**FALL 2019 PROJECT COURSE (EECE 8991)**

Progress of this independent study project will be assessed weekly through submission and presentation of a ppt document, a written mid-semester progress report due on Oct. 18, and a final report due on Dec. 6, 2019.

**Project De: Investigation of model-based method sensitivity to noise**

Tasks:

1. *Evaluation of noise impact (noisy data and noisy parameters) on the model-based method*

The model-based reconstruction method is sensitive to the collected data and the parameters and functions of the developed forward imaging model. Specifically, for the Tunable 3D-SIM system, the forward model relies on correct knowledge of the phases and modulation frequencies of the illumination pattern and of the point spread function (PSF). During this task, the student will learn how the noisy data and noisy (i.e. inaccurate) parameters affect the restoration from the model-based method of the simulated 6-µm bead. The CIRL group will provide the MATLAB codes for the model-based reconstruction method, and for this task, the CIRL group will also provide tutorials/exercises each week to help the student with understanding the method, the MATLAB codes, how to evaluate the noise and how to analyze the results. The student is expected to run the MATLAB codes, to get the figures of the collected data and the restoration, and to compute the noise level and the mean squared error between the truth and the final restored image.

1. *Investigation of the model-based method for noisy PSF (simulated and experimental)*

As described in task 1, the model-based method is sensitive to the PSF. In this task, the student will first investigate how inaccuracies (due to optical aberrations and/or presence of noise) in the PSF affect the model-based restoration when the simulated PSF is used. Then, the student will use the noisy experimental PSF from FairSIM to investigate the reconstruction. A qualitative and quantitative comparison of the restoration obtained with simulated and experimental PSF will then be performed and presented. The MATLAB codes and the noisy PSF from FairSIM will be provided to the student by the CIRL group. For this task, the CIRL group will not provide tutorials or exercises, but the student will suggest the sub-tasks to be done each week, with help from the CIRL group. Besides being able to run the MATLAB codes and get the figures (similar to the expectation of task 1), the student is also be expected to do more analysis during this task, with help from the CIRL group.