MEng Design Project Announcement – 2017-18 AY

Project title: Machine learning applied to 3-D electron microscopy: finding particles in noisy micrographs

Brief Description of Design Project Goals:

Overview: Graduate students and I have worked on 3-D image reconstruction problems for biological cryo electron microscopy for years, e.g., Zheng, Wang, Doerschuk, “Three-dimensional reconstruction of the statistics of heterogeneous objects from a collection of one projection image of each object”, Journal of the Optical Society of America Series A 29(5):959-970. May 2012 and more recently on nanotechnology particles. We need to improve the pre-processing of the input images. We would like to use modern machine learning methods to (1) extract small sub-images each showing a single particle from large micrographs showing many particles in addition to other “junk” material and (2) determine the location of the center of the particle in the small sub-images of Item (1). Both of these tasks are complicated by the low SNR and the complicated “non-particle” content of the images.

Specific MEng Contribution: Use statistical ideas, deep learning ideas, and computation to achieve Item (1) above.

ECE Field Advisor Name: Peter C. Doerschuk
- Email – pd83@cornell.edu
- Phone - 607-255-4179
- Office – Phillips 305

Number of MEng Students Needed: One or two.

Required Skills: The project needs students with a balance of “algorithms” interests, especially statistical and deep learning, and “computation” interests. As much as possible I would like to take advantage of existing software frameworks such as Python, Matlab, Google TensorFlow, and so forth. But this means that there will be some pure software deployment effort since getting consistent versions of all the interacting packages is usually a challenge.

Estimated Project Time Frame:

2017-18 Academic Year, Two (2) Semesters