CS512 Computer Vision

PROJECT PROPOSAL

Jose Pablo Cereceda - A20432616
Diego Martin Crespo- A20432558
MCS

1. Problem Statement

Nowadays technology has reached a point in which intelligent systems are substituting some of the daily activities that humans perform. From highly precise actions to game related interests, the influence of artificial intelligence is on the rise.

One of the fields in which this kind of technology is in increasing adaptation is the automotive industry. With the appearance of companies such as Tesla, vehicles have introduced the use of intelligent systems for a great variety of utilities. However, the main goal that every car related company wants to reach is the autonomous driving. To be able to get to that goal, the problem has been divided in several parts. One of them is the recognition of traffic signals, so that the car can behave adequately to the road regulation.

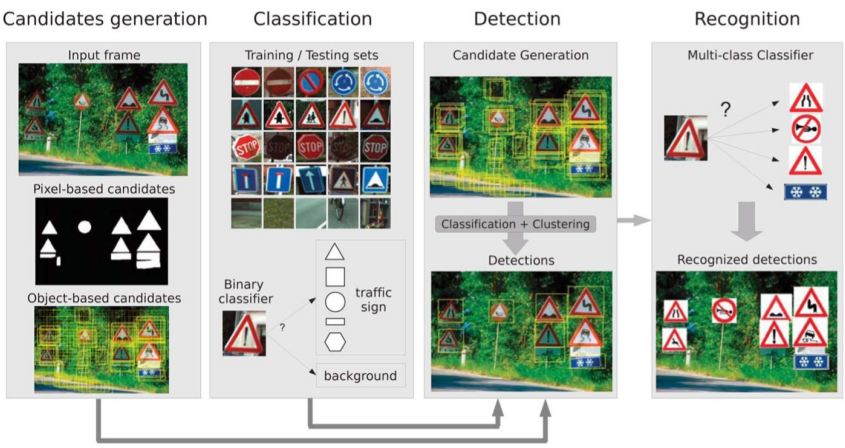
The purpose of this project is to program a simple traffic sign recognition program based on computer vision and learning techniques. This program would be able to detect on live video footage where the traffic sign is located and also to recognise which traffic signal is.

Since there are a lot of traffic signs, the students are going to use a limited number of these to create the program, in order to simplify the problem. Therefore, the program should distinct which signal is detecting between a short amount of them, and if it is not in that subset, then it should mark it as "*other*".

The work division for each student is going to be mentioned on the following section. However, this division is orientative, the complete and accurate division will be described in the final report.

2. Approach

The approach for this project will be similar to the milestones from the paper "Traffic Sign Recognition for Computer Vision Project-Based Learning", as it is shown in the following figure:



2.1. Candidates Generation

Given an input image, candidate generation aims to propose bounding boxes that are likely to contain a traffic sign of some type. A bottom-up approach using the distinctive colors and geometric shapes of the signs is first suggested. Given the variability of images, some of the approaches will most likely fail, so we will try to scan the image with all the possible candidate windows. This part will be performed by the student Jose Pablo Cereceda.

2.2. Binary Classification

Candidate generation usually produces false positives together with the correctly framed signs, which introduces the need for a more sophisticated filtering step. Therefore we will used descriptors, classifiers and more complex features, such as histograms of oriented gradients and learning machines. This part will be performed by the student Diego Martin Crespo.

2.3. Detection System

A detection system combines candidate generation and binary classification together with clustering to group overlapping positive candidates as single detections. This part will be performed by the student Jose Pablo Cereceda.

2.4. Recognition System

The final step consists in upgrading from traffic sign detection to sign recognition: deciding which specific sign (“stop,” “give way,” etc.) is contained in each positive detection. Its name will be displayed on top of the sign recognized in the video. This part will be performed by the student Diego Martin Crespo.

3. Data

To test all the previously mentioned steps and also to generate a classification model, some of the following datasets are going to be used. The grade of utility of each one will be analysed prior to the beginning of the project.

Linköpings University traffic sign dataset, composed by more than 20,000 images that contain 3,486 traffic signs. It was used by the paper *Fredrik Larsson and Michael Felsberg, Using Fourier Descriptors and Spatial Models for Traffic Sign Recognition , In Proceedings of the 17th Scandinavian Conference on Image Analysis, SCIA 2011, LNCS 6688, pp.* 238-249.

Lisa traffic sign dataset, a set of videos and annotated frames containing US traffic signs. It is released in two stages, one with only the pictures and one with both pictures and videos. It has 47 US sign types and 7855 annotations on 6610 frames.

4. References

Papers of reference:

- D. Gerónimo, J. Serrat, A. M. López and R. Baldrich, "Traffic Sign Recognition for Computer Vision Project-Based Learning," in IEEE Transactions on Education, vol. 56, no. 3, pp. 364-371, Aug. 2013.

- Cahya Rahmad, Isna Fauzia Rahmah, Rosa Andrie Asmara, Supriatna Adhisuwignjo, “Indonesian traffic sign detection and recognition using color and texture feature extraction and SVM classifier”. 2018 International Conference on Information and Communications Technology (ICOIACT).

- J.D. Zhao, Z.M. Bai ; H.B. Chen, “Research on Road Traffic Sign Recognition Based on Video Image”, 2017 10th International Conference on Intelligent Computation Technology and Automation (ICICTA)

- Cheolyong Jang, Hyoungrae Kim, Eunsoo Par, Hakil Kim, “Data debiased traffic sign recognition using MSERs and CNN”, 2016 International Conference on Electronics, Information, and Communications (ICEIC)

Other useful links:

https://docs.opencv.org/master/

https://docs.python.org/3/

http://scikit-learn.org/stable/

https://rdmilligan.wordpress.com/2015/03/01/road-sign-detection-using-opencv-orb/

https://www.irjet.net/archives/V4/i4/IRJET-V4I4275.pdf