

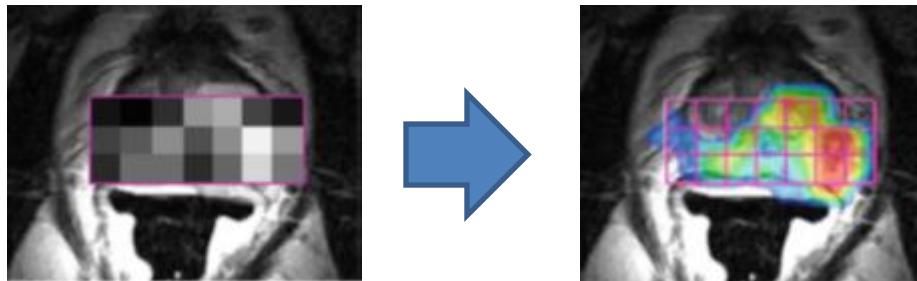
**Guide: Please provide your answers as a brief paragraph of not more than a few lines or points. You do not need to perform any computations or coding. Just clearly express your independent ideas.**

1. In diagnosing lung cancer, a volumetric CT scan is performed to collect a set of slices for the whole chest as shown. It is desired to design a CAD system to detect lung cancer from the collected CT volume. You are asked about your requirements to start building such system. Provide them in terms of the following items explained:
  - a. The data required to build the system.
  - b. The list of processing blocks that will be included in such system.
  - c. How 3D ROIs will be handled in the CAD system.

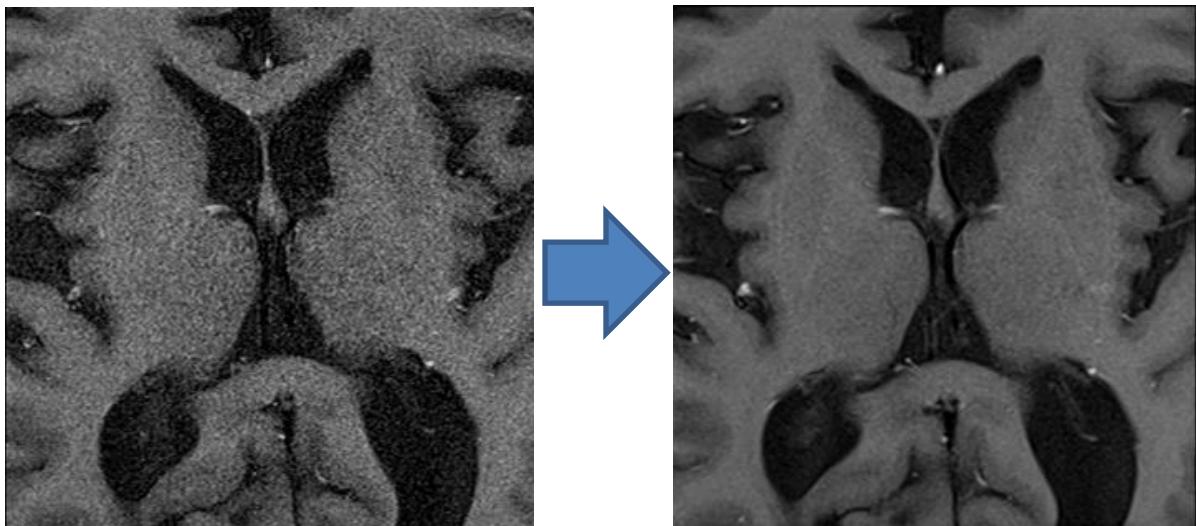


2. In collecting MRI k-space data on a new research system, it was found that one of the data acquisition channels of the system is a problem of more noise than the other. Recall that the data acquisition of MRI has 2 channels for real and imaginary parts of the k-space. Provide your opinion on the following:
  - a. What would be the effect of such noise on the reconstructed image (including both the absolute value and phase images)?
  - b. If you have a choice to connect the noisy channel to either the real or imaginary channels of the collected data, which would you choose and why?

3. In magnetic resonance spectroscopic imaging, a map of the metabolites inside a region of interest within the image are estimated. Given the length of time taken to estimate the map, it is possible to estimate only a low-resolution version of the map (as shown in the image to the left). If it is desired to display such map at the same resolution as the original anatomical image, how can that be done?



4. Even though open MRI systems are more comfortable to the patients especially large or claustrophobic ones, the signal-to-noise ratio of their images are significantly less than closed magnet MRI systems. That is, images taken from open MRI systems tend to be more noisy than those from closed MRI systems. It is desired to find a processing method to improve the quality of open MRI images to make them closer to those from closed MRI systems. Provide your opinion on how to approach this problem and a possible strategy to follow.



5. You are given the data set for a classification problem with 4 different pathologies representing normal, benign, malignant, and necrotic (dead tissue). Since you already tried binary classification in class projects, provide your opinion about the following:
- The main changes you need in your binary CAD system to allow it to work for this 4-class CAD problem.
  - How can you evaluate the outcome of the system using performance metrics?
6. Consider the four images shown below showing grades of fatty liver based on visual appearance (a: normal, b: fatty liver grade 1, c: fatty liver grade 2, d: fatty liver grade 4). It is desired to design a CAD system that allows automated grading of such images. Can you propose 3 features that you think will help discriminate between images? Explain your choice of features.

