**Medical Physics 710 / BME 710 Due: Nov. 12th, 2018**

Journal Discussion 8, Quiz #6: **Simonis et al., MRM 2016, Improving the Arterial Input Function in**

**Dynamic Contrast Enhanced MRI by Fitting the Signal in the Complex Plane**

Name: *Grant Roberts*

**Due**: Nov 12th at the beginning of class. Please turn in by hand, email, or submission to Learn@UW.

# Question 1 (2.5 points)

**1. What is the novelty / what is unique about the way the AIF is estimated in this article?**

AIF is measured using complex data directly, incorporating *both* magnitude and phase information. This is helpful because saturation and nonlinear behavior of the magnitude signal occur at high concentrations, and phase errors occur at low concentrations. The combination avoids shortcoming of using magnitude and phase alone.

# Question 2 (2.5 points)

**2. What is used as a comparison for AIF values in the in vivo study? Is that a good surrogate for a gold standard?**

DCE-CT was used for comparison. This is a good gold standard because the CA concentration is directly proportional to the signal loss, as shown on radiographic images. In other words, since there is a linear relationship between absorption of x-rays due to iodine presence (electron density) and signal loss, represented on the image. This is unlike DCE-MRI where there is a non-linear relationship between signal and concentration.

# Question 3 (2.5 points)

**3. Why does the magnitude model overestimates S0?**

Inflow effects lead to higher signal magnitudes than described by the model, mainly at low CA concentrations. The magnitude model, therefore, overestimates S0, leading to an underestimation of all subsequent concentration values.

# Question 4 (2.5 points)

**Could complex signal fitting also be applied for concentration estimation in tissue? If so, what changes would have to be incorporated compared to fitting in arteries?**

In this case, the T­1 and T2\* cannot be assumed as it was for blood. This now needs to be explicitly calculated and is dependent on tissue. A T1 and T2\* map could be registered to the DCE-MRI and could be used to estimate T1 and T2\* in tissue.