Traffic Symbol Identification as Train Intelligence

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Abstract

Video Surveillance is very common in day-to-day life. In this paper we show how a video analytics takes place in a video surveillance, specifically aimed at efficient detection and recognition the traffic symbols that's recorded by the video camera. We used a DVR installed in the train to track the symbols along the track. This is done in single frames using set of colour and shape-based criteria using OpenCV library.

Keyword- Computer Vision, Traffic Sign Recognition, OpenCV

I. INTRODUCTION

A. Video Surveillance

Video Surveillance is an integral part of our modern lives. CCTV (Closed Circuit Television) is also called video surveillance. A DVR (digital video recorder) and NVR (network video recorder) security systems are used to provide protection for the place under its surveillance. The DVR connects with the security cameras enabling one to view and record what that cameras see.
DVRs and NVRs come with almost 24 channels to connect 24 different cameras to a single DVR/NVR. All these can be connected to a central monitoring system to take further actions.

Video Surveillance's main objective is to prevent crimes. Nowadays it has lot of applications in traffic monitoring for predicting traffic jams ; preventing accidents; reading the number plates etc.., banks for preventing theft , schools for monitoring the examination halls to prevent any malpractices, Home security to prevent theft, museum to protect the valuable monuments, etc..,

Monitoring the various activities/behaviours/changes for protecting the things/place/ person is very common nowadays. Video Analytics is part of video surveillance system. In this project, we show how the video analytics take place as part of train's video surveillance.

B. OpenCV

OpenCV is a computer vision library which is very faster when compared to other vision libraries and matlab. OpenCV allows you to efficiently encode algorithms for computer vision. OpenCV runs much faster and preserves time and cost.

More time and memory optimizations are possible in OpenCV. While doing research with very large datasets, features, etc., OpenCV is the best option to play with memory optimization, since large data tends to crash frequently.

OpenCV is portable across many Operating systems and is compatible with many compilers like DevC++, VisualC++, etc..,

It includes over 500 functions for various commonly used algorithms. It also comes with a machine learning library and a portable window creation library. With version 2.0, OpenCV comes with a C++ interface as well. Before 2.0, it was only the C interface.

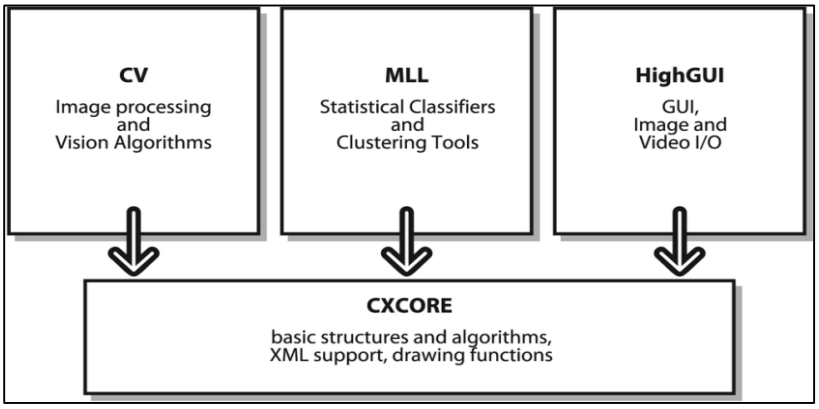

Fig. 1: Basic Structure of OpenCV

OpenCV is broadly structured into five main components. The CV component contains the basic image processing and higher level computer vision algorithms; ML is the machine learning library, which includes many statistical classifiers and clustering tools. High GUI contains I/O routines and functions for storing and loading video and images, and CX Core contains the basic data structures and content. CvAux contains both defunct areas (embedded HMM face recognition) and experimental algorithms (background/ foreground segmentation).

C. Traffic Symbol Detection and Recognition

Traffic symbols are those which represent some speed limit, direction, restrictions, prohibitions, etc.., in our project, the major focus in video analytics include the traffic symbol recognition.

There are varied traffic signs. First the Traffic symbols are fed into the System as templates for recognition. The Videos recorded are then analysed for such symbols/signs.

II. RELATED WORK

In our project, we identified the traffic symbols using 3 different techniques. They are color based identification, shape based identification and template matching.

A. Color based Identification

In the color based identification, the video recorded is retrieved frame by frame. The basic colors of the traffic symbols/ signs are identified first. The camera records the video and retrieves the RGB image. First the RGB color is converted to HSV value and the colors like red, green, blue and white are found. The result is then fed to the shape based identification

B. Shape based Identification

The result of the color based identification is then analyzed for various mathematical shapes like circle, triangle, square, rectangle, octagon, etc.., for further processing. The edges are detected and a boundary is drawn around it and the result is given to template matching algorithm

C. Template Matching

In this the resulted image is compared with the existing templates fed in the system and displayed in the monitor of the driver. This enables the driver to follow the traffic rules promptly.

III. SYSTEM DESIGN

A. Block Diagram

Fig. 2: Block Diagram of the Surveillance System

In the above diagram, the main component is the forward facing camera which records all the scenes while the train is travelling and stores it on the DVR (P22 in the figure)
The other cameras are installed inside the train for future works.

IV. SYSTEM IMPLEMENTATION

The system is implemented by the help of VisualStudio using OpenCv library and Windows Operating system. Some of the screen shot of the output are given below.

Fig. 3: Traffic Symbol Identification

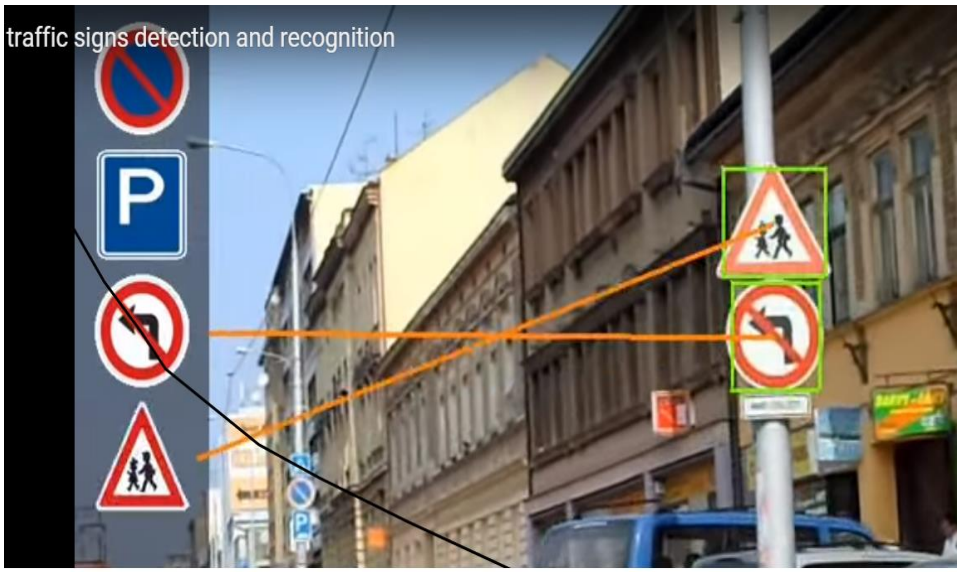

Fig. 4: Traffic Symbol Recognition

V. RESULT ANALYSIS

In this section we attempt to analyse the result of our proposed scheme. In this project the video recorded is successfully analysed for the traffic signs. OpenCV is the library used to perform all the above functions. It's very fast and efficient when compared to other existing vision libraries.
The efficiency of the system is shown in the below chart

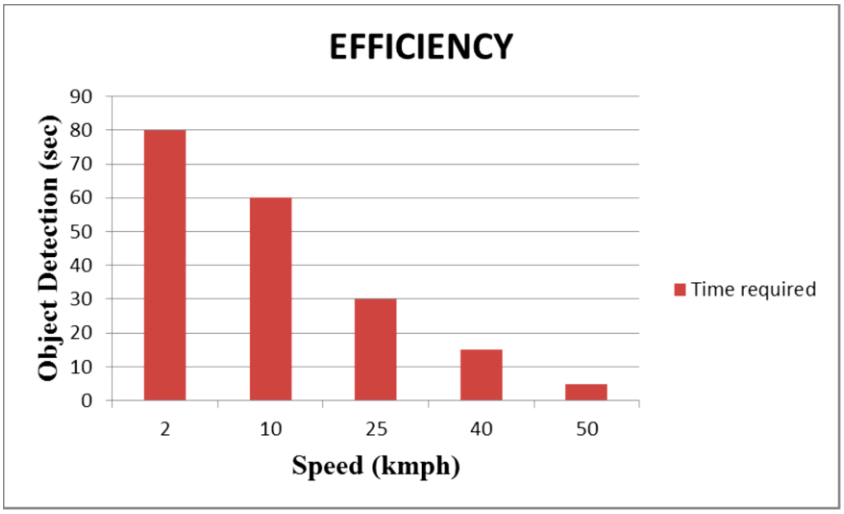

Fig. 5: Efficiency Chart

In this chart the efficiency of traffic symbol detection (Object detection in chart) is shown. The graph is plotted for speed of train (X-axis) and time to detect the sign (Y-axis).

The main advantage of this project is its used to avoid any accidents and make sure the driver doesn't miss any sign and ensures safety of the train.

VI. Conclusion & Future Work

Thus the system created provides a secured environment for the train. In future, the project can be expanded to do the following:

- Multiple dimensions of tracking of objects
- Signal and Symbol board count to detect missing objects
- Enhance further security

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