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Detection of Distracted Driver UsingConvolutional Neural Network

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Abstract: ***Abnormal driving behaviour detection helps to ensure safety of driver and passenger. Recent studies have concluded that talking on phone while driving distracts driver attention upto 20%, which leads to accidents. Deep learning models can be used to find these distracted actions. In this system the abnormal behaviour of the driver like reaching behind, hair and make-up, drinking, texting etc. are detected through deep learning. Densely connected Convolutional Neural Networks, Residual Networks are used for detection. AWGRD model, the most sophisticated model of ResNet, is formedby superpositions of previous layers, and is used to detect the driver behaviour. The input to the proposed system will be a video file. The video input can be a real time live video or it can be uploaded. In output the system detects the activity or behaviour of the driver and warns them.***
Keywords: Densely Connected Convolutional networks, Deep learning, Artificial Intelligence, Neural Networks.

I. INTRODUCTION

For the time being, detection of a distracted driver is becoming increasingly popular because it is extremely useful for ensuring the safety of both the driver and the passengers in the vehicle.

Researchers found in a recent practice that making use of a phone during driving- either by making a call or by sending a text can cause a driver to lose a quarter of their attention, making them twenty three times more likely to get into a fatal automobile accident than normal attentive drivers. According to research, distracted driving is responsible for nearly 3,000 accidents each year on the road. Only about 8% of them end in death.

A driver may be tipsy, or may be on a call, conversing with atraveler, working the radio, doing hair and cosmetics, messagingon phone and so on. They could die from a small mistake. The significant objective is to ensure that the driver is cautioned by the framework at whatever point he/she is showing occupied conduct. An alarm will sound to notify the driver from the system[1].

As a result, our goal for this paper is to define the means to detect the aforementioned abnormal behaviors.

II. OBJECTIVES

The following are the paper's goals:

1) To group the actions in the video file that was uploaded.
2) To design a user interface.
3) To classify the actions in real-time live video based on howpeople act while distracted.
4) To incorporate project modules.

III. LITERATURE SURVEY

High-resolution videos are now present in an increasing numberof visual applications, something that is widely acknowledged. For example, in video reconnaissance[2], numerous high-goal cameras are important to be put at various areas. In order to identify[3], and re-identify, and then track the target which is moving, they collaborate, making it easier to conduct subsequent high-level analyses of the target which is moving (such aspotential intention or even behavior)[4]. In profound calculation,high-goal cameras should be used to catch both self-evident andfine changes of feelings of the objective individual progressivelywhich has huge effects in security these days. It is not difficult to see from the above portrayals that, procuring and putting away an enormous volume of high-goal recordings are frequently quite easy to be acknowledged for the present[5]. Themain problem, though, is how to use those large volumes of low-level video clips to make accurate high-level decisions in an efficient and effective manner. High-quality videos of drivers taken while inside of vehicles are considered in this study.Identifying drivers' abnormal driving behavior—also known as patterns—is the central decision here. There are some research studies conducted already. The first study, for example, is based on the identification of anatomical waves of human beings such as, electrooculogram, electro-encephalogram, changes in respiratory actions, changes in blood pressure flow, etc, utilizinga variety of sensors[6].

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The next one depends on the subtleties of the face.The third is based on the movement characteristics ofthe steering wheel and can detect the steering time, braking behavior, driver's hand pressure and other factors. It is important to note that the detection of human anatomical signals is very accurate and real-time, which is good, its main advantage, which affects the normal driving of drivers, cannot be ignored. Besides, physiological signs of people change extraordinarily because of the physiological contrast in every unique individual and her/his ecological circumstances. In this manner, giving quantitative and objective principles to distinguishing people's physiological signs too is testing.

IV. PROPOSED SYSTEM

A. *Methodology*

The working of the project can be understood and analysedthrough the following steps:
Step-1: Generate and load AWGRD Model.
Step-2: Upload a recorded MP4 Video file as input
Step-3: Access the input video stream using the VideoCaptureclass of OpenCV.
Step-4: Loop over the number of required sample frames andread them.
Step-5: Start behaviour monitoring.
Step-6: For real time live camera detection click on the LiveCamera Button.
Step-7: Predict and classify the actions.

B. *Architecture*

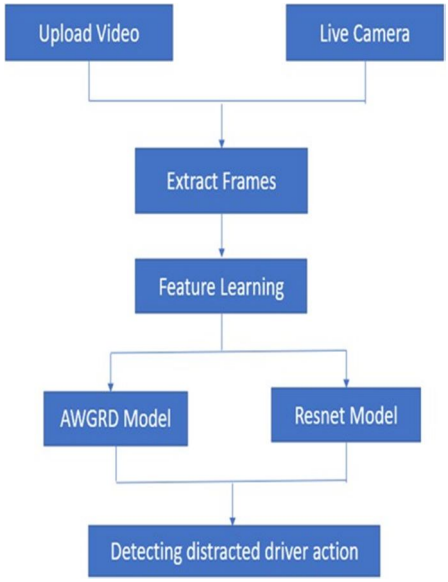


Figure 1: The Architecture of System

Figure 1 shows the architecture of proposed system. The input to the system is uploaded recorded video or livecamera input. Firstly frames are extracted from the input video file and then feature learning is performed on the frames. In case if the input is recorded video then AWGRDModel of Densenet is used and if it is live camera input thenResnet model is used. After this driver's distracted behavioris monitored and an alarm is provided in case he is displaying activities that can lead to fatal accidents.

C. *Algorithm AWGRD Densenet*

Densenet, a fundamental deep learning model has inspired three very novel deep learning-based models. In general, this vast DenseNet family includes a number of well- established models, including Highway Network, GoogleNet, and others. When we compare Resnet and Densenet with each other it has been found that the most efficient one is Densenet[8]. An explanation is that theResNet just adds the results of the two contiguous layers while the DenseNe model needs to append the current layerto all of its previous layers. For example, when there are many layers, ResNet tends to have associations that are direct in nature. One of the major advantages of DenseNet is that, it deals with the problem of vanishing gradientefficiently[9],[10].

1) Resnet

ResNet or in other words Residual networks is being recognized these days as one among the most powerful learning-based models currently[11],[12].Residualnetworks has gained a lot of success because they efficientlysolves the well-known issue of vanishing gradients, which can be found in a lot of very deep models. The basic idea isincluding an identity mapping parallelly in the basic network, which is useful for creating a learning structure which is residual in nature. Based on a possible nonlinear mapping such as a stacked network which is nonlinear, it can technically be constructed to represent a residual mapping. Optimizing non linear mapping is difficult whereas optimizing residual mapping is easy. This makes Residual networks useful and important[13].

V. IMPLEMENTATION

A. Dataset

1) State Farm Distracted Driver Dataset

The dataset for distracted driving detection that is made publicly available is State Farm Distracted Driver Dataset. There were 44 distinct drivers in the sample. 29 of the 44 drivers were men and 15 were women. Some drivers took part in many recording sessions with various driving conditions and times of day. There are 102150 photos in total[15]. 79726 of these are training photos, and 22424 are validation images.640 x 480 pixels is the size of each photo. Each photo falls into one of the ten categories listed below.

The 10 classes are:

- Class 0: Safe Drive
- Class 1: Texting on phone - Right hand
- Class 2: Talking on phone - Right hand
- Class 3: Texting on phone- Left hand
- Class 4: Talking on phone - Left Hand
- Class 5: Radio operating
- Class 6: Drinking while driving
- Class 7: Turning Behind
- Class 8: Makeup and Hair
- Class 9: Communicating with a passenger.

2) Kinetics Human Action Dataset

To implement live video, kinetics human-action dataset from Kaggle was utilised. The Kinetics dataset is used to detect human actions. Around 500,000 video clips totaling 400 humanactivities make up the dataset, with at least 400 clips for every class. The length of each video is 10 seconds and has one class labeled to it. The videos have human to object interactions like playing musical tools and also communication between humanslike handshakes. The Kinetics dataset's major goal is to transform into ImageNet's counterpart of video data.

B. Modules

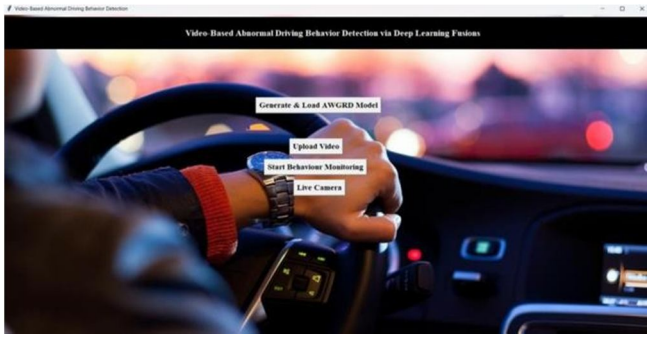


Figure 2: Main Page

The Figure 2 shows the various modules in the project. The modules are Loading AWGRD Model, Upload video, Start Behaviour Monitoring, Live Camera.

1) Loading AWRGD Module

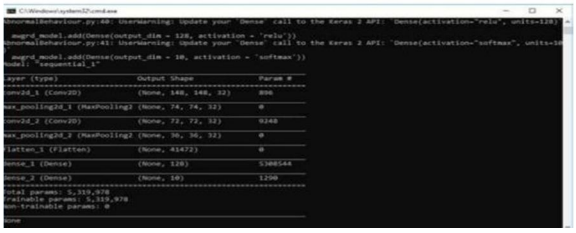


Figure 3: Model generated in console

After clicking the 'Generate & Load AWGRD Model' button, a model is created. The information regarding it is displayed in Figure 3 in black console.And also, the model is generated and loaded which means now we can start monitoring the driver**.**

2) Uploading Video Module



Figure 4: Uploading Video Module

In Figure 4 After the model is generated and loaded successfully the video can be uploaded from the local system for behavior monitoring. The video input file should be in mp4 format.

3) Behavior Monitoring Module



Figure 5: Behavior Monitoring

In Figure 5, Once the video has been uploaded the behavior monitoring can be started i.e. the model now detects the driver's abnormal behavior which includes Drinking, talking on phone, Texting, reaching behind, talking to passengers, Hair or make up actions etc.

4) Live Camera Module

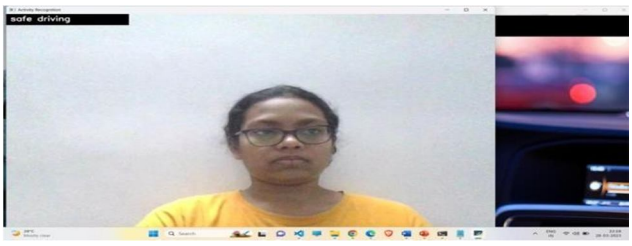


Figure 6: Live camera

The Figure 6 shows the Live camera module. On clicking the live camera, a new window opens whereit records the live actions and classifies the actions. It is implemented using OpenCV. The classified action is displayed on the top left corner of the window.

VI. RESULTS AND DISCUSSIONS

Created Graphical User Interface using Tkinter. The user must first generate and load an AWGRD Model. Then the user must upload a video. To classify various activities the user has to click the start behavior monitoring option. Accuracy of the model is 85%.

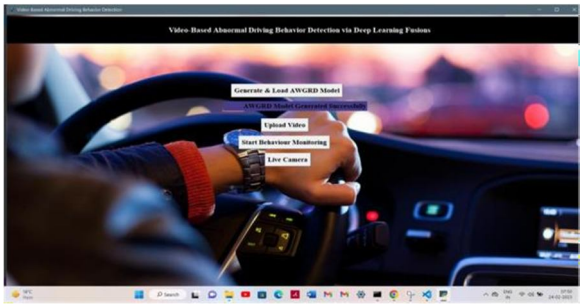


Figure 7: Generating and loading the model

Figure 7 shows how to generate and load AWGRD model. If the model is not present, we need to generateand load, if the model is present, we need to load the model.

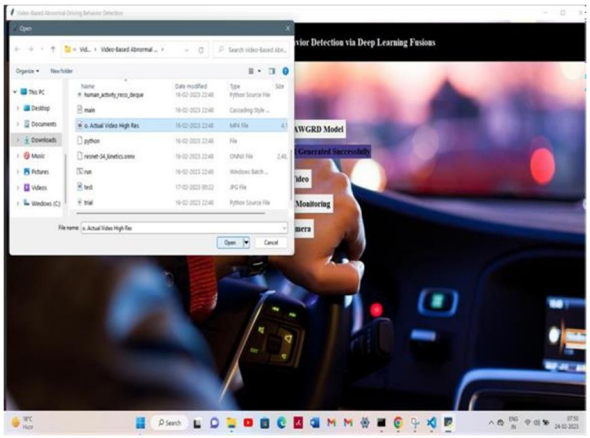


Figure 8: Uploading video

Figure 8 shows uploading the input video file on clicking the upload video button.

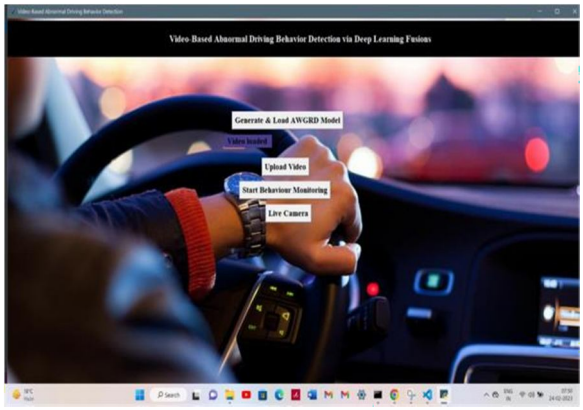


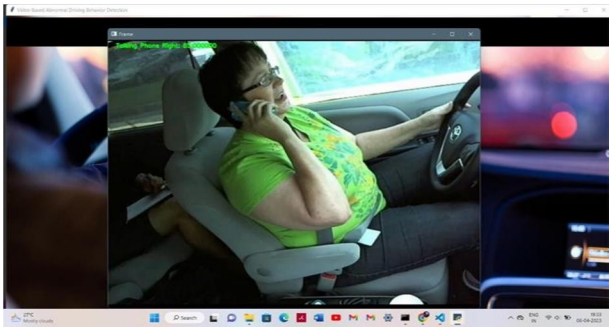
Figure 9: Video loaded

The Figure 9 shows a message that the input video has been uploaded successfully.



Figure 10: Safe Driving

On clicking Start Behavior Monitoring the modelclassifies driver actions. The Figure 10 shows that themodel classified driver action as “Safe driving”.


Figure 11: Talking on Phone Right.

The Figure 11 shows that the model classified driver action as “Talking on Phone Right”.

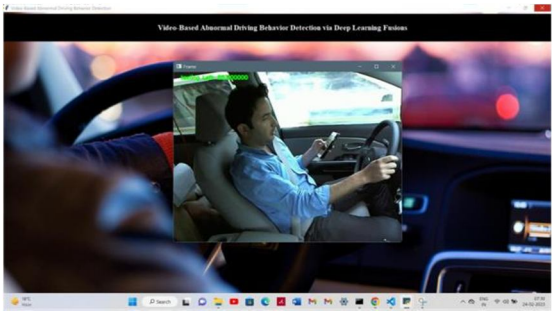
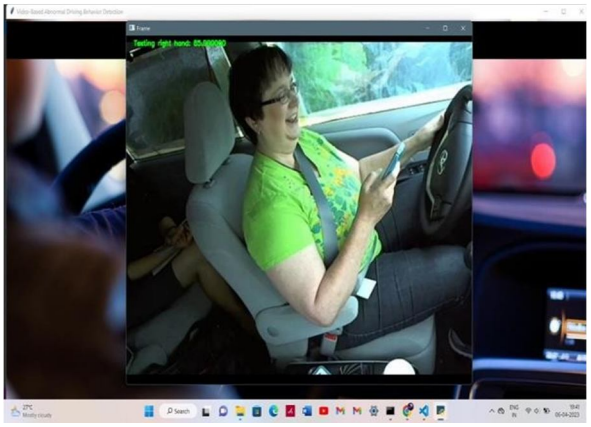


Figure 12: Texting left

The Figure 12 shows that the model classified driveraction as “Texting left”.


Figure 13: Texting right

The Figure 13 shows that the model classified driveraction as “Texting on phone right”.



Figure 14: Talking on phone left

The Figure 14 shows that the model classified driveraction as “Talking on phone left”.

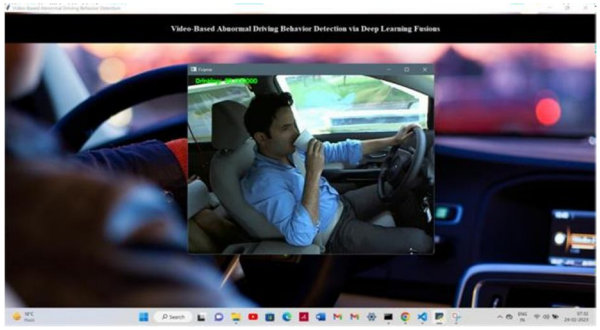


Figure 15: Drinking

The Figure 15 shows that the model classified driveraction as “Drinking”.

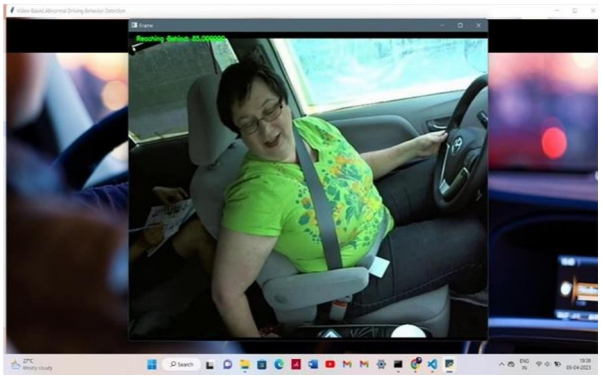


Figure 16: Reaching Behind

The Figure 16 shows that the model classified driveraction as “Reaching Behind”.



Figure 17: Hair and Makeup

The Figure 17 shows that the model classified driveraction as “Hair and Makeup”.

In the next part of this project, live video distracted action classification is done. On clicking the live camera button, a new window opens where it recordsthe live actions and classifies the actions. It is implemented using OpenCV. The classified action is displayed on the top left corner of the window and forevery distracted action occurrence an alarm rings to alert the driver.

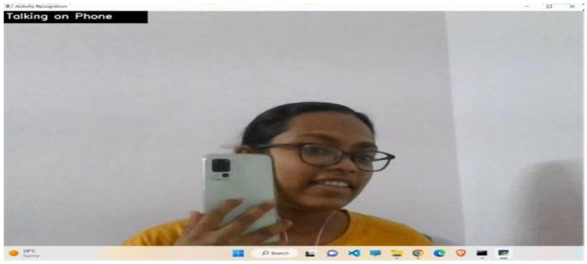


Figure 18: Talking on phone

The Figure 18 shows that the model classified driver action as “Talking on phone”.



Figure 19: Drinking

The Figure 19 shows that the model classified driver action as “Drinking”.



Figure 20: Texting

The Figure 20 shows that the model classified driveraction as “Texting”.

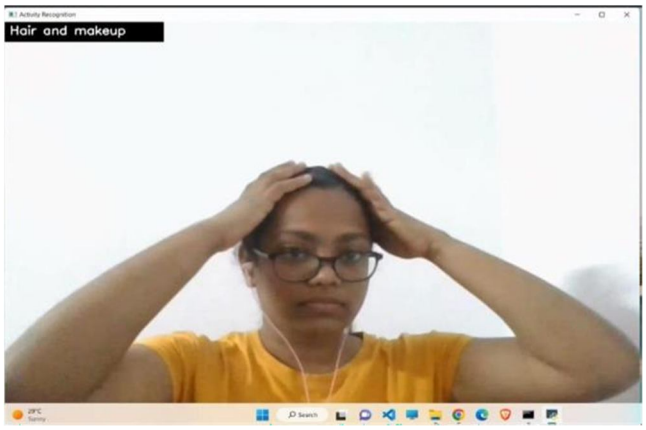


Figure 21: Hair and makeup

The Figure 21 shows that the model classified driver actionas “Hair and makeup”.

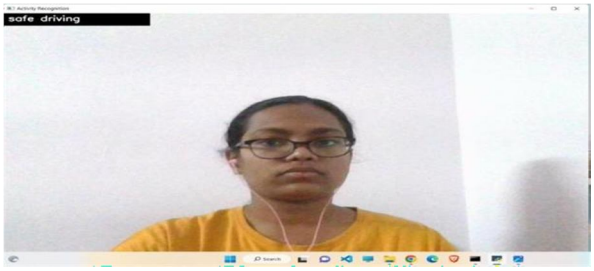


Figure 22: Safe Driving

The Figure 22 shows that the model classified driveraction as “safe driving”.

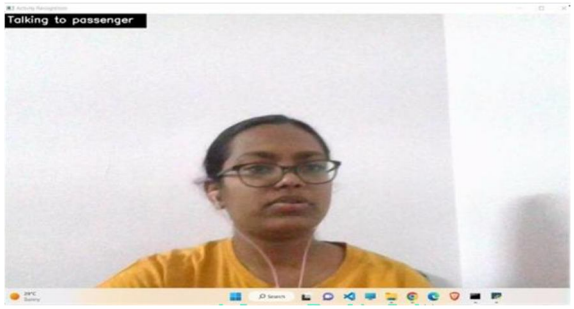


Figure 23: Talking to passenger

The Figure 23 shows that the model classified driveraction as “talking to passenger”.

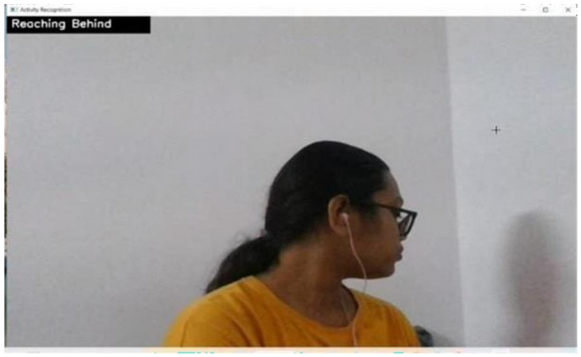


Figure 24: Reaching Behind

The Figure 24 shows that the model classified driver action as “Reaching Behind”.

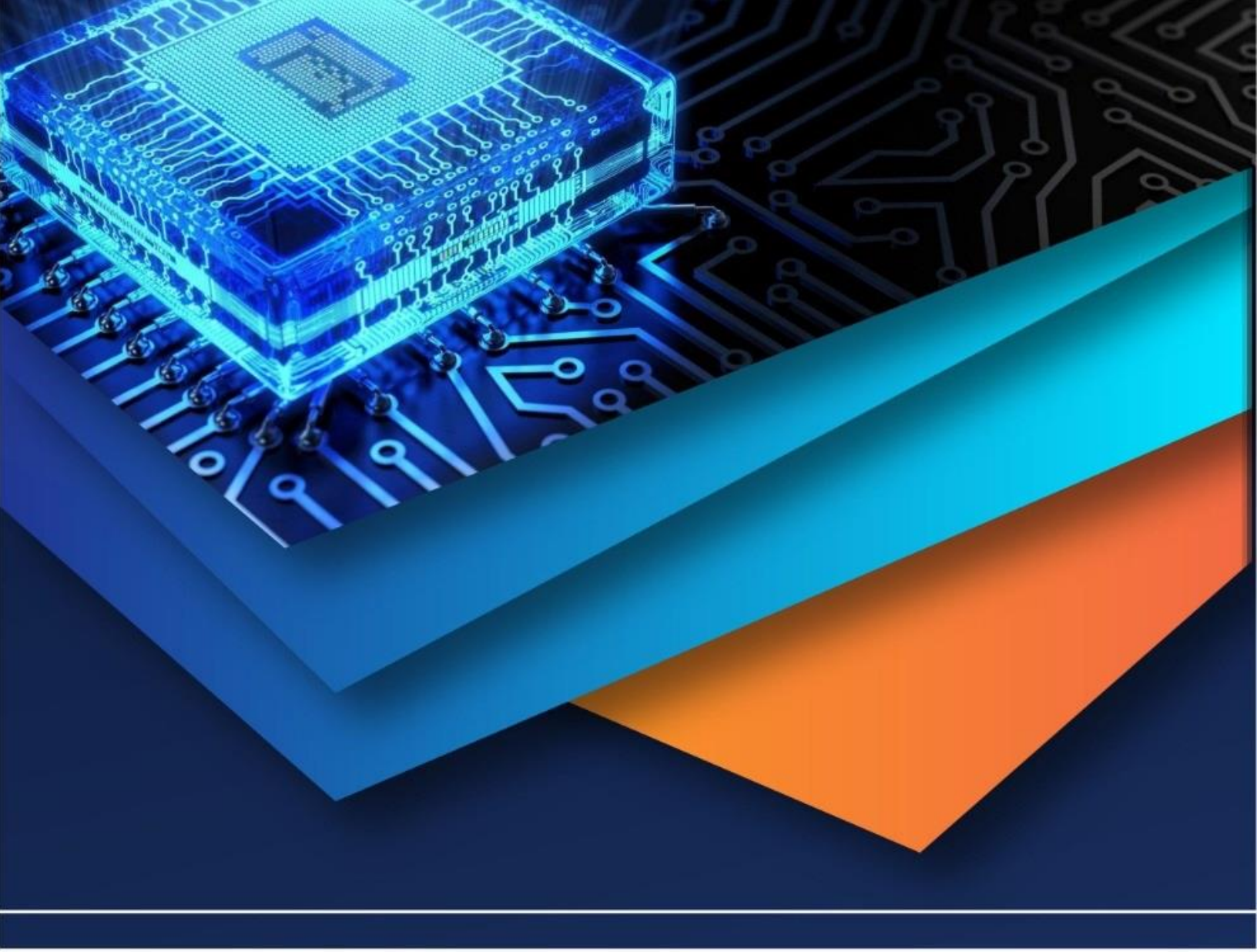
VII. CONCLUSION

The study of video recording-based detection of abnormal driving behavior has attracted the attention of many researchers and has become more important today than ever, due to the increasing count of accidents occurring worldwide. This is an automated and reliable system to ensure safety of the drivers and passengers, thus reducing the risks of accidents related deaths. It is receiving so much popularity these days as it has become a very crucial step to realise fully automated driving. The deep learning-based fusion model is used in the proposed method for the purpose of abnormal driving detection. The proposedmodel is very recently developed DenseNet and Resnet. The model is efficient because in the case of AWGRD Densenet model the previous layers are added. This method is very beneficial in the abnormaldriving behaviour detection task in a video-basedformat, as spatial and temporary hidden information can be comprehensively described by superpositions of previous layers. The AWGRD model classified thedriver actions with the accuracy 85%. For executing instantaneous live camera detection of distracted driving, Residual networks (Resnet) has been used. Inthe future, efficient and effective deep learning models can be realised via mobile chips to investigateabnormal driving behaviour detection. Provision of email notification, full body behaviour monitoring can also be implemented.

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