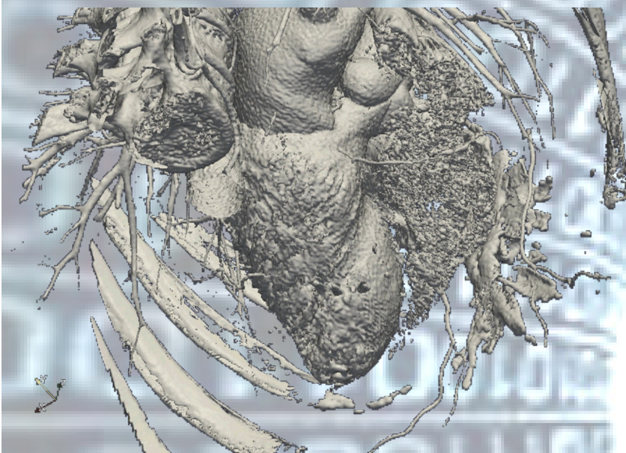
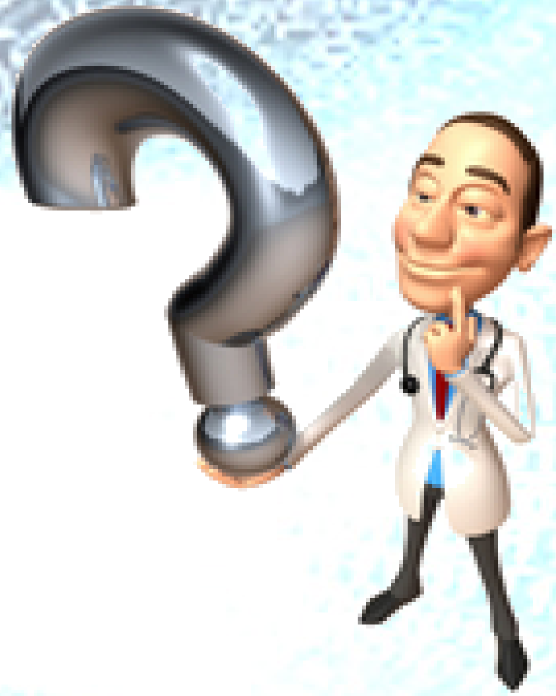
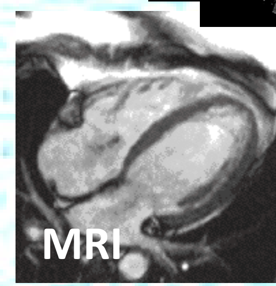
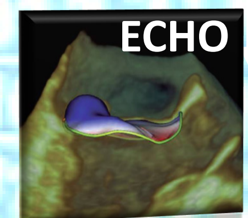
BIA 2014









<u>Quiz 5, 22 Oct 2014</u>

Image Gradients by Fitting

(**from Snyder, Chapter 5**)

TAKE-HOME QUIZ on Image Gradients (40 pts)

TEXT BOOK: *Chapter 5, Machine Vision, Snyder & Qi.*

Read Sections 5.1-5.6,5.8-5A (through page 101, but skip 5.7).

Q3. A 2D image may be represented as a "surface", g(x,y), with height given by the intensity of the image at each pixel. If the equation of a plane, f(x,y) could be fitted as a 'tangent' to this surface representation of the image at any given point, this would be equivalent to computing the gradient vector components at that point. f(x,y) for a plane is given

$$f(x,y) = A^T X = [a \quad b \quad c]^T [x \quad y \quad 1]$$

Therefore, df/dx = a . The tangent fitting problem at some surface region given by g(x,y) can be be defined as:

$$E = \sum_{\eta} (A^T X - g(x,y))^2$$

Our aim is to minimize the squared error, E, by taking derivatives w.r.t A set the result to zero (Ch 5, Snyder):

$$\frac{dE}{dA} = 2\left(\sum_{\aleph} XX^T\right) A - 2\sum_{\aleph} Xg = 0. \qquad (5.10)$$

1) Based on your reading of section 5.3 in Snyder (i.e. the text book), where the scatter matrix XX^T is computed for a 3x1 neighborhood region of *x* ranging from [-1,0,1], **what would this scatter matrix look like for a 5x1 region of *x*..?**
2) **What does the final formulation for the image gradient in the x-direction become with this 5x1 neighborhood**..? That is, what is '*a*' now equal to in terms of g(x,y) and x..?