Summer 2017 USRA Opportunities in MEG and fMRI Neuroimaging Processing
Supervisor: Teresa Cheung

Magnetoencephalography (MEG) is a non-invasive brain imaging technology that measures the electromagnetic signals generated by neuronal activity. MEG is used to assess brain health and has played an increasingly important role in our understanding of how the brain functions. Because MEG combines both excellent spatial and temporal resolutions, this technology provides dimensionally rich data sets for analysis. A key concept in MEG image processing is the concept of the source localization or the neuromagnetic inverse problem. Combined with complementary data from functional magnetic resonance imaging (fMRI) for validation, our research seeks to develop robust methodologies to solving the inverse problem. Our research integrates computational modeling and neuroimaging methods and seeks to develop models of neural systems.

This undergraduate-level research opportunity will provide excellent training in the area of neural signal processing techniques and algorithm development. The student will also have opportunity to contribute to commercial software development through a partnership with local MEG manufacturer MISL. We are looking for a student who is interested in employing their skills towards improving the lives of patients’ and their families by creating novel medical technologies. Applicants should be familiar with MATLAB and have good programming skills as well as a strong mathematical background in linear algebra.

You’ll play a key role in the establishment of a new research initiative aimed at developing and deploying the next generation of diagnostic and therapeutic medical devices for brain diseases and disorders. In this project you will analyze MEG and fMRI data that was collected on a group of healthy volunteers undergoing a visual-motor task. You’ll also work with the team to develop advanced analytical techniques enabling the development of the medical devices. Working within a multidisciplinary team of neuroscientists, biomedical engineers, computer scientists, medical physicists, neurologists and other medical professionals; you’ll have the opportunity to not only learn about the brain but will gain exposure to the latest advances in medical imaging, bio-informatics, medical technology development and patient centric research. Finally, this project may lead to both journal and/or conference opportunities.

Figure 1: Group contrast map of preparing for feature and conjunction search relative to watching display from time 100-1300ms (p<0.001 uncorrected)