



INTELLIGENT DROWSY EYE DETECTION USING CONTOURLET TRANSFORM AND WEB LOCAL DESCRIPTORS

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ABSTRACT: There are various non-driver related reasons for automobiles crashes including street conditions, the climate and the mechanical execution of automobiles. However, a significant number of automobile accidents are caused by driver error. Driver error includes drunkenness, fatigue, and drowsiness. Many factors can affect a driver's ability to control a motor vehicle, such as natural reflexes, recognition and perception. The diminishing of these factors can eventually reduce a driver's vigilance level. There have been numerous "raising awareness" campaigns about drowsiness and drunken driving. However, they have been ineffective for the most part. Such accidents not only affect the drowsy drivers, but also any potential victims. Driver Drowsiness Detection, which is used to detect or not a driver is drowsy can use different features i.e. heart rate, eye status etc. This work introduces an alerting process for when the driver fall asleep based on computer vision based mechanism in which eye status has been calculated by extracting frames from the ongoing video. There are various features which has been found in literature i.e. DWT, statistics, LBP etc. but still an improvement was required as the drowsiness detection results was not similar when different classifiers were used. Hence a contourlet transform and web local descriptor based feature set has been proposed which gives high accuracy in drowsiness detection when different classifiers have been tested by this feature set. Also video compression does not affect much when we evaluated this feature set and high accuracy has been achieved by different classifiers

Keywords: Contourlet transform, Drowsiness, fatigue, compression.

I. INTRODUCTION

Drowsiness is basically characterized as "a condition of close rest because of weariness". It is actually unmistakable from weakness, which has been characterized as an "unwillingness to keep playing out the job that needs to be done". The impacts of languor and weariness are almost the same. Exhaustion influences mental readiness, diminishing a person's capacity to work a vehicle securely and expanding the danger of human blunder that could prompt fatalities and wounds. Languor moderates response time, diminishes mindfulness, and weakens judgment. Exhaustion and lack of sleep affect all transportation administrators (for instance: carrier pilots, truck drivers, and railroad engineers). In the two conditions, driver can't concentrate on essential errand of driving which may improve the probability of crash event. With the consistently developing movement conditions, this issue will additionally break down. Therefore, it is important to create driver readiness framework for mishap counteractive action [1]. In [2] image processing method is utilized for drowsiness recognition. The framework ought to distinguish the condition of the driver as ahead of schedule as could be allowed and the false identification rate ought to be diminished. The framework utilizes Gabor ordinal measures so as to identify the face. A nonintrusive drowsiness recognition method is used eye-tracking and image processing[3]. Open CV's library is used to accept each frame and store it in an image structure that can easily be used for further processing [4]. Eye movements of 14 drivers is observed using electrooculography (EOG) at the moving-base driving simulator of Mercedes Benz to assess driver drowsiness[5]. A module for automatic driver drowsiness detection based

on visual information and Artificial Intelligence is used to locate, track and analyze both the driver's face and eyes to compute a drowsiness index to prevent accidents[6]. Both face and eye detection is performed by Haar-like features and AdaBoost classifiers[7].

II. LITERATURE SURVEY

Cheng et al. [8] exhibit a nonintrusive laziness acknowledgment technique utilizing eye-following and picture handling. A hearty eye identification calculation is acquainted with address the issues caused by changes in light and driver act. Six measures are figured with level of eyelid conclusion, greatest conclusion length, and squint recurrence, normal opening level of the eyes, opening speed of the eyes, and shutting speed of the eyes.

Emam et al. [9] proposed integration between image mining technique and the developed real time drowsy eye detection architecture. They present Intelligent Drowsy Eye Detection using Image Mining (IDEDIM) system architecture.

G. Kong et al. [10] presents visual examination of eye state and head posture (HP) for ceaseless checking of sharpness of a vehicle driver. Most existing ways to deal with visual discovery of non-ready driving examples depend either on eye conclusion or head gesturing points to decide the driver tiredness or diversion level.

Loonis et al. [11] propose a novel wise reconnaissance framework to gauge driver sleepiness in light of the Observer Rating of Drowsiness (ORD) show incorporated into prove hypothesis through combination of path and eye

highlights. ORD is a subjective evaluation of sluggishness that is reflected in individuals' physical appearance, practices and peculiarities.

Majlis et al. [12] evaluate the use of electrooculogram (EOG) as an alternative to video-based systems in detecting eye activities caused by drowsiness. The EOG, which is the electrical signal generated by eye movements, is acquired by a mobile bio signal acquisition module and are processed offline using personal computer.

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Yang et al. [14] assess the execution of the most recent eye following situated in-vehicle weakness forecast measures. These measures are evaluated factually and by an arrangement technique in light of an extensive dataset of 90 hours of genuine street drives.

Oguri et al. [15] presents a novel method that uses eyelid closure and heart rate variability to estimate the driver's drowsiness level. Laboratory experiments were conducted by using a proprietary driving simulator, which induced drowsiness among the test drivers.

Bhuiyan et al. [16] present an improved method for estimating a driver's drowsiness level using eyelid closure and heart rate variability. Laboratory experiments were conducted by using a proprietary driving simulator, which induced drowsiness among the test drivers.

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III. PROPOSED WORK

The system module of the proposed system is shown in Figure 1. First of all, frames have been extracted from the captured video. Next eye region has been localized using cascade object detector. The cascade object detector uses the Viola-Jones algorithm to detect people's faces, noses, eyes, mouth, or upper body. Next a set of features are extracted from each eye patch to help discriminate between open and closed eye patches and used to build a Feature vector. Given an image feature set, different classifiers are employed to classify the images into drowsiness and non-drowsiness frame. The steps used are given below in figure 1.

- **Local Binary Patterns**

The local binary pattern is a powerful gray level invariant texture primitive [18]. The histogram of the binary patterns computed over a region is used for texture description [19].

- **Contour Let Transform**

Most of the classical frequency domain transforms such as Fourier transform, Discrete Cosine Transform and Wavelet transform are very efficient in capturing the details as far as they are exploited in one-dimensional context. In order to extract the details of an image, 2-D extensions are constructed from the 1-D separable basis functions. Such transforms are good at capturing the details when the image is a collection of 1-D piece-wise smooth signals.

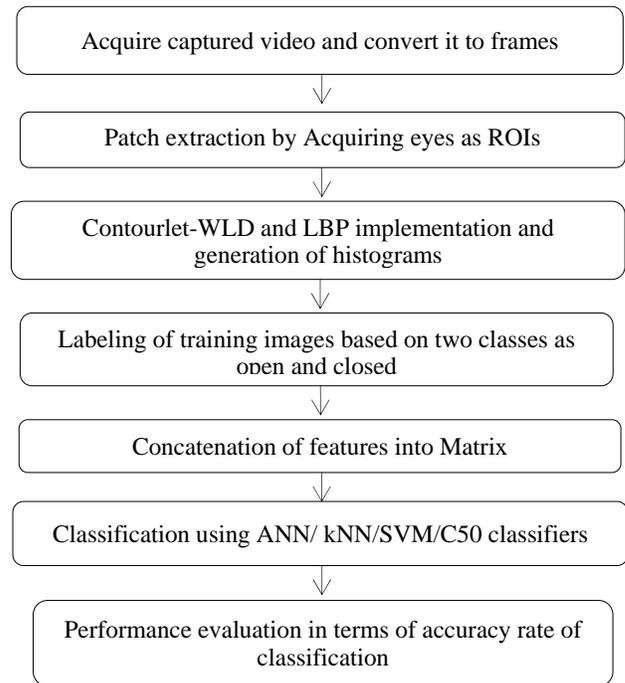


Figure 1: System Module

- **Weber Local Descriptors (WLD)**

Weber's law signifies the relationship between incremental threshold (ΔF) and surrounding intensity (F). It states that the ratio $\Delta F/F$ is always constant and denoted by Weber fraction [20] where, F is initial intensity in the signal/image and ΔF is the smallest change which is noticeable. For example, in signal processing context, in a crowded room, one has to speak loud in order to get heard, whereas a whispering sound is sufficient in a quiet place to get noticed. Such a phenomenon in the context of human vision is known as 'Just Noticeable Difference' (JND). Chen et al. [20] proposed the JND based Weber local descriptor (WLD) which became popular feature extraction technique for texture classification, face detection and face recognition. In particular, it leads to a representation close to biological human vision. The WLD histogram is constructed after mapping of differential excitation and orientation components. Further, it is projected onto 1-D space for classification efficiency.

IV. RESULT AND DISCUSSION

The receiver operating characteristic is a metric used to check the quality of classifiers. For each class of a

classifier, ROC applies threshold values across the interval [0, 1] to outputs. For each threshold, two values are calculated, the True Positive Ratio (TPR) and the False Positive Ratio (FPR). For a particular class *i*, TPR is the number of outputs whose actual and predicted class is class *i*, divided by the number of outputs whose predicted class is class *i*. FPR is the number of outputs whose actual class is not class *i*, but predicted class is class *i*, divided by the number of outputs whose predicted class is not class *i*.

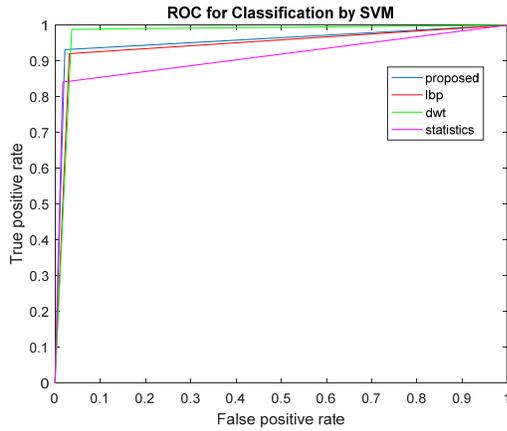


Figure 2: Receiver Operating Characteristics using SVM

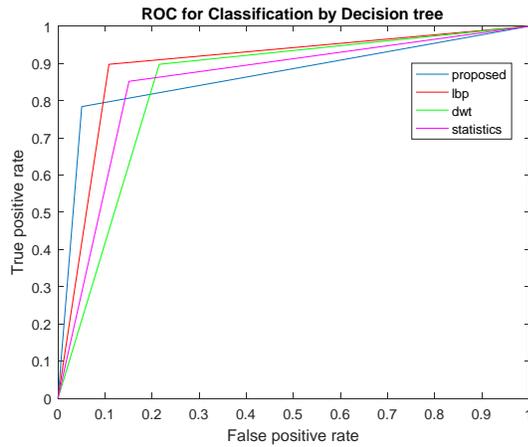


Figure 3: Receiver Operating Characteristics using Decision tree classifier

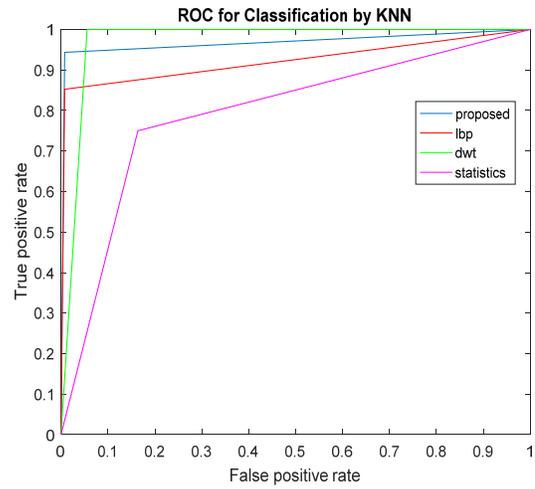


Figure 4: Receiver Operating Characteristics using KNN

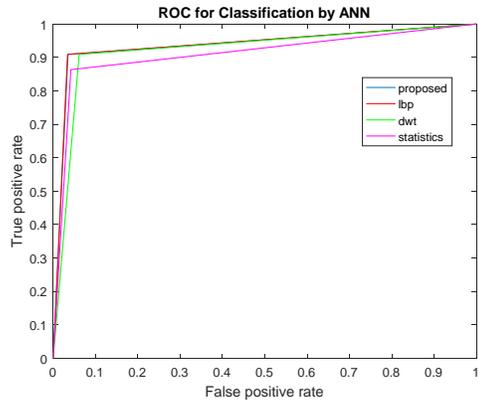


Figure 5: Receiver Operating Characteristics using ANN

The results for the actual pixel location using ground truth images and that of resulted outputs has been described with above parameters.

Table 1: Results in tabular form using different features and classifiers

Classifier used	Features used			
	LBP	DWT	Statistics	Contourlet-WLD and LBP
SVM	96.4143	96.5139	97.0120	97.4104
Decision tree	89.2430	79.4821	84.9602	93.5259
KNN	98.0080	94.9203	82.8685	98.8048
ANN	96.1155	93.6255	95.0199	96.0159

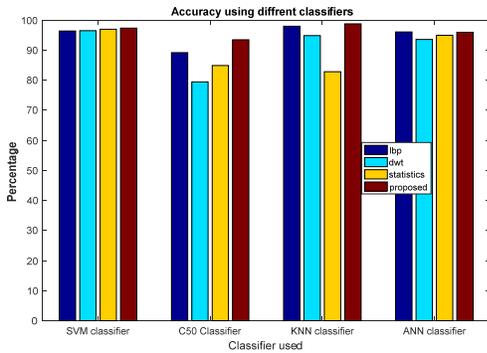


Figure 6: Classification Accuracy of different classifiers

Table 2: Results of classification after 50% video compression

Classifier used	Features used			
	LBP	DWT	Statistics	Contourlet-WLD and LBP
SVM	96.6056	96.0159	95.9163	97.4004
Decision tree	92.7291	91.6335	91.1355	93.5159
KNN	97.1116	96.6135	83.1673	98.8040
ANN	95.1076	90.5378	95.3187	96.0150

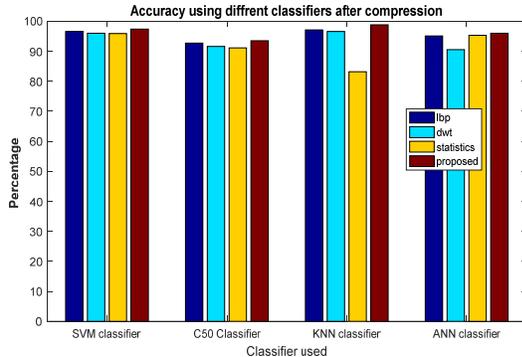


Figure 7: Classification Accuracy of different classifiers after compression

As shown in above table and graphs, there is not much difference in classification parameters when video has been compressed to 50%. However if we increase the compression ratio, results can be degraded due to small size of the patches.

V. CONCLUSION

Driver drowsiness was perceived as a vital reason in the vehicle mishaps. It is demonstrated that driving performance reduces with increase in drowsiness. Advanced innovation offers some would like to maintain a strategic distance from these sorts of mischances up to some degree. As video camera facility is easily available, a computer vision oriented mechanism can gives real time

results in alerting the driver when he/she feels sleepy based on the status of the eyes. Similar research has been explored in this work in which different types of features has been used on eye region. At first face has been detected from whole frame and later left and right eye patches has been extracted so that better features can be obtained only from eye region. Later a set of features has been evaluated in which LBP, statistics and DWT features has been used from existing literature and a new feature based on contourlet transform and web local descriptors has been introduced. Different classifiers i.e. ANN, SVM, decision tree etc. has been trained and tested using the extracted features from both closed and open eye datasets. Experimental results show high accuracy in drowsiness detection when new feature has been considered as compared to existed feature sets.

VI. REFERENCES

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