Vessel Detection Using Synthetic Aperture Radar Satellite Imagery Proposal:

With recent advances in algorithms and technology within the realm of computer vision, satellite imagery has become an applicable field of study. Roughly 1,700 commercial satellites were launched in 2021, bringing the total to 5,000 satellites orbiting Earth by the end of 202. These satellites can complete an orbit around Earth in under 2 hours and take 5m resolution pictures from over 500 km away providing vast amounts of image data. Using computer vision techniques, we are able to obtain necessary information from the images. Specifically, analyzing satellite imagery for ship detection has been subject to a lot of research where different satellites and detection models have been created and improved on for better speed and accuracy. One of the most widely used image data within this sphere has been the SAR images. Previously, optical satellites have been known to produce some of the highest resolution images, however with the drawback that it can only produce high resolution images under certain time of day and weather conditions. SAR's strengths lie in the fact that it can produce high quality images even if it is cloudy or at night time.

Ship detection has been a popular subject for research within the fields of object detection. And with the use of SAR satellite imagery, machine learning and deep learning models are able to more accurately detect vessels across the globe. With uses in various economic tasks, search and rescue operations, aiding in determining military decisions, managing ship traffic, and monitoring possible illegal activity, not only do models have to be accurate, but they also need to be quick as well. Previously, other researchers were only to do classification or extract the region of interest from an image. Now, with the emergence of deep learning, we are able to automatically detect vessels without the need of handcrafted features or large amounts of computational resources. In quarter 1, we mainly explored the The *You Only Look Once* (YOLO) framework on the Large-Scale SAR Ship Detection Dataset-v1.0 (LS-SSDD-v1.0) dataset. Within the dataset, there was a good mix of images offshore and more inshore near land masses and ports and because of this, the classifiers we trained are able to somewhat generalize to our new task. To increase accuracy, we plan on creating a separate model for inshore and offshore images. To separate the two, we intend to first clean images and then from there we can take the sum or the mean pixel value to classify it. Some other types of object detection models we will be testing include Retinanet and Faster R-CNNs. After experimenting with the models, we will select the best one in order to detect ships in an area of interest. We plan to make a report visualizing our findings over a period of time in a specific geographic area, similarly to this.