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# 25th Industrial Mathematical and Statistical Modeling Workshop
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## GROUP TITLE/ABSTRACT

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"Coastal Imagery Analysis and Hydrodynamic Estimation with Machine Learning"

Estimates of local scale nearshore hydrodynamics (e.g., wave height, wave period, wave direction, current velocity) and morphological features (e.g., sand bar location, foreshore slope, beach width) are important for both the civil works and military missions of the Army Corps of Engineers. The safety of people from rip channels and sneaker waves as well as flood protection from hurricanes rely on designing beaches and coastal structures correctly. However, estimating local scale hydrodynamics requires accurate representation of boundary conditions (bathymetry/underwater topography, and wave forcing offshore) and high-fidelity numerical models that are both fiscally and computationally expensive.

To address this issue, we are interested in exploring a different approach. We aim to use modern machine learning tools to infer local scale effects, from estimates at a regional scale. As a test case, we will use a rich set of field measurements at the Field Research Facility in Duck, NC to determine the plausibility of such an approach.

In this project, students will consider the estimation of localized nearshore bathymetry and hydrodynamics based on nearshore imagery and regional scale wave conditions in deep water. They will be asked to perform image processing to estimate local bathymetry features based on surface properties of the ocean. Additionally, they will be asked to evaluate computational techniques, from the machine learning literature, to resolve the differences between regional to local scale estimates. Based on the interest of the students, they will be asked to explore different data sources and numerical modeling techniques, or probabilistic boundary formulation based on historical datasets.