**Using Deep Learning based Detection Methods to**

**Detect Map Elements in Choropleth Map Images**

This paper aims at prompting the ability of machine to automatically understand a map image by detecting map elements in choropleth map images primarily, because there is a considerable amount of information in these elements. For instance, we can know the theme of a choropleth map according to its title. In this study, deep learning based object detection methods, Faster Region-based Convolutional Network (Faster R-CNN) and You Only Look Once (YOLO), will be applied to detecting map titles and legend areas of choropleth map images. More than 1000 choropleth map images with either map titles or legends will be collected using Google Images or other online sources. Faster R-CNN and YOLO are among the most commonly used object detection methods today. Faster R-CNN is the first end-to-end deep learning detector with high detection accuracy, while YOLO is the first one-stage detector in deep learning era with no need to generate region proposals before detection, saving a good deal of computing costs. For both two detectors, the input data is choropleth map images, and the output is locations and sizes of bounding boxes in the images and the corresponding object classes, i.e. map title or legend. Additionally, each of the two methods will be evaluated by mean Average Precision (mAP) and frame rate (number of frames processed per second) for detection accuracy and speed respectively. I believe that both detection methods are able to detect most of the elements correctly because they have been successfully used in other detection fields. And based on the properties of Faster R-CNN and YOLO, I suppose that Faster R-CNN will detect map elements with higher mAP, while the detected objects of YOLO are not as accurate as Faster R-CNN but YOLO is much more efficient.