Traffic Sign Detection Mobile App

CS 231M - Project

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Introduction:

Traffic sign recognition is an interesting computer vision problem that we plan to build as a mobile app. Our project will focus on recognizing traffic signs through a windshield mounted phone or tablet. This system can be used to alert the driver to possibly occluded or unseen signs.

Technical Details:

Approach:

We evaluate a number of different recognition and classification techniques to track the image values in order to learn about their practicality in detecting image features on the mobile platform. Our studies show that the following two approach are among the more promising traffic sign recognition solutions. We plan to pursue both approach to evaluate which one is a better fit for the mobile platform.

- ***HOG+LDA+VQ:***
  we use Histogram of Oriented Gradients (HOG) followed by Linear Discriminant Analysis (LDA) to collect and detect image features. The features are ran through Vector Quantization (VQ) to eliminate outliers and improve feature detection accuracy. All three algorithms used in this approach are part of the OpenCV library.
- ***Convolutional Neural Networks (CNN):***
  we use the ConvNet library in OpenCV to implement this algorithm.

In all the above models we intend to start our analysis by following the techniques described in [4] to build the initial version of our traffic sign detector. We then evaluate the performance of these algorithms and choose the algorithm that is best suited for the mobile platform.

Evaluation:

The ultimate goal of this work is to enable detecting all valid traffic signs on mobile. However, for the purposes of this project, we plan to narrow our focus on three key signs (shown below - danger, no-entry, stop signs) and evaluate the performance of our application only on those; if time permits, we will expand our evaluation set to encapsulate more signs once all technical aspects of the app are completed.

We evaluate our app through the following studies:

1. Feature detection speed on mobile
2. Feature detection accuracy on mobile (GPU or CPU depending on the application)
    a. Traffic sign object identification
    b. Traffic sign confusion

Dataset:

We plan to use the LISA dataset to detect traffic signs [1]. We would also like to build a live demo of our app on the streets of Palo Alto when the application becomes fully functional.

Mobile Platform:

We use the Android mobile platform to build our traffic sign detection app.

Timeline:

May 19-22:	literature survey
May 22-26:	build feature detectors
May 26-31:	test classifiers
June 1-2:	work on presentation
June 2-8:	work on CNN, write report

References

[1] http://cvrr.ucsd.edu/LISA/

[2] Hoferlin, B.; Zimmermann, K., "Towards reliable traffic sign recognition," *Intelligent Vehicles Symposium, 2009 IEEE* , vol., no., pp.324,329, 3-5 June 2009

[3] J. Stallkamp, M. Schlipsing, J. Salmen, C. Igel, Man vs. computer: Benchmarking machine learning algorithms for traffic sign recognition, Neural Networks, Volume 32, August 2012, Pages 323-332, ISSN 0893-6080, http://dx.doi.org/10.1016/j.neunet.2012.02.016.

[4] Stallkamp, J.; Schlipsing, M.; Salmen, J.; Igel, C., "The German Traffic Sign Recognition Benchmark: A multi-class classification competition," *Neural Networks (IJCNN), The 2011 International Joint Conference on* , vol., no., pp.1453,1460, July 31 2011-Aug. 5 2011