Quest Journals
Journal of Electronics and Communication Engineering Research
Volume 8 ~ Issue 6 (2022) pp: 53-59
ISSN(Online) : 2321-5941
www.questjournals.org

Research Paper

Supervision Guidance For Visually Impaired Using Machine Learning And Opencv Techniques

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Abstract—*The electronic travel aid's primary function is to detect zebra crossings. It can find and estimate the direction of a zebra crossing, allowing the visually challenged to safely cross the road. In contrast to traditional approaches, a regression approach based on the RANSAC algorithm is used to identify zebra crossing. To detect the zebra crossing, the picture patches are loaded progressively into the logistic regression model. The zebra crossing picture patch is then given into the regression model, which predicts the direction. Before making predictions, the RANSAC algorithm optimises model parameters. The suggested technique may increase the precision recall performance of zebra crossing recognition and lower the root mean square error of anticipated directions when compared to existing methods.*

***R**eceived 15 June, 2022; **R**evised 28 June, 2022; **A**ccepted 30 June, 2022 © The author(s) 2022.*
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I. INTRODUCTION

The zebra crossing detection technology has been extensively researched in a variety of fields. The approach is used to detect the position of the zebra crossing in advanced driver assistance systems (ADAS). The approach is used in the electronic travel assistance (ETA) to assist the visually handicapped in crossing the road independently[reference]. The zebra crossing is an important traffic signal that indicates a safe crossing point. The visually impaired should have access to the accessible zebra crossing region for safe travel. Furthermore, the visually challenged require the zebra crossing direction to change their travelling orientation.

There are several works on zebra crossing, This work is on using machine learning and RANSAC algorithm. RANSAC is Random sampling consensus, It consists of two datas i.e inliers and outliers. It randomly chooses data points. From those data points only the inliers are chosen and the outliers are neglected.

Model will split the real-time video into frames and process each frame with respect to the directional parameters and will give the output in audio form.

PRIOR ACCIDENTS

According to CNN-analysis, News18's the number of deaths has grown by approximately 70%. According to the statistics, the percentage of pedestrians killed in overall traffic accidents increased from about 15% to around 18% between 2018 and 2020.

According to the Union Ministry of Road Transport and Highways, pedestrian deaths in India have increased from 13,894 in 2015 to 23,483 in 2021.

According to CNN-analysis, News18's the number of deaths has grown by approximately 70%. According to the data, the percentage of pedestrians killed in traffic accidents increased from about 15% to almost 18% between 2018 and 2021, The data shows.

Some traffic experts were confident going into the pandemic that pedestrian deaths would decrease.. After all, millions of motorists were slashing their driving time and hewing to social distancing measures. The opposite happened.

Because the roads were empty, some people were able to travel significantly faster than previously. Because they were afraid of face-to-face interaction, several police chiefs relaxed enforcement. Drivers appeared to become angry for reasons that psychology and transit safety experts are just now beginning to understand. Crashes killed more than 8,350 pedestrians in 2021, up about 5 percent from the estimated 6,412 the year before, according to the Governors Highway Safety Association.

Fig 1 & 2: Visually impaired people crossing the road

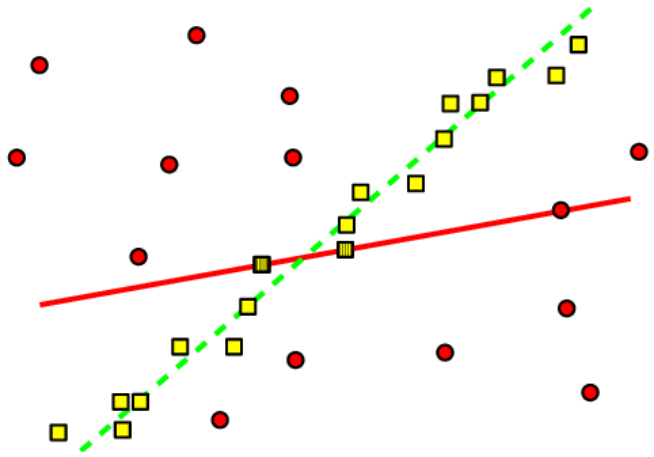
PROBLEM AND PROPOSED METHODOLOGY

The zebra crossing is made up of white stripes that run parallel to each other. The straight margins of white stripes are difficult to perceive in natural landscapes because they are constantly affected by shadow, smear, and slope. The data was gathered in Chennai's metropolitan neighborhoods from dawn to dusk. At the conclusion of a tactile pavement, each picture is recorded.

The outline is that the video is split into frames and each frame is processed individually and each second consists of 24 real time frames. The algorithm chosen is RANSAC algorithm. It consists of inliers and outliers.

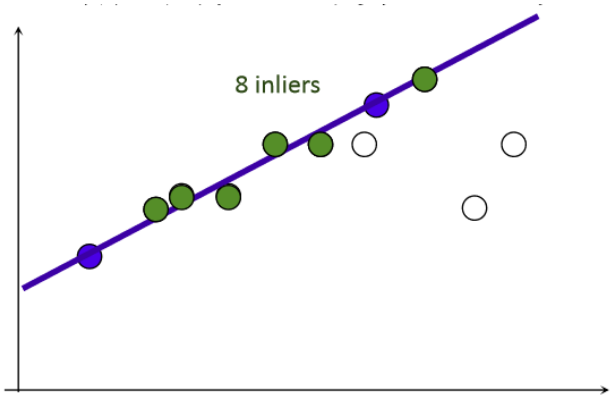
Inliers are the actual data points which accurately detect the white stripes in the zebra crossing pattern. Data points that are significantly different from the rest of the observations are known as outliers. An outlier can be the result of measurement variability or it can be the result of experimental mistake; the latter is sometimes eliminated from the data set.

To estimate random sampling of observed data RANSAC algorithm is chosen. RANSAC employs the voting mechanism to determine the best fitting solution for a dataset that contains both inliers and outliers.



Graph 1: RANSAC dataset

From a cluster of data points, random sampling is done and 2 points are chosen and a line is drawn across these samples. The figure indicates the data points which don't accurately describe the model.



Graph 2:- Data points with 2 accurate data points.

Here the 2 chosen points are indicated in blue, the green points are data points which lie close to the data line. The white points are neglected from the dataset since they are away from the line and these are the outliers.

RANSAC ALGORITHM

1: Select the smallest number of points needed to calculate the model parameters at random.
2: Calculate the model's parameters.
3: Determine how many points in a set of all points meet a particular tolerance. .
4: Re-estimate the model parameters using all the discovered inliers if the proportion of inliers over the total number of points in the collection exceeds a predetermined threshold τ .
5: If not, repeat steps 1 through 4 again (maximum of N times). The number of repetitions, N, is selected to guarantee that the chance p (typically set to 0.99) that at least one set of random samples does not contain an outlier is high enough. Let u denote the likelihood that every given data point is an inlier, and v = 1 u the likelihood of seeing an outlier. There must be N iterations of the minimal number of points designated m, where

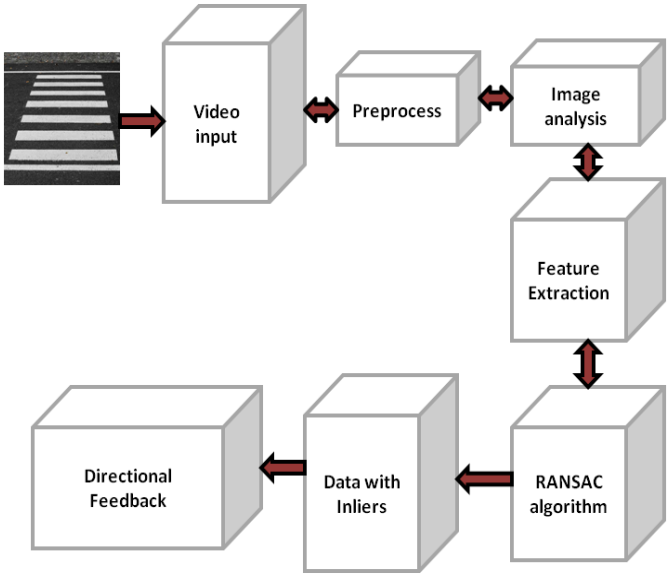
$$1 - p = (1 - u\ m)^N$$

and thus with some manipulation,

$$N = \log(1 - p)\ \log(1 - (1 - v)m)$$

RANSAC algorithm combined with OpenCV allows the input information to be interpreted and work on the data without any labeling of data as seen in traditional supervised learning machine learning algorithms which require a special training set in order for the system to recognize and interpret the raw input information.

The first phase involves reading, preprocessing and
segmenting the contours from the zebra crossing pattern. The second phase involves prediction and classification of the zebra crossing pattern. The features of the crosswalk are then extracted using contour extraction. The prediction model is developed using RANSAC algorithm and OpenCV techniques.



Block Diagram

The input video is broken down into frames and for each second 24 frames are extracted so that in the output a clean video result is obtained. And for each frame the feature extraction takes place and whenever the model detects a zebra crossing pattern (i.e alternating white and black lines or striped colored lines).

RANSAC is a reliable method for estimating the basic matrix in stereo vision, determining the commonality between two groups of points for feature-based object recognition, and registering consecutive video frames for video stabilization in computer vision.

A video mosaic is made up of video frames that have been stitched together. The geometric transform between video frames is estimated using RANSAC.

Fig 4 shows the zebra crossing pattern before detection and preprocessing. Fig 5 shows the zebra crossing pattern which has finished preprocessing and feature extraction and started drawing contours on the zebra crossing pattern.

Here in both the figures the white color in the crosswalk is extracted and recognized using the RGB color code scheme, most of the zebra crossing patterns are of black and white.

For white the value is (255, 255, 255) and for black the value is (0, 0, 0) likewise we can get all the colors using this scheme and it can be done for any zebra crossing pattern which is of any color.

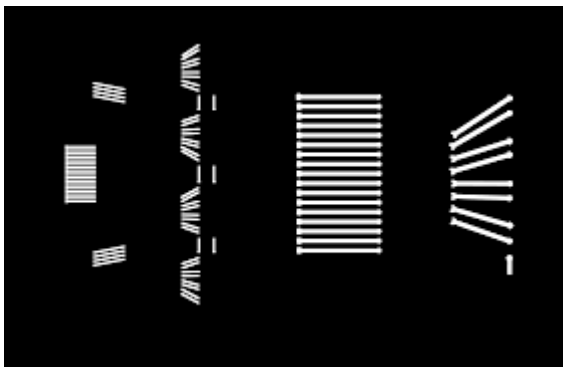


Fig 3:- Example of grouping nearby contours

From Fig 6 & 7 after detection, based on the POV of the user and the threshold values are standard 2-Dimensional values based on which the user gets instructions prompted on the screen as well as in the audio feedback. The user can reorient him/her with respect to the instruction.

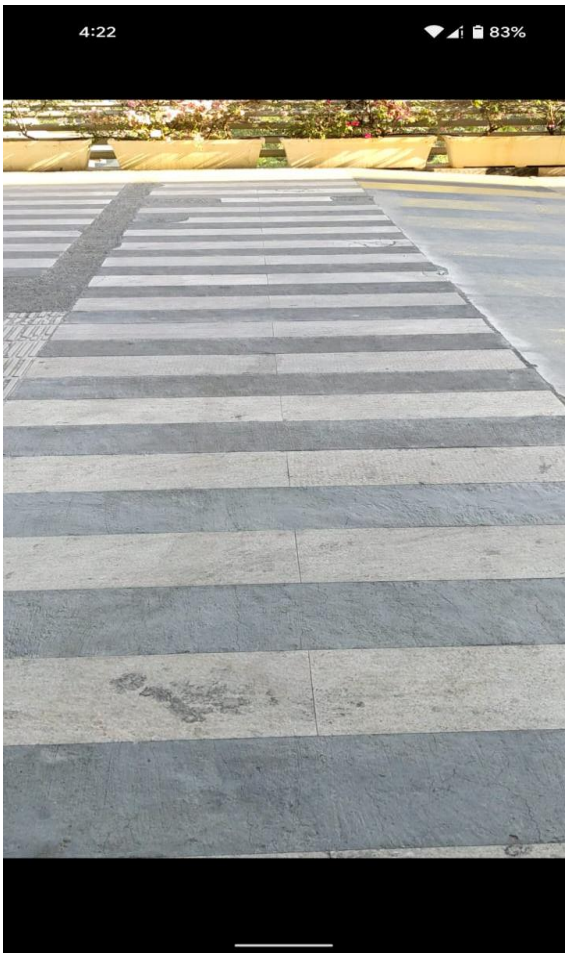


Fig 4:- Zebra crossing before detecting

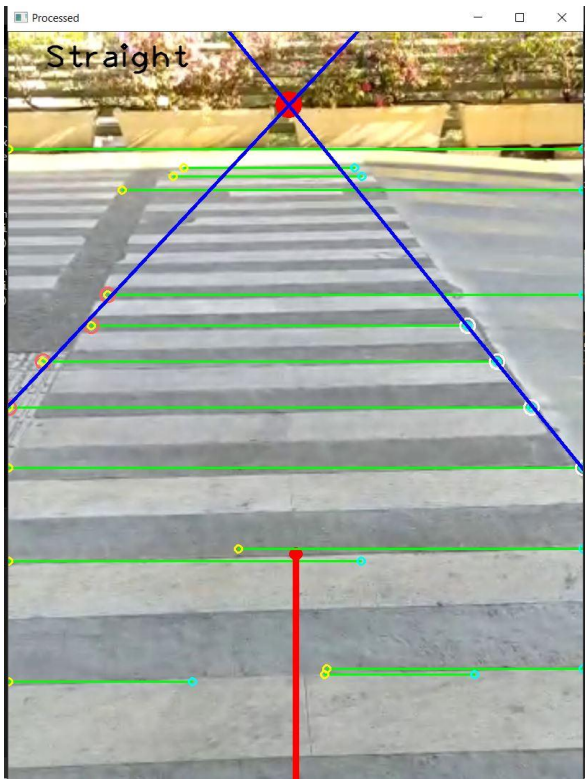


Fig 5:- Zebra crossing after detecting

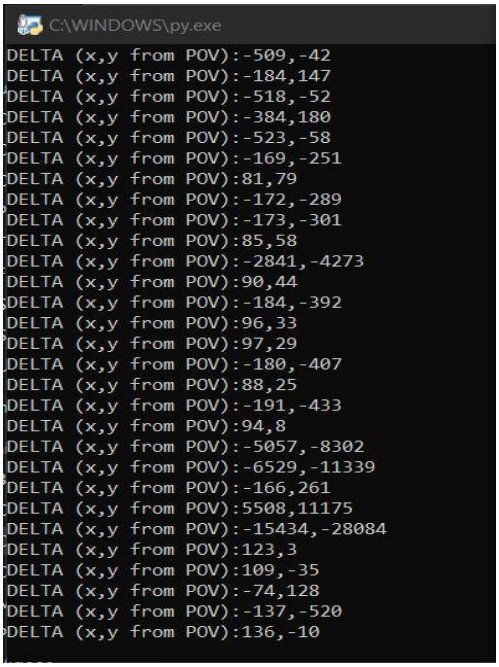


Fig 6:- POV Threshold values

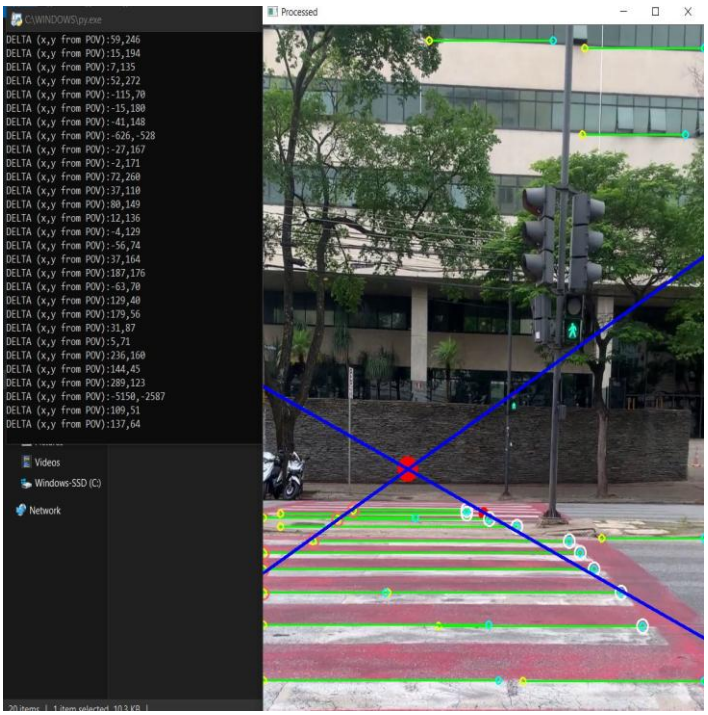


Fig 7:- Zebra crossing detection along with position threshold values.

The algorithm makes sure that whatever is the color of the zebra crossing pattern, it extracts the contours from the crosswalk and starts drawing navigation lines and using these lines as reference, The model will start calibrating the position of the user and from the POV of the user the model will start predicting the directions using the threshold values.

II. CONCLUSION

In this paper, Machine learning and Computer vision methods are used to identify and detect the zebra crossing pattern and provide directional feedback to the user. The input video of the zebra crossing were processed in this work to track the position of the user and provide accurate directional feedback to make the user cross the road. This research will aid in the safe and independent crossing of visually impaired pedestrians in order to avoid any road accidents. The RANSAC algorithm is used to accurately detect and extract features from the input video.

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