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A Survey on Pulse Rate Monitoring Using Image Processing and ML

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ABSTRACT:-Heart rate is an important indicator of people's physiological state. Recently, several projects reported methods to measure heart rate remotely from face videos. Those methods work well on stationary subjects under well controlled conditions, but their performance significantly degrades if the videos are recorded under more challenging conditions, specifically when subjects' motions and illumination variations are involved.

I. INTRODUCTION

Heart beat sensing without any physical contact using signal and image processing is one of the best techniques. Image and Signal processing is the use of computer algorithms to perform image processing and for improving the accuracy of digital images/ videos. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Heart Rate Variability can be estimated from simple recorded facial video which makes evaluation easier, cheaper. Our basic approach is to consider the time series of colour values any spatial location and amplify variation in a given temporal frequency band of interest.

LITERATURE SURVEY

SR. NO	TITLE	AUTHOR NAME	PUBLICATION	DESCRIPTION
1	Emotion & Heartbeat Detection using Image Processing	KaushalKanakia, SaurabhPatil, SujaySabnis, Vedant Shah	International Journal of Scientific & Engineering Research Volume 9, Issue 3 2018	Emotions can be detected by using Haar cascades, feature extraction from ROI and then processing it. OpenCV and Python has been used for human computer interaction. For the detection of heartbeat, they used remote photoplethysmography. This paper discusses the reimplementation of one such approach that uses independent component analysis on mean pixel color values within a region of interest (ROI) about the face
2	Real Time Heart Rate Monitoring From Facial RGB Color Video Using Webcam	H. Rahman, M.U. Ahmed, S. Begum, P. Funk	The 29th Annual Workshop of the Swedish Artificial Intelligence Society (SAIS) 2016	A real time noncontact based HR extraction method is described in this paper using facial video which is easy to implement, low cost and comfortable for real time applications. Here, the main idea is to extract HR from the color variation in the facial skin due to cardiac pulse and the implementation has been done using a simple webcam in indoor

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				environment with constant ambient light.
3	Heart Rate Monitoring using Peak Detection in Photoplethysmography Signals of Fingertip Images Captured using Smartphone	Jean Effil N, Rajeswari R	International Journal of Recent Technology and Engineering (IJRTE) Volume-8 Issue-2, 2019	In this paper, a smartphone-based application that uses the variation of skin color observed in sequence of fingertip images along with a peak detection algorithm proposed to calculate heart rate is introduced. The computation of heart rate directly from raw PPG data without using any preprocessing techniques such as smoothing or filtering is elaborately discussed.

II. ALGORITHM PROPOSED

Detecting Heartrate and Emotions consists of 3 sections which are mentioned below. Firstly, the facial region must be detection. Secondly, desired region of interest (ROI) must be chosen within face bounding box. And third, the plethysmography signal and emotions must be extracted from the change in pixel colours within the ROI over time and analysed to determine the prominent frequency within the heart rate range.

Face Detection and Tracking

Face detection and tracking is performed using Haar cascade classifiers as proposed by Viola and Jones. Specifically, we use the OpenCV Cascade Classifier pre-trained on positive and negative frontal face images. The face detector is built from a cascade of classifiers of increasing complexity, where each classifier uses one or more Haar-like features. The features consist of two, three, or four rectangular pixels. Each feature is calculated as the sum of pixels in the grey rectangles less the sum of pixels in the white rectangles. These features are able to detect simple vertical, horizontal, and diagonal edges and blobs. Since there are over 180,000 potential features in each sub-window, only a small subset of these features is actually used. The AdaBoost learning algorithm is used to train classifiers built on one to a few hundred features. To choose which feature(s) to use, a weak classifier is trained on each feature individually and the classification error is evaluated. The classifier (and associated feature) with the lowest error is chosen for that round, the weights are updated, and the process is repeated until the desired number of features are chosen. This process creates a single strong classifier that is a weighted combination of numerous weak classifiers. The strong classifiers are then used in series in the attentional cascade, which is essentially a decision tree for each sub-window within the image.

Region of Interest (ROI)

Since the face bounding box found using face detection contains background pixels in addition to the facial pixels, an ROI must be chosen from within the bounding box. The simplest choice of ROI is to use the center 60% of the bounding box width and the full height. Since the bounding box is usually within the face region height-wise but outside the face width-wise, this method simply adjusts the box to exclude background pixels to the sides of the face. With this method, some hair or background pixels are usually still present at the corners of the box. We also explore other means of selecting the ROI. We examine the effects of removing the eye region, which contains nonskin pixels that may vary across frames due to blinking or eye movement. Removing pixels from between 25% and 50% of the bounding box height worked well to remove the eyes. We also explore retaining only the pixels above the eye region, since the fore-head has the strongest plethysmography signal.

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III. PROPOSED METHODOLOGY

Pulse rate is one of the most important physiological parameters to be measured in-home health monitoring system. As it is well said in English proverb "prevention is better than cure" pulse rate monitoring in our routine daily activity plays the main role in preventing an illness than to treat it. In this project, a new, low price easily accessible method to monitor human pulse rate by using PC webcam is presented. The method implements the Haar cascade classifier algorithm presented in OpenCV to detect human face. By limiting a region of interest (ROI) in the face and extracting the raw RGB trace to a video frame in the ROI, independent component analysis (ICA) is applied to determine the strongest source signal used to estimate the pulse rate in beat per minute (BPM). A graphical user interface is also designed to make this application more convenient for a user.

IV. CONCLUSION

A real time noncontact based HR extraction method is described in this paper using facial video which is easy to implement, low cost and comfortable for real time applications. Here, the main idea is to extract HR from the colour variation in the facial skin due to cardiac pulse and the implementation has been done using a simple webcam in indoor environment with constant ambient light. This non-contact technology is promising for medical care and others indoor applications due to widespread availability of camera specially webcams. For applications in outdoor environment for example driver monitoring, few things such as variable environmental illumination or head movement should be considered. Also, to increase the efficiency, the experiment needs to be done by more test subjects and more verifying systems.

V. FUTURE SCOPE

1. With the help of IoT this system can also be modified to send real time data to medical professionals for analysis and alerts.

2. Feature such as video calling or chat can be added to provide conversation platform between user and medical professional.

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