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Real Time Eye Blinking Detection Using OpenCV and DLIB

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ABSTRACT: Eye blink detection using OpenCV, Python, and DLIB is an advanced technique that plays a crucial role in applications like driver drowsiness detection, human-computer interaction, and fatigue monitoring. The process begins with face detection, where OpenCV's Haar cascades or deep learning-based detectors isolate the face region from an image or video stream. Subsequently, facial landmark detection is performed using DLIB's pre-trained shape predictor, which identifies 68 key points on the face, including those around the eyes. From these landmarks, specific points outlining the eye regions are extracted, typically involving six points per eye. The Eye Aspect Ratio (EAR) is then calculated by measuring the vertical eye-opening relative to its horizontal width. The EAR significantly decreases when the eyes close during a blink.

I. INRODUCTION

Detecting eye blinks is important for instance in systems that monitor a human operator vigilance, e.g. driver drowsiness [5, 13], in systems that warn a computer user staring at the screen without blinking for a long time to prevent the dry eye and the computer vision syndromes [17, 7, 8], in human computer interfaces that ease communication for disabled people [15], or for anti-spoofing protection in face recognition systems [11]. Existing methods are either active or passive. Active methods are reliable but use special hardware, often expensive and intrusive, e.g. infrared cameras and illuminators [2], wearable devices, glasses with special close-up cameras observing the eyes [10]. While the passive systems rely on a standard remote camera only. Many methods have been proposed to automatically detect eye blinks in a video sequence.

II. LITERATURE SURVEY

A. Asthana(2022)The development of facial databases with an abundance of annotated facial data captured under unconstrained 'inthe-wild' conditions have made discriminative facial deformable models the de facto choice for generic facial landmark localization. Even though very good performance for the facial landmark localization has been shown by many recently proposed discriminative techniques, when it comes to the applications that require excellent accuracy, such as facial behaviour analysis and facial motion capture, the semi-automatic person-specific or even tedious manual tracking is still the preferred choice. One way to construct a person-specific model automatically is through incremental updating of the generic model. This paper deals with the problem of updating a discriminative facial deformable model, a problem that has not been thoroughly studied in the literature. In particular, we study for the first time, to the best of our knowledge, the strategies to update a discriminative model that is trained by a cascade of regressors. We propose very efficient strategies to update the model and we show that is possible to automatically construct robust discriminative person and imaging condition specific models 'in-the-wild' that outperform state-of-the-art generic face alignment strategies.

L. M. Bergasael. at.el(2021)This paper presents a non-intrusive prototype computer vision system for monitoring driver's vigilance in real-time. It is based on a hardware system, for real time acquisition of driver's images using an active IR illuminator, and their software implementation for monitoring some visual behaviors that characterize a driver's level of vigilance. Six parameters are calculated: PERCLOS, eye closure duration, blink frequency, nodding frequency, face position and fixed gaze. These parameters are combined, using a fuzzy classifier, to infer the inattentiveness level of the driver. The use of multiple visual parameters and the fusion of them yield a more robust and accurate inattention characterization than by using a single parameter. The system has been tested with different sequences recorded in night and day driving conditions in a motorway and with different users. Some experimental results and conclusions about the performance of the system are shown.

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J. Cech et.al(2022)A real-time algorithm for accurate localization of facial landmarks in a single monocular image is proposed. The algorithm is formulated as an optimization problem, in which the sum of responses of local classifiers is maximized with respect to the camera pose by fitting a generic (not a person specific) 3D model. The algorithm simultaneously estimates a head position and orientation and detects the facial landmarks in the image. Despite being local, we show that the basin of attraction is large to the extent it can be initialized by a scanning window face detector. Other experiments on standard datasets demonstrate that the proposed algorithm outperforms a state-of the-art landmark detector especially for non-frontal face images, and that it is capable of reliable and stable tracking for large set of viewing angles.

M. Chau and M. Betke(2019)A human-computer interface (HCI) system designed for use by people with severe disabilities is presented. People that are severely paralyzed or afflicted with diseases such as ALS (Lou Gehrig's disease) or multiple sclerosis are unable to move or control any parts of their bodies except for their eyes. The system presented here detects the user's eye blinks and analyzes the pattern and duration of the blinks, using them to provide input to the computer in the form of a mouse click. After the automatic initialization of the system occurs from the processing of the user's involuntary eye blinks in the first few seconds of use, the eye is tracked in real time using correlation with an online template. If the user's depth changes significantly or rapid head movement occurs, the system is automatically reinitialized. There are no lighting requirements nor offline templates needed for the proper functioning of the system. The system works with inexpensive USB cameras and runs at a frame rate of 30 frames per second. Extensive experiments were conducted to determine both the system's accuracy in classifying voluntary and involuntary blinks, as well as the system's fitness in varying environment conditions, such as alternative camera placements and different lighting conditions.

III. METHODOLOGY

The study of this project is to develop a Real-time eye blink detection and counting using OpenCV and Dlib involves creating a system that can accurately detect and count eye blinks as they happen. This system uses a webcam to capture live video and processes each frame to identify and track the eye regions. OpenCV, a computer vision library, handles image processing tasks, while Dlib, a toolkit for machine learning, is used for detecting facial landmarks. By calculating the Eye Aspect Ratio (EAR) from these landmarks, the system determines if the eyes are open or closed. Blinks are counted based on changes in the EAR.

DISADVANTAGES OF EXISTING SYSTEM:

- It not performs well on faces with extreme expressions or in challenging scenarios, such as fast-moving subjects
- Significant changes in head pose or occlusions (e.g., hair, glasses) can hinder accurate landmark detection.
- Landmark detection can be resource-heavy, requiring powerful hardware for smooth operation.

PROPOSED SYSTEM

The eye blink is a fast closing and reopening of a human eye. Each individual has a little bit different pattern of blinks. The pattern differs in the speed of closing and opening, a degree of squeezing the eye and in blink duration. The eye blink lasts approximately 100-400 ms. We propose to exploit state-of-the-art facial landmark detectors to localize the eyes and eyelid contours. From the landmarks detected in the image, we derive the eye aspect ratio (EAR) that is used as an estimate of the eye opening state. Since the perframe EAR may not necessarily recognize the eye blinks correctly, a classifier that takes a larger temporal window of a frame into account is trained.

ADVANTAGES OF PROPOSED SYSTEM:

- Consistent detection in varying lighting conditions.
- Multi-view facial landmark detection models that can handle a wider range of head poses.
- Techniques to filter out noisy detections and improve the reliability of blink detection.
- Using more efficient algorithms and reducing the resolution of the input frames.

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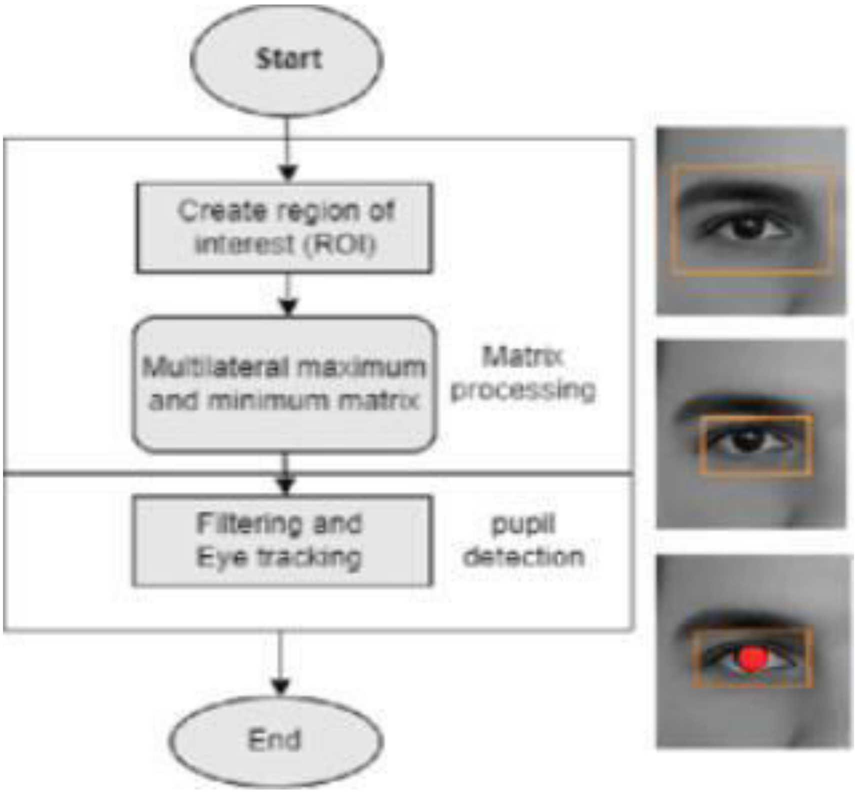
SYSTEM ARCHITECTURE:



MODULES:

1. **Environment Setup** :The setup begins by installing OpenCV, Dlib, and Imutils for video processing, facial landmark detection, and image manipulation. A Python development environment, such as Jupyter or PyCharm, is configured. This ensures the libraries are ready for use in the application.
2. **Load Pre-trained Models**:Dlib's pre-trained shape predictor model is used for facial landmark detection. This model identifies 68 key facial points, including the eyes, nose, and mouth. It is downloaded and loaded to facilitate accurate detection.
3. **Live Capture :**OpenCV initializes real-time video capture using the device's camera. Each video frame is processed to detect and analyze facial features in real time. This enables a dynamic and continuous input stream.
4. **Face and Eye Detection :**Dlib's facial landmark detector identifies faces in each frame. Key regions like the eyes are extracted using specific indices from the detected landmarks. These eye regions are then used for further analysis.
5. **Compute EAR (Eye Aspect Ratio)**:EAR is calculated using the coordinates of eye landmarks, indicating whether the eyes are open or closed. A threshold, such as 0.2, is used to classify the state. This value is computed for both eyes, and the average is used.
6. **Blink Counting :**A blink is detected when the EAR value falls below the threshold and then rises above it. Each blink is accurately counted based on this logic, providing real-time feedback on blinking activity.
7. **Display Results :**The processed video feed is displayed with overlays of detected facial landmarks and the blink count. The real-time display ensures an interactive experience, with clear visual updates for the user.

IV. IMPLEMENTATION

The blink detection system integrates OpenCV, Dlib, and Flask for real-time functionality. OpenCV captures video frames from the webcam, which are converted to grayscale for efficient face detection. Dlib's pre-trained facial landmark model identifies key facial points, specifically those around the eyes. The Eye Aspect Ratio (EAR) is computed using these landmarks to determine if the eyes are open or closed. A blink is counted when the EAR falls below a threshold and rises above it. Flask serves as the web framework, providing a live video stream of the processed

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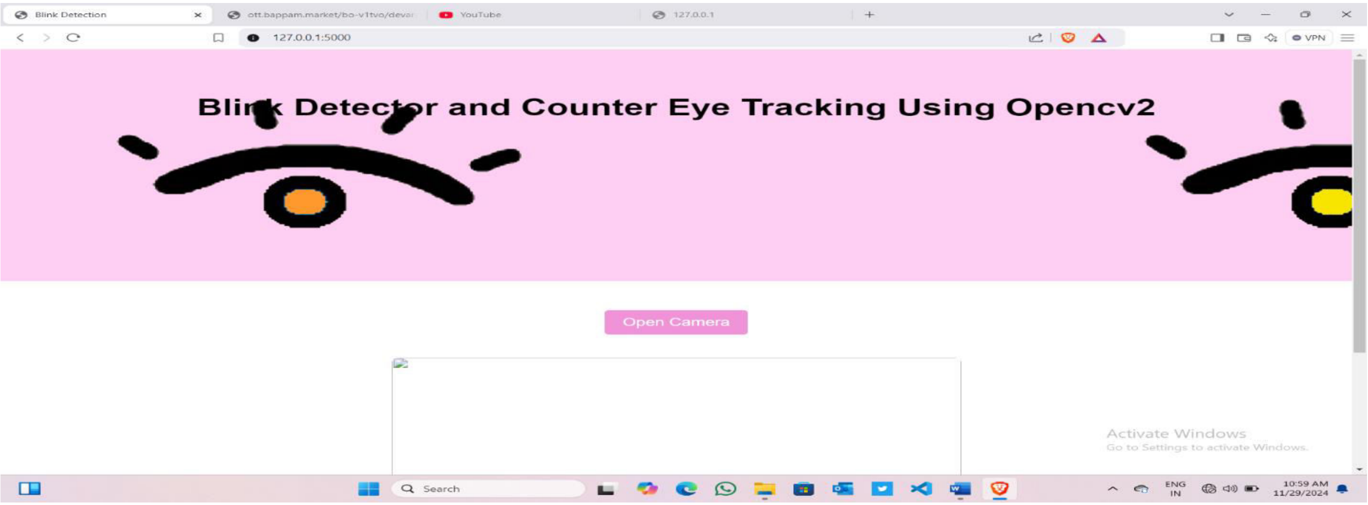
frames with overlaid blink counts and status indicators. The system ensures real-time interaction and seamless visualization, making it effective for applications like fatigue monitoring and human-computer interaction.

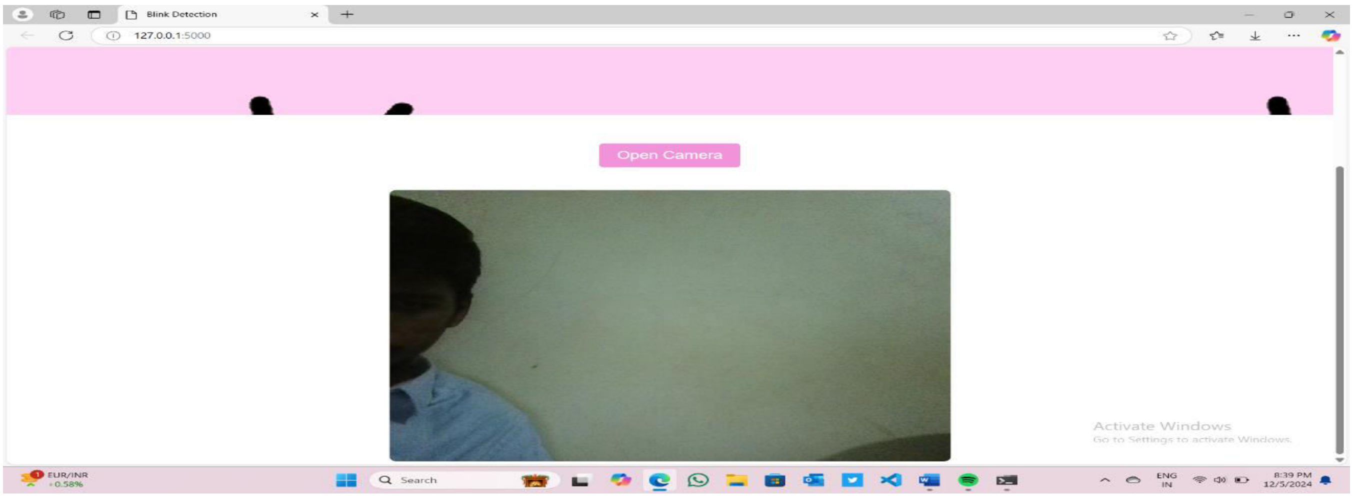
V. EXPERIMENTAL RESULTS

HOME PAGE:



EXPLANATION: This is the homepage which will describe the button as open camera after clicking it will redirect to another space using OpenCV. After that webcam or camera will be opened and it will detect the count of eye blink.

TEST RESULT PAGE:



EXPLANATION: This page will open after we click the open camera, then it will capture the image and finds eye's in green color and blink count will be counted and showed on the screen with another color

VI. CONCLUSION

In conclusion, a real-time eye blink detection algorithm was developed and demonstrated to be effective. The regression-based facial landmark detectors used in this project proved to be precise enough to reliably estimate the level of eye openness.The algorithms howed robustness to various challenging conditions,including low image quality, low image resolution,non-formality, poor illumination,and facial expressions.The accuracy of the eye blink detect or was quantitatively measured by the Area UndertheCurve(AUC)as afunction ofimage resolution. This robustness ensures the

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system's applicability in real-world scenarios,making it a valuable tool for applications such as driver drowsiness detection and user engagement analysis.

VII. FUTURE ENHANCEMENT

Future enhancements for the real-time eye blink detection system include improving accuracy by integrating advanced machine learning models and optimizing the algorithm for faster performance on low-power devices. Adaptive thresholds for Eye Aspect Ratio (EAR) can be implemented to account for individual differences in eye shape and blinking patterns. Enhancements to robustness against occlusions and support for multi-person detection are also important. Integration with other sensors,such as heart rate monitors,can provide comprehensive monitoring solutions. Improving the user interface, extending cross-platform support, and exploring new applications in medical diagnosis,lie detection,and adaptive gaming are key areas for development. Finally, extensive real-world testing will ensure the system's reliability and effectiveness in diverse environments.

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