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HEART RATE PREDICTION WITHOUT USING PHYSICAL DEVICES

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ABSTRACT

Heart Rate (HR) is one of the foremost necessary Physiological parameters and a vital indicator of people's state and is thus important to watch. Monitoring of unit of time typically involves high prices and sophisticated application of sensing elements and sensor systems. Analysis progressing throughout the last decade focuses additional on noncontact primarily based systems that area unit straightforward, low-priced, and simple to use. This project presents a true time unit of time watching methodology employing a digital camera of a laptop or a computer. The center rate is obtained through facial colour variation caused by blood circulation. Three totally different signal process ways like quick Fourier remodel (FFT), freelance element Analysis (ICA), and Principal element Analysis (PCA) is applied on the colour channels and compared to corresponding reference measurements.

KEYWORDS: *Quick Fourier Remodels (FFT), Principal Element Analysis (PCA), Freelance Element Analysis (ICA), Heart Rate, Region of Interest (ROI), Red, Green and Blue (RGB)*

Article History

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INTRODUCTION

In recent years, new technologies used for providing clinical health care remotely have appeared and new fields like tele medicine have knowledgeable about vast advancements. New ways for observance of patients mechanically are developed, likewise as techniques for measuring physiological parameters out of the hospital. one among these parameters is that the rate, and it's sometimes employed by medical professionals to help in the designation. However, the knowledge provided by the heartbeat isn't solely helpful in telemedicine, however conjointly in different fields like automatic feeling recognition, interactive videogames, or sport-people observance.

For this reason, this project addresses the planning, analysis, and implementation of a system ready to estimate the guts rate of individual exploitation solely facial video data coming back from a customary digital camera. By the utilization of photo plethysmography techniques and processing tools, the planned methodology captures the tiny illumination changes created within the user's face due to the variation within the number of blood gifts on the surface of the skin. This system permits AN unnoticeable thanks to living people's rate at any place, with none e ort over being before of a video camera.

This project consists of planning, evaluating, and implementing a noncontact pulse estimation system mistreatment Face reading. Following the theme projected by, this work is concentrated within the development of a period application capable of police work the time unit of an individual employing a commonplace digital camera. This involves capturing the little light-weight fluctuations that area unit created within the user's face as a result of the heartbeat. These little light-weight fluctuations (imperceptible to the human eye) are often perceived by a regular photographic camera.

In the existent algorithms of non-contact time unit measurements, it's essential that users stay still, breathe ad-lib and face the camera for a moment. During this context, this project presents some enhancements, which include hardiness to user's motion, reduction of the time exposure before of the camera, and period estimation method.

THEORETICAL ASPECTS

Heart Rate Monitoring Using Face Reading

Heart Rate (HR) is one of the foremost necessary Physiological parameters and an indicator of people's state and is therefore important to observe. Watching a unit of your time usually involves high costs and complex application of sensing parts and device systems. Analysis progressing throughout the last decade focuses further on noncontact-based totally systems that unit of measurement easy, low-priced, and comfortable to use. This project presents a real of time look methodology using a camera of a portable computer or a computer. The middle rate is obtained through facial colour variation caused by blood circulation.

Used Algorithms

In this work we are going to present only the algorithms that we are going to use in our system:

- **Fast Fourier Transform:** The average of the R, G, and B signals was calculated for the FFT technique. The normalized raw traces were rotten into 3 freelance supply signals (R, G, and B) supported the joint approximate resolving of the chemist matrices (JADE) algorithmic program. The data assortment was purported to perform in a very sitting position with no movement however in point of fact, they take a look at persons captive their hands and head a bit that is that the reason for motion artifacts.
- **Independent Component Analysis:** ICA is employed that is in a position to get rid of motion-artifact by separating the fluctuations caused by little motions or movement. Apparently, ICA returns the freelance parts indiscriminately and therefore the part whose power spectrum contained the very best peak is then chosen for any analysis.
- **Principal Component Analysis:** Transformation is outlined in such how that the primary principal element has the most important attainable variance and every succeeding element successively has the best variance attainable below the constraint that it's orthogonal to the preceding parts. The ensuing vectors area unit AN unrelated orthogonal basis set. The principal parts area unit orthogonal as a result of they're the eigenvectors of the variance matrix, which is bilateral. PCA is sensitive to the relative scaling of the primary variables.

DESIGN OF SYSTEM

The system of web mining is split in three subsystems. At the subsequent, we are getting to describe the various modules of everyone.

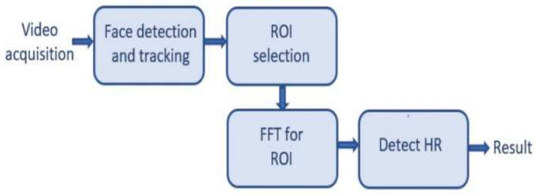

Figure 1

Subsystem of Exploration

Face Detection and Tracking Module: Facial image is the input of the proposed non-contact HR monitoring algorithm and therefore it is very important to track facial part of the user. The real time method needs a powerful face tracking method to perform higher face detection rate. The Face detection can be performed using the classical feature based cascade classifier models are organized into a hierarchy of increasing complexity called a cascade. A modern implementation of classifier cascade face detection algorithm is provided within the Open CV library. This is often a C++ computer vision library that provides a python interface. The advantage of this implementation is that it provides pre trained face detection models and provides an interface to coach a model on your own dataset. Open CV provides the Cascade Classifier class which will be wont to create a cascade classifier for face detection. The constructor will take filename as an argument that specifies the XML file for pre trained model. Input is from Camera. Output indicates the detected face.

ROI Selection: A region of interest (ROI) containing useful pulse information is detected. Skin pixels containing pulse information, thus face detection followed by removing non-skin pixels are performed for ROI extraction. Usually, a face is detected using Open CV or model based face detectors. Subsequently, non-skin pixels due to background and hairs, are removed by applying skin colour discrimination techniques. Inevitable movements (like eye blinking) near the attention areas can degrade the HR estimation. Thus, the eye areas are detected by employing facial geometry heuristics or trained classifiers and then these eye areas are removed for the better estimation. The remaining face area is used to define the region of interest (ROI). Some commonly used ROI are forehead region or cheek areas. Input is the Face detected from the Camera input. Output gives R, G,B colour values extracted from ROI detected images.

FFT for ROI: Environmental parameters changes like temperature or external noise, the collected RGB signals are going to be drifting and noising. Therefore the signals got to detrend. The RGB signal has been detrended using the method used in [41] based on smoothness priors approach with the smoothing parameter λ =10 and cut-off frequency = 0.059 Hz.

Before applying PCA, ICA and FFT the Red, Green and Blue signals formed from all red, green and blue image frames are filtered by Hamming window (128 point, 0.6-2 Hz, for normal HR 36-120).The signal needs to be normalized and the normalization has been performed $Xi(t) = Yi(t) - \mu i(t)/ \delta i$, For each i = R, G and B signals where μi is the mean and δi is the standard deviation of Y. Three algorithms such as FFT, ICA and PCA have been applied at the same time.Fast Fourier Transform (FFT) is applied to the guts beat signal and therefore the frequency like the utmost amplitude within the pulse spectrum corresponds to the heart rate. For the ICA method, the normalized raw traces are decomposed to three independent source signals. To extract HR in real time at first the number of peaks in frequency domain was calculated for

first 50 image frames and also the required time was recorded. Therefore HR is calculated as HR = 60*f□ bpm (beats per minute) where f□ is that the extracted frequency of the HR. Output gives Heart rate of the person.

Detect HR: A Graphical User Interface (GUI) has been developed using MATLAB to monitor HR in real time which has 3 main sub-sections. The final output shows the real time HR monitoring Graphical User Interface (GUI) which displays the 3 subsections such as detected face, pulse peak and current HR using the three methods. Output gives Pulse peak and current Heart Rate of the person.

CASE STUDY

The case study has like main objective to describe the behaviour of this project:

Operation of the System

At the beginning, our system looks like,

Figure 2: When You Click "START".

Figure 3: Your Heart Rate, Pulse Peak Graph, Fps Count on Separate Screen.

Result Analysis

The obtained results show that there's a high degrees of agreement between the proposed experiments and reference measurements. This technology has enough potential for advancing personal health care and telemedicine. Further improvements of the proposed algorithm considering environmental illumination and movement are often very useful in many real time applications like driver monitoring.

CONCLUSIONS

Heart rate monitoring is essential, as unusual charges related to the cardiovascular system help to obtain a diagnosis. Among all the pulse monitoring methods, the non-contact ones are considered to become the most useful in daily life and IoT applications. The approach we have presented is solving the problem of multiple-subjects heart rate monitoring and makes a mobile implementation to become feasible. We verify that this method will be able to perform equally well under varying movement and physiological conditions. The face is detected and continuously tracked Signal is obtained by determining the facial color in every frame pulse is estimated using frequency analysis and filtering of the series. The region of interest is an area of the image, selected on specific criteria, which is to be used during the computational process. In order to observe the skin color variation, the most suitable area is the forehead as it provides detailed changes encountered. The FFT (Fast Fourier Transform) is applied to the window formed by the last 200 frames of the signal obtained at the previous point. Since normal heart rates are between 35 and 195 beats per minute, frequency filtering can be applied to correct false readings. The heart rate translates to a frequency between 0.5 Hz and 3 Hz.

REFERENCES

1. *C. Takano and Y. Ohta. Heart rate measurement based on a time-lapse image. Medical Engineering and Physics, vol. 29, pp. 853-857, 2007.*
2. *W. Vekruysse, L.O. Svaas and J.S. Nelson. Remote plethysmographic imaging using ambient light. Optics Express, 2008.*
3. *J. Allen. Photoplethysmography and its application in clinical physiological measurement. Physiological Measurement, vol. 28, pp. R1-R39, 2007.*
4. *M.Z. Poh, D.J. McDu and R. Picard. Non-contact, automated cardiac pulse measurements using video imaging and blind source separation. Optics Express, vol. 18, pp. 10762-10774, 2010.*
5. *M.Z. Poh, D.J. McDu and R. Picard. Advancements in noncontact, multiparameter physiological measurements using a webcam. IEEE Transactions on Biomedical Engineering, vol. 58, no. 1, pp. 7-11, 2011.*
6. *X. Xie, R. Sudhakar, and H. Zhuang. Real-time eye feature tracking from a video image sequence using kalman lter. IEEE Transaction on Systems, Man and Cybernetics, vol. 25, no. 12, pp. 1568-1577, 1995.*
7. *Q. Zhang, G.-Q. Xu, M. Wang, Y. Zhou, and W. Feng, ''Webcam based*
8. *Non-Contact real-time monitoring for the physiological parameters of drivers,'' in Proc. 4th Annu. Int. Conf. Cyber Technol. Automat., Control, Intell. Syst., Jun. 2014, pp. 648–652.*
9. *J. Allen, ''Photoplethysmography and its application in clinical physiological measurement,'' Physiol. Meas, vol. 28, no. 3, pp. R1–R39, 2007.*
10. *M.-Z. Poh, D. J. McDuff, and R. W. Picard, ''Non-contact, automated cardiac pulse measurements using video imaging and blind source separation,'' Opt. Express, vol. 18, no. 10, pp. 10762–10774, 2010.*
11. *M. Dilli Babu, S. Kumari, D. Karunkuzhali, A Boon to Gold Miners for fast data Transmission and Data Confidentiality Using Fidelity Technology To preserve their life., Journal of CTNS,vol.15,No.8,PP 2659-2664,August 2018.*