**Review of Existing Research**

**Image Classification Models**

**Convolutional Neural Networks for Images**

**Neighborhood Quality/Infrastructure Surveys**

**Project Sidewalk Predecessors**

Project Sidewalk, a broad scale research project at the University of Maryland, has established several lines of research that will provide a body of work and basis for this project’s extension to machine learning and image classification.

Broadly, Project Sidewalk has used crowd sourced labor to label features on Google Street View related to the accessibility issues. In (1), the researchers had an objective of labeling bus stop attributes by site, using crowd sourced labor. First the researchers first worked to define requirements for cataloging transit access points for persons with disabilities. After defining the requirements for cataloging site attributes, the team crowd sourced labored to help define all of the physical attributes of each transit access point. The visuals within Google Street View were compared in an audit of 179 sites to ensure that the images in Google Street View were an accurate representation of the actual physical environment. The auditors found that 29/179 surveyed sites were missing from Google Maps data but were found in the physical survey.

Crowd sourced labor for labeling was provisioned through the Amazon Mechanical Turk service using minimally trained users. The training was incorporated for the user as part of the introduction to the work. The interface allowed users to label attributes, specific to bus transit, included signage, shelters, seating and trash disposal bins. The crowd sourced labor was found to have an accuracy of 82.5% in labeling features. Errors tended more in the direction of omission of features. The sample size of sites was 150.

A similar Project Sidewalk team in (2) applied a similar process in another research work. Again, images were sourced from Google Street View to attempt to catalog physical attributes of accessibility to disabled individuals. Again, the images were presented to crowd sourced labor for purposes of cataloging the attributes. The crowd sourced labor this time achieved a high score on a Spearman Rank Correlation. The process was further expanded in this paper with a discussion of a machine learning extension to the project.

A four step process was described. First, images were scraped from Google. Then crowd sourced labeling provided wire framing of locations of curb cuts, and other crowd sourced labeling verified the correctness of the labels. Using the correctly labeled dataset, another process called svDetect uses a “Deformable Part Model” to attempt to identify the features of a training set in another set of images. Another step of a support vector machine was also used to help refine the performance of the model. The performance of the model was limited, reaching less than 80% in recall.

**Sources**

1. Kotaro Hara, Shiri Azenkot, Megan Campbell, Cynthia L. Bennett, Vicki Le, Sean Pannella, Robert Moore, Kelly Minckler, Rochelle H. Ng, and Jon E. Froehlich. 2015. Improving public transit accessibility for blindriders by crowdsourcing bus stop landmark locations with Google Street View: An extended analysis. ACM Trans. Access. Comput. 6, 2, Article 5 (March 2015), 23 pages.
2. Kotaro Hara, Jin Sun, Robert Moore, David Jacobs, Jon E. Froelich. 2014. Tohme: Detecting Curb Ramps in Google Stret View Using Crowdsourcing, Computer Vision, and Machine Learning. UIST ’14, October 5-8 2014. Honolulu, HI.