US. Traffic Signs
Detection & Geospatial Localization

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Introduction

This research aims to develop a Deep Learning based system to process a stream of road-images in order to classify and localize them on a map by estimating their GPS coordinates and their types. Furthermore, we introduce the largest traffic signs repository to support future work on Traffic Signs Recognition (TSR), and serve as a benchmark in this domain.

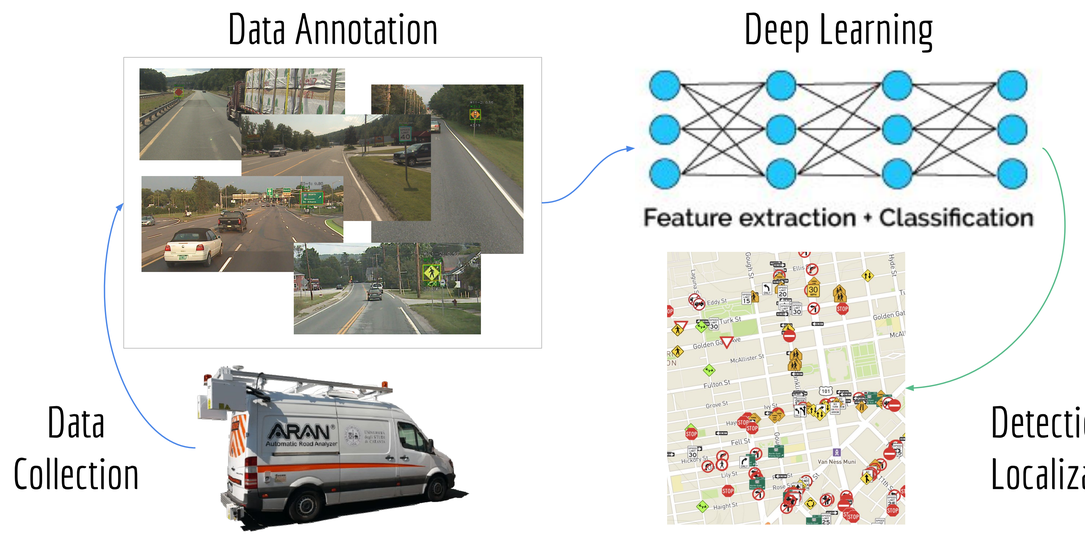

Figure 1. A deep learning model to build a GIS database of US. traffic signs.

Methods

Our baseline-system uses a heavily modified version of the state-of-the-art object-detector known as RetinaNet[2], along with a new geospatial-based object tracking unit as described in Figure 2.

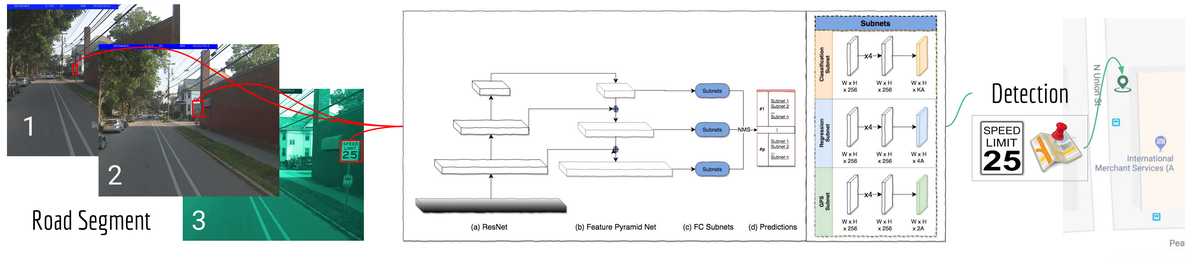

Figure 2. This architecture utilizes a FPN backbone on top of a ResNet model (a) to create a convolutional feature pyramid (b). Then, we attach 3 subnets (c); one for classification, one for detection, and one for GPS/depth estimation.

Results

Our current dataset covers 176 different types of traffic signs containing more than 51K images and over 27K annotations, which surpasses our top competitor dataset LISA[1] by a huge margin as illustrated in the graphs below:

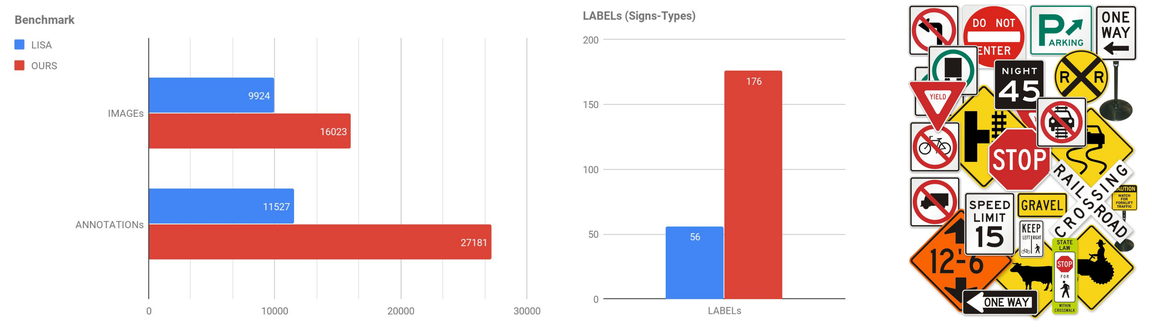

Figure 3. A comparison between our dataset and LISA in terms of the number of annotations, images, and labels in each dataset.

Our baseline-system achieved 87% average precision (AP) on 62 different sign-types. More importantly, the system scored an average of (±) 4.69 meters' geospatial margin of error.

Conclusion

We introduces a new dataset and a DL system for TSR to accurately localize road assets in order to make better assessments and maintenance plans.

Future Work

- **Enhancement of object classification and localization.**
- **Implementation of fully-automated geospatial mapping system.**
- **Addition of other road assets (i.e. utility poles, trees, traffic lights, etc.)**

References

[1] Møgelmose, M. M. Trivedi, and T. B. Moeslund, "Vision-based traffic sign detection and analysis for intelligent driver assistance systems: Perspectives and survey." IEEE Trans. Intelligent Transportation Systems,vol. 13, no. 4, pp. 1484–1497, 2012.

[2] T. Lin, P. Goyal, R. B. Girshick, K. He, and P. Doll´ar, "Focal loss fordense object detection,"CoRR, vol. abs/1708.02002, 2017.