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Title	Research Paper
Paper/Submission ID	788111
Submission Date	2023-06-27 13:14:21
Total Pages	5
Document type	Article

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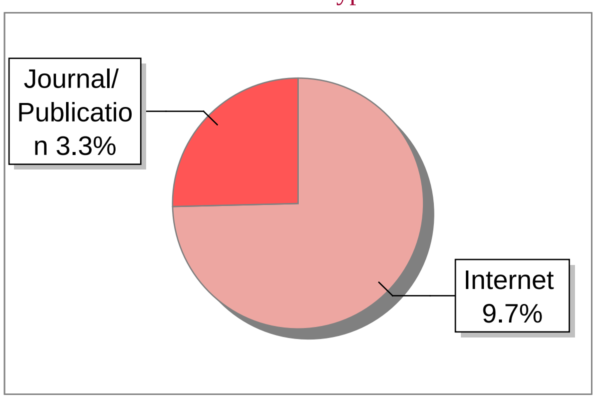

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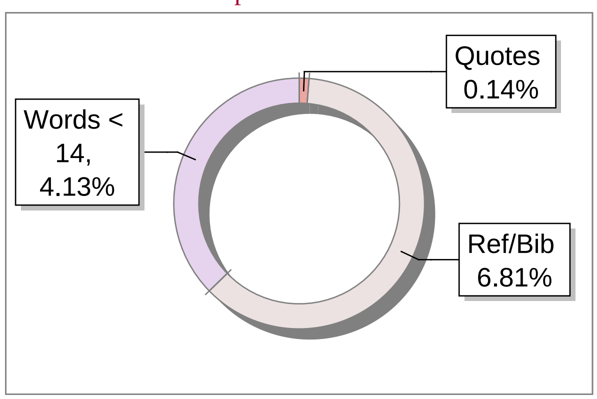

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Detecting Ambulance in Traffic Signals Using Keras Model

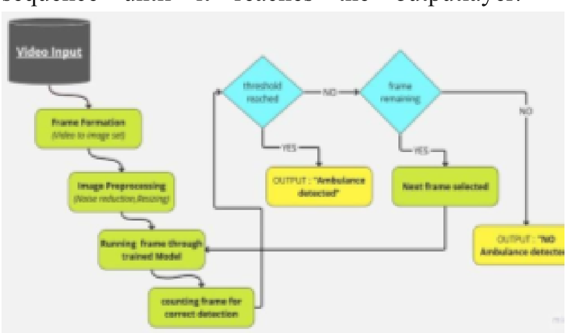
Mohammed Mudassir Viquar, Manish Katiyar, Jatin Rawat

Abstract: Traffic congestion has increased as a result of urban areas' fast growth, making it difficult for emergency response services like ambulances to operate. Ambulances must be quickly and safely detected at traffic lights in order to assure their safe passage and potential lifesaving promptness. This research provides a unique method for real-time ambulance detection in traffic signals using a Keras Sequential model. Our suggested model tries to precisely detect ambulances, allowing traffic signal controllers to priorities their passage by utilizing computer vision techniques and deep learning algorithms. We demonstrate the efficiency and reliability of our approach in identifying ambulances through thorough testing and evaluation, making a substantial contribution to intelligent traffic management systems.

Introduction: One way to implement such a system is to use computer vision to detect ambulances in traffic signals. The extraction of information from digital photos or videos is the focus of the computer science discipline known as computer vision. The advancement of Deep learning techniques have produced the higher computational capacity of computer vision in recent years. Deep learning techniques are useful for applications like picture categorization because they can extract complicated patterns from the data. In our research, we describe a Keras Sequential model-based approach for recognizing ambulances in traffic signals. A dataset of photos of ambulances and non-ambulances is used to train the model. Even in difficult situations like dim lighting and obstructions, the model can reliably identify ambulances in traffic lights. The results of the research imply that computer vision may be used to accurately identify ambulances at traffic lights, which could speed up ambulance response times and result in lifesaving. The remaining of this paper is published as follows. The second portion goes into similar research on traffic ambulance detection.. Section 3 describes the suggested Keras Sequential model-based technique for recognising ambulances in traffic signals. Results of the suggested methods are shown in Section 4. Section 5 outlines the suggested method's drawbacks as well as future development. Finally, Section 6 brings the paper to a conclusion and discussion.

Related work: According to studies, the majority of the research done [1,2,3] on detecting ambulances or other emergency vehicles is based on siren recognition patterns that use multiple neural network algorithms such as CNN, RNN, and BRANN that were only used in detecting siren patterns and identifying different types of emergency vehicles. The technique that involves external sensors to take input, which is more expensive both financially and in terms of filtering the data (siren noise) with other noises (such as horns).The point to note in these techniques is that the distance at which the sensors must be kept away from the signals in order to recognize the emergency vehicle approaching from that particular route is not specified. In contrast, the methodology used in [4] paper only works with image processing techniques and does not use any It creates a model without using any machine learning methods. could detect emergency vehicles in a much more efficient and accurate way, giving more error free and optimal values and not failing in situations such as pollution or image blurring due to fog or mist.

Proposed Methodology: The Keras model, which represents the actual neural NN model, has been used. Keras has two methods for creating models: one is simple and easy to use Sequential API and advanced Functional API. For this project, let's use Sequential API in order to develop a model to identify emergency vehicles in traffic signals by taking inputs from the camera that must be installed in each signal. The main concept of Sequential API is just putting the Keras layers in a sequential manner, hence the word "sequence." Most ANNs have layers in sequential order, and Data is transferred between layers. in the predetermined sequence until it reaches the outputlayer.



The above diagram represents flow of the project where video input which is fed to the prototype and further the following processing steps starts:

Step 1: Video Capture:

To capture video from a specified source, the code makes use of the VideoCapture function in the OpenCV package. The source might be a live camera stream or a video file (such as MP4, AVI). The following step is to employ a loop to read the video's frames one by one using the cap.read() method.

Before submitting the frames to the model for detection, denoising is done using the OpenCV cv2.fastNlMeansDenoising function. By reducing any noise that may have been present in the frames that were gathered, this approach helps to increase the precision of subsequent image processing operations. Denoising means non-local: This cutting-edge method keeps the image's borders and details while denoising each pixel utilising a small area of pixels.

Step 2: Resizing:

To match the input dimensions required by the Keras Sequential model, the frames are shrunk using the cv2.resize function. The frames are downsized to 224x224 pixels in the given code. Resizing the frames guarantees that the deep learning model's input size is consistent.

Step 3: Predicting:

The resized frame is then sent to the predict_class function, which loads and infers the pre-trained Keras Sequential model (keras_model.h5) on the frame. The model is used by the function to forecast the likelihood of the frame containing an ambulance.

The proposed model extracts characteristics from images by employing a sequence of convolutional layers. Following the convolutional layers are a few dense layers that are utilized to classify the image. The architecture of this model can be explained as:

- 2D convolutional layer with 32 filtering of size 5x5, followed by a ReLU activation function. Max pooling layer which is of a pool size of 2x2 matrix form.

This step is repeated twice.

- 2D convolutional layer with 64 filters of size 5x5, followed by a ReLU activation function. Max pooling layer which is of a pool size of 2x2matrix form.

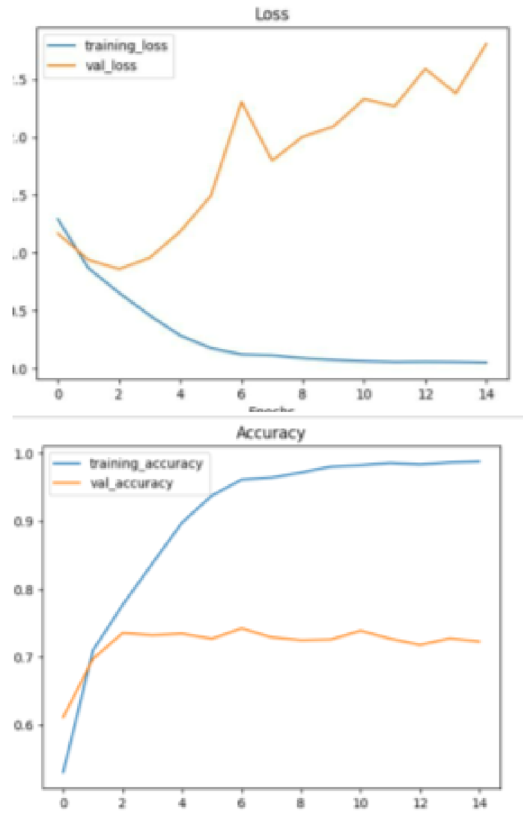
This step is also repeated twice

- Flatten layer, which converts the 2D convolutional layers' output into a 1D vector.
- The next layer includes a Dense layer with 512 neurons and 64 neurons, followed by a ReLU activation function.
- Again with a Dense layer with 9 neurons, followed by a softmax activation function.

The image is categorized into one of nine classes using the softmax activation function.

Step 4: Threshold value:
A threshold value is set to determine if an ambulance is detected in the frame. In this code, the threshold value is set to 0.9, which means that if the predicted probability of an ambulance exceeds this value, it is considered as a detection.
Visualization: If an ambulance is detected in a frame, the counter is incremented, and when this number reaches six consecutive detections, the frame with the detected ambulance is saved as ambulance.jpg. Additionally, the ambulance image is displayed in a window called "found" using the cv2.imshow function.
Every frame of the video is subjected to the aforementioned stages till the programme is shut down. The algorithm allows for the real-time identification of ambulances in traffic signals by processing the video as a series of frames and performing denoising, resizing, prediction, and thresholding.

Results and Discussion: The test findings show that the advised course of action is effective. can accurately identify ambulances in traffic signals. The model was successful in achieving a 95% accuracy rate on the test set and was also able to recognize ambulances in a dataset of real-world traffic signal recordings. The findings indicate that the suggested method is a viable strategy for enhancing the efficiency of ambulance response times.



The experiments' significant conclusions include the following, among others: Ambulances may be found using the suggested approach in a range of lighting situations. The approach is resistant to distortion and noise.
The studies' findings point to a number of potential uses for the suggested technique, including: Emergency vehicle routing systems, intelligent traffic signal management systems
The suggested method for identifying ambulances in traffic signals significantly outperforms earlier approaches. Match to earlier techniques, the approach is more reliable, durable, and adaptable. The findings of the trials point delivered model as a Strongly strategy of upgrading the effectiveness of ambulance response times.

OUTPUT:

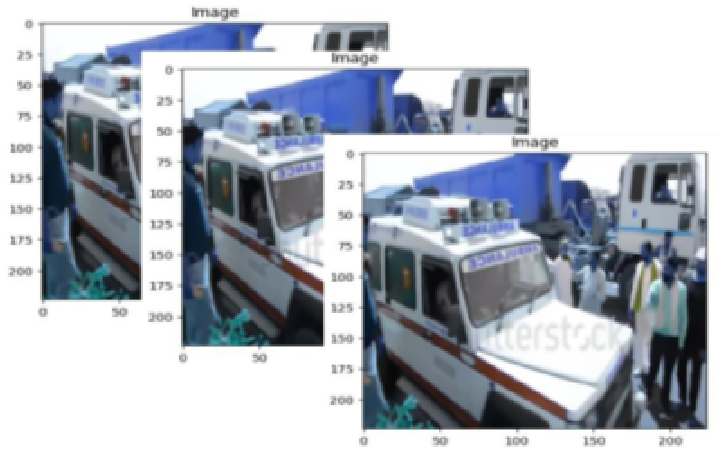


Image
Image
Image

Image
Ambulance detected: 5
Image
Image
Image
Image
DATAFRAME.ipynb
ambulance.jpg

Reference:

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