A Computer vision framework for detecting and preventing Human-Elephant Collisions

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Introduction

In this paper we propose a framework that relies on computer vision approaches for detecting and preventing Human elephant collision system .

Input video containing Elephant on road.

Signal send to central authority as soon as the elephant comes in area of conflict

Central authority signals the team person to move the elephant off road before accident happens

Person in charge run to the location to move the elephant off the road before collision happens

No more need to monitor for 24/7!!!

Proposed Methodology

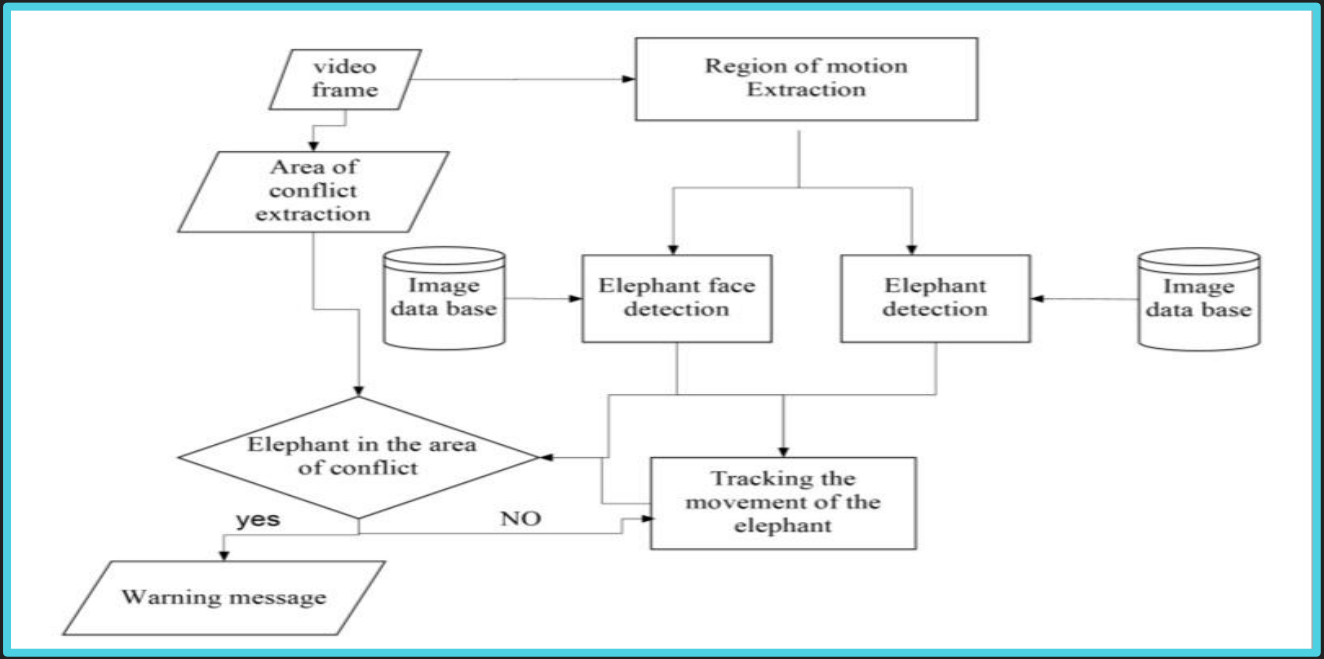


Fig: The diagrammatic representation of proposed approach

Identify area of conflict

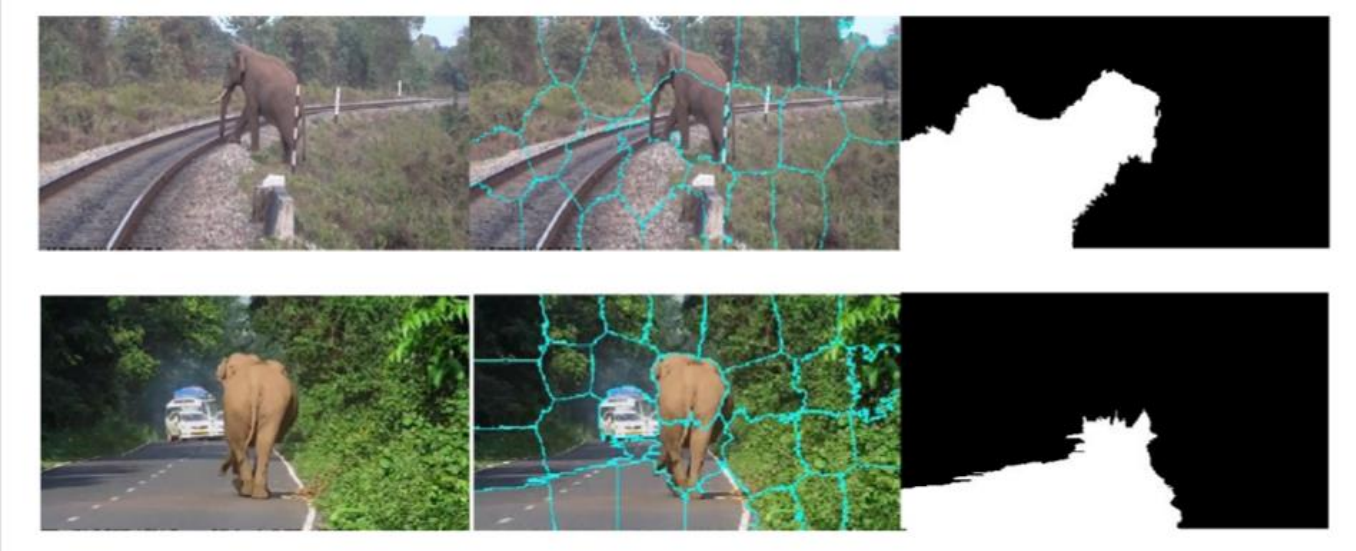
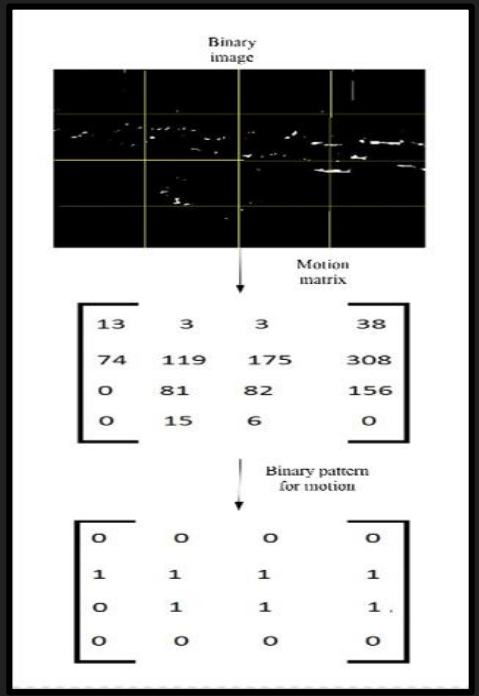


Fig: The above figure shows extraction of the area of conflict for two different scenarios. The railway track was identified as the area of conflict in the first scenario while the road was identified as the area of conflict in the second scenario. The coordinates of the area of conflicts that were extracted using the color + spatial properties have been shown in the figure along with super pixel cluster for the frame.

Binary pattern for motion

- The binary pattern for motion for a binary image containing the difference of two frames. The image was divided into 16 cells. The total number of 1’s in each cell are then calculated and stored in a motion matrix. The thresholding of the motion matrix results into a binary pattern for motion.



Identify the area of motion in videos

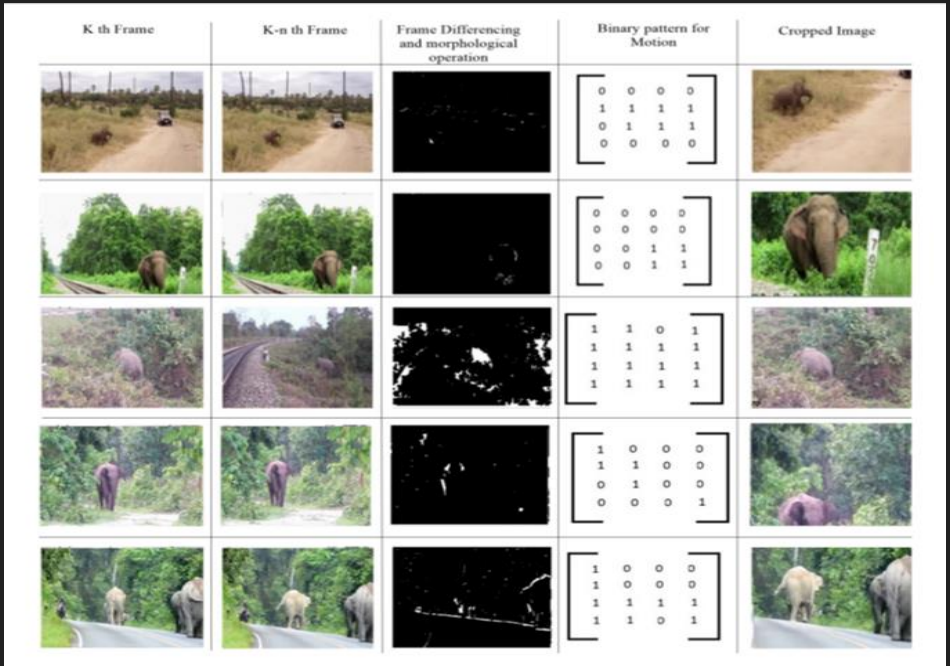


Fig: The above figure shows process of extracting the area of motion in different videos. The method uses binary pattern for motion for generating binary image containing the difference of the images. Later the cropped image is generated according to the binary pattern for motion.

Dataset

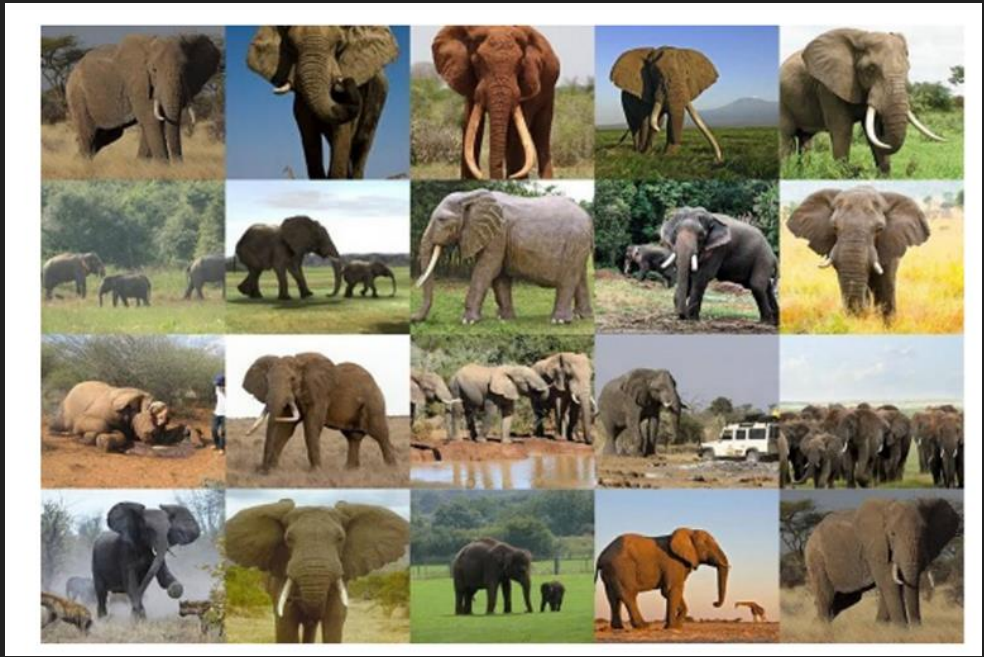


Fig: Samples of images of elephants used for training the elephant recognition model.

Dataset

Fig: Samples of images of elephants face used for training the elephant recognition model.

Deep CNN for classification

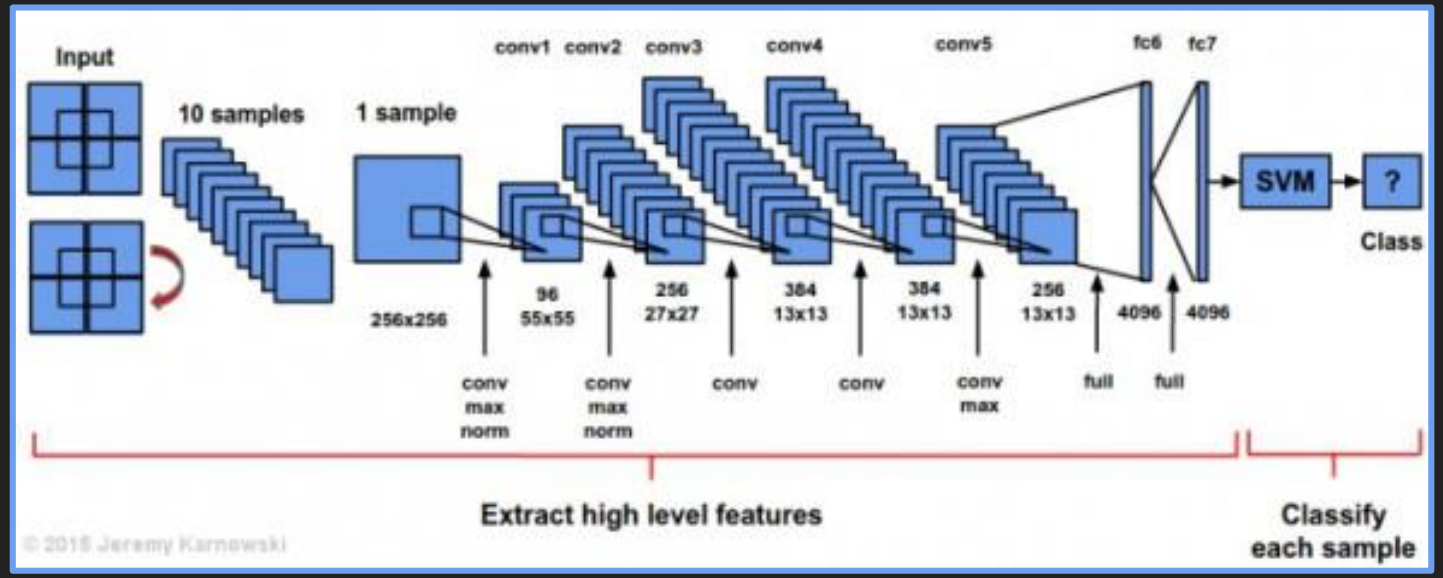


Fig: The figure shows the deep convolutional neural network used for extracting high level features from the input cropped image.The extracted features are then fed into binary SVM classifier to classify into either elephant class or non elephant class

Qualitative Results

Fig: A scenario of depicting elephant intrusion on Indian road.The elephant is crossing a road . The scenario can be dangerous for the elephant, if it collides with fast moving car. The particles detect an elephant and change the color as soon as the elephant crosses the area of conflict.

Qualitative Results

Fig: A scenario of depicting elephant intrusion on railway tracks. The elephant is crossing a railway track. The scenario can be dangerous for the elephant, if a train passes by. The particles detect an elephant and change the color as soon as the elephant crosses the area of conflict.

Quantitative Results

Approach	MAP(%)	MAR(%)
LBP +KNN	28	82.353
LBP +SVM	80	57.97
LBP +Random Forest	86	78.12
SIFT + KNN	78	78.416
SIFT+ SVM	22	100
SIFT+ Random Forests	48	32.44
HOG+ KNN	32	82.353
HOG+ Random Forests	78	78.409
Dua .et.al	100	63.29
Proposed Approach	**98.621**	**97.279**

Table: A comparison of Various approaches applied for elephant recognition

Qualitative Results

Approach	MAP	MAR
HOG+ KNN	72	63.158
HOG+ Random Forests	90	77.586
Dua .et.al	72	63.158
Proposed Approach	**98.67**	**96.109**

Table: A comparison of Various approaches applied for elephant face recognition

Demo videos

Video showing detection and tracking of elephant on road.

Demo Videos

Video showing the scenario of human elephant collision on the road. The elephant is chasing a human-being on a road. The particles appear to be in red as the elephant continuously on road.

Conclusion

- Two different methods were used to detect the presence of elephants having accuracy of 98.621% and 98.667% .
- The future work focusses on detecting elephant in real time scenarios and at night time.

No more need to keep eye on roads/railways/agriculture

24/7!!!!

Thank you!