Sleep Detection using Facial Landmarks withc Dlib and OpenCV

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Abstract— **This program can be use to detect driver drowsiness. Or monitoring patient condition at hospital, avoiding them falling into comma without notice.**

Keywords— **Sleep Detection, Facial Landmarks.**

I. INTRODUCTION

Nowaday computer science has become the driving force behind the development of the world. Computer need not only to be faster but smarter as well.

A reliable method of detecting human asleep can be helpful. As it can be used in vehicle to detect driver drowsiness or to aid doctor to monitor patient condition.

The methods being used for sleep detection are either active or passive. Active methods require devices such as: glasses with closed-up camera[2,9] which can be very expensive. Passive methods use a static camera only.

There are many methods have been used to detect eye closing in a video. Some are based on estimating eye region motrion. Typically, the face and eyes are detected by a Viola-Jones type detector. Next, motion in the eye area is estimated from optical flow, by sparse tracking [6,7], or by frame-to-frame intensity differencing and adaptive thresholding. Finally a decision is made to decide whether the eyes are cover by the eyelids [8,13]. A different approach is to infer the state of the eye opening from a single image, as e.g. by correlation matching with open and closed eye tem- plates [3], a heuristic horizontal or vertical image intensity projection over the eye region [4,5], a parametric model fitting to find the eyelids [15], or active shape models [12].

However, these methods rely heavily in the setup and are easily affected by the evironment.

Nowaday, robust real-time *facial land- mark detectors[1,11,14,16]* that capture most of the characteristic points on a human face image, including eye corners and eyelids, are available, see Fig. 1. With a error below five percent, the detector can be use together with a simple algothithm to effectively distingush between close and open eyes. Therefore helps to detect sleep.

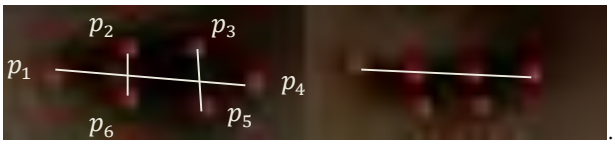


Figure 1: The result of the algorithm drops significantly when the eye shut(from above 0.2 to under 0.1).

II. THE EAR ALGORITHM

For every video frame we compute the eye aspect ratio(EAR)[17] between height and width of the left eye, then the right eye. After that we calculate the average of the results. If the average is lower than 0.2, the eyes are considered close.

$$EAR = \frac{|p_2 - p_6| + |p_3 - p_5|}{2|p_1 - p_4|}$$

With $p_1, \dots, p_6$ are the points marked on your eye.

III. THE PROGRAM

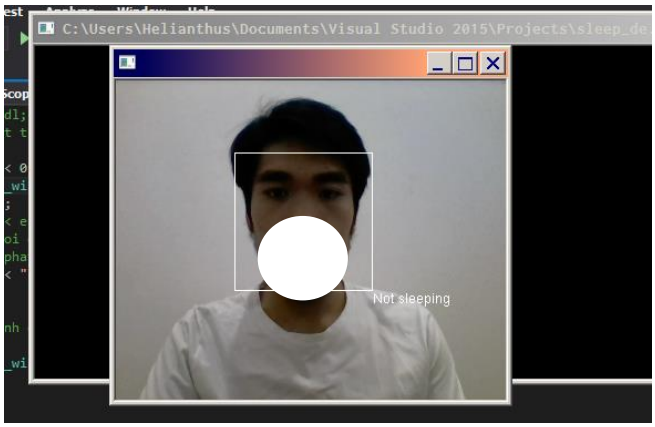
OpenCV, Dlib and C++ are combined to generate to code for the task. OpenCV is a well developed and widely used computer vision library. Dlib is a modern C++ toolkit containing machine learning algorithms and tools for creating complex software in C++ to solve real world problems. It is used in both industry and academia in a wide range of domains including robotics, embedded devices, mobile phones, and large high performance computing environments. Dlib's open source licensing allows you to use it in any application, free of charge. For the developing environment, visual studio 2015 community version is suited.

The hardware configuration used to test the program is:

- Processor: Intel Core i5-4200U CPU 1.60GHz-2.30GHz
- RAM: 4.00GB (3.89GB usable)
- System type: 64-bit Operating System
- OS: Window 7 Ultimate SP1 64-bit

With this system, the program perform at real-time with frame size of 480x320 and produce accurate classification between sleeping and not sleeping.

The program can work well at the distance of 40cm between the eye and the camera. And the distance can be increase up to 1m with a small drop in performance.



IV. CONCLUSION

The paper show how we can combine mordern computer vision library with the high performance of C++ to create real time recognition task. With the right algothithm, the facial landmark detector can be used in effectively classifing face expresions or reading speech in real time at a low cost of equipment.

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[17]Real-Time Eye Blink Detection using Facial Landmarks
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