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**Medical Physics 710 / BME 710 Due: Oct. 22nd , 2018**

Journal Discussion 5, Quiz #3: O Dietrich et al., **Measurement of Signal-to-Noise Ratios in**

**MR Images: Influence of Multichannel Coils, Parallel Imaging, and Reconstruction Filters,**

**JMRI 2007**

**Due:** October 22nd at beginning of class. Please turn in by hand, email, or submission to Learn@UW.

**Question 1: (3 points)**

Some reconstruction filters introduce inhomogeneity to the spatial distribution of noise intensities over an image, while other filters do not. From which of the following filters could you expect a reasonably accurate SNR (with deviation less than 10%) when SNR is computed using the SNRmean and SNRdev two-region methods? Assume you are scanning a phantom image using a 1CH head coil without parallel imaging. Mark all that apply.

a. No filter

b. Hanning filter

c. Large‐FOV compensation filter

d. Intensity normalization filter

e. Elliptical filter

**Question 2: (4 points)**

Explain why the two‐region approaches to SNR calculation, SNRmean and SNRdev, show tolerable deviations (less than 10%) for 1CH SSFP and EPI sequences, but demonstrate considerable bias for all 8CH acquisitions, with and without parallel acceleration.

The 8Ch acquisitions without parallel imaging were reconstructed using the SoS method, which results in a noncentral chi-square distribution. This is problematic because the SNRmean and SNRdev methods assume a Rayleigh distribution of signal.

The 8Ch acquisitions with parallel imaging also differ from the expected Rayleigh distribution because these techniques (GRAPPA and mSENSE) modify the spatial distribution of the noise.

**Question 3: (3 points)**

You are working as an imaging scientist in a Radiology Dept and your Department chair decides that he wants to do add quality control for his MRI scans. For one week he wants to estimate the SNR in the last scan series (aka last imaging sequence) of each subject that is scanned. He wants to do this with the same method across all those scans. Which method out of the Dietrich paper do you suggest and why.

It would be very hard to argue for the SNRmean and SNRdev techniques because these techniques are only accurate for very limited circumstances, requiring assumptions about spatial noise distribution that are not always valid when applying advanced imaging techniques (parallel imaging, reconstruction filters, multiple channels, etc.). **SNRdiff seems to be a very practical and reliable method for** **measuring SNR, as seen in the paper**. It only requires one more “identical” scan, which is feasible for the patient (assuming this scan is relatively short). This is opposed to the even more robust SNR­mult technique, requiring many identical scans. SNRmult would not be practical in the clinical scanning, because scan time is often limited and you do not want the patient in the scanner for an excessive amount of time.