

# UNIVERSITY OF SOUTH FLORIDA

## *Defense of a Master's Thesis*

### *Automatic Detection of Vehicles in Satellite Images for Economic Monitoring*

by

*Cole Hill*

*For the MSCS degree in Computer Science*

With the growing supply of satellites capturing images of the planet, governments and investors are looking for ways in which these new images may be used to determine which businesses are struggling and thriving. Recent works have shown that parking lot fill rates can provide valuable information about businesses' earnings, however, the task of manually annotating the number of vehicles in a parking lot is expensive and time-consuming. Systems which can automate this process are therefore valuable as they are faster and cheaper than human labor. In this thesis, the problem of detection of small objects in large low-resolution images is investigated by building a detector to locate vehicles in satellite imagery. To train and evaluate the model's ability to estimate parking lot fill rates, we present a new dataset of satellite images captured by Maxar Technologies. The dataset contains images of store and restaurant locations in the Tampa Bay area going back to mid-2019, where we have manually annotated the positions of vehicles. To build the parking lot fill rate estimations, the RetinaNet Detector, first introduced by Facebook AI research, is used which we have modified to use multitask learning. We show that the additional task of satellite metadata estimation improves the detector's performance. To evaluate the detector against the state of the art we compare it with other detectors found in literature on the COWC, VEDAI, and VehSat datasets.

*Monday, March 22, 2021*

*Time 3:00 PM*

*Online (MS Teams)*

*Please email for more information*

*coleh@usf.edu*

**THE PUBLIC IS INVITED**

*Examining Committee*

**Sudeep Sarkar, Ph.D., Major Professor**

**Dmitry Goldgof, Ph.D.**

**Barnali Dixon, Ph.D.**

***Robert Bishop, Ph.D.***  
***Dean, College of Engineering***

***Dwayne Smith, Ph.D.***  
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