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Touchless Heart Rate Measurement Using Facial Expression

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ABSTRACT - This paper presents a system for touch-less heartbeat detection and a cardiopulmonary signal modeling approach. Using a vector network analyzer, a microwave system is tested for the detection of the heartbeat signal at a distance of 1 m from a person. The pro-posed system shows the ability of detecting the heartbeat signals with the possibility of tuning both frequency and power. Measurements are performed at 2.4, 5.8, 10, 16, and 60GHz, as well as at different power levels between 0 and -27 dBm. Based on measurements performed for both respiration and heart beatings, a model of the measured signals representing the cardiopulmonary activityis presented. The heartbeat rate and the heartrate variability are extracted from the modeling signal using wavelet and classic filters,for SNR between 0 and -20 Db

Key Words: Logistic regression, Random Forest, Ridge regression, Gradient boosting Machine learning

I. INTRODUCTION

Some medical conditions are easy to diagnose. Measles give you a rash. Chest pain might indicate a heart attack. But the symptoms of depression can be harder to pin-point. Medical professionals currently use the Patient Health Questionnaire (PHQ)designed by the American Psychological Association to diagnose depression. In a
recent paper, Al Hanai and her team describe a study aimed at detecting depression using a Long-Short Term Memory (LSTM) neural network to model audio and texttranscriptions extracted from The Distress Analysis Interview Corpus (DAIC).

II.MOTIVATION

In an emergency situation, your pulse rate can help find out if the heart is pumping enough blood. Help find the cause of symptoms, such as an irregular or rapid heart-beat dizziness, fainting, chest pain, or shortness of breath.

III.LITURETURE SURVEY

D. Obeid1 , S. Sadek2 , G. Zaharia1 , and G. El Zein "Touch-less Heartbeat Detection and Measurement based Cardiopul monary Modeling."[1] This paper presents a system for touch-less heartbeat detection and a cardiopulmonary signal modeling approach. Using a vector network analyzer, a mi-
crowave system is tested for the detection of the heartbeat signal at a distance of 1m from a person. The proposed system shows the ability of detecting the heartbeat signals with the possibility of tuning both frequency and power. Measurements are performed at 2.4, 5.8, 10, 16, and 60 GHz, as well as at different power levels between 0 and -27 dB m. Based on measurements performed for both respiration and heart beatings, a model of the measured signals representing the cardiopulmonary activity is presented. The heartbeat rate and the heart rate variability are extracted from the modeling signal using wavelet and classic filters, for SNR between 0 and 20 dB Author:JEAN-PIERRE LOMALIZA1 , HANHOON PARK 1 , AND MARK BILLINGHURST2 "Combining Photoplethysmo graphy and Ballistocardiography to Address Voluntary Head Movements in Heart Rate Monitoring"[2] Daily vital signs monitoring is very important for detecting diseases in early stages and for preventive treatments. Such a task can be achieved by taking advantage of the omnipresence of cameras in people's personal space. As heart related diseases are part of the leading causes of deaths worldwide, monitoring heart-related vital signs appear to be very crucial. In this article we aim to provide a touchless approach and propose a robust method for estimating heart rate through analysis of face videos. In particular, we consider a challenging scenario, i.e., the user is on a video call and may often move his/her head. Existing touchless, vision-based methods use either photoplethysmography (PPG) or ballistocardiography (BCG). PPG methods

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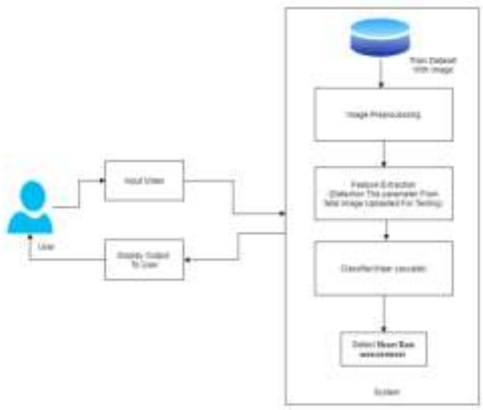
exploit color changes in human skin during heartbeats caused by blood volume variations, but this is very sensitive to unstable lighting conditions. On the other hand, BCG methods exploit subtle head motions caused by Newtonian reaction to blood influx into the head at each heartbeat, thus being sensitive to a subject's voluntary head movements. Unlike conventional studies where either a PPG method or a BCG method is used, we propose to combine both to overcome the weakness faced by each method. We use BCG methods as the main approach due to their better accuracy on heart rate estimation, and PPG methods are used as the secondary backup to improve the accuracy in cases of large and frequent voluntary head movements. To this end, we introduce a dynamic voting system that effectively combines results of several variants of PPG and BCG methods. Experiments conducted on 20 healthy subjects with different skin tones in different lighting conditionsshow that our method has better accuracy compared to state-of-the-art methods, well address-ing large voluntary head movements. Our method had a mean absolute error of 1.23 beats per minute (BPM) in the cases without voluntary head movements and 2.78 BPM in the cases with voluntary head movements Jerry Silvious and David Tahmoush, "UHF Measurement of Breathing and Heartbeat at a Distance" [3] The detection of breathing and heartbeat from a distance is important for medical triage and mass casualty events as well as routine monitoring of higher-risk patients. Typical approaches include wiring up patients to devices and wearable devices, but remote detection and monitoring is both easier on the patient and easier to administer. Monitoring at low frequencies means that there is less patient risk as well as extended range and reduced power. In this paper we look at the measurement of breathing and heartbeat of human subjects at UHF frequencies. We characterize the system design and capabilities as well as the algorithmic approach to extracting the signal. We measure biometric ground truth using heartbeat sensors, respiration monitors, and accelerometers. We do accurately measure breathing, and can measure heartbeat when the subject is holding his breath, but have not yet separated the heartbeat from breathing when both are being done simultaneously

Hirooki Aoki, ":Non-contact Heartbeat Measurement by Hybrid Method of Passive Stereo and Active Stereo"[4] We propose a system which simultaneously measures 3-D shape of chest and minute change of chest shape by heartbeat by a hybrid stereo method combining the passive stereo and the active stereo. Specifically, the 3-D shape of the chest is measured by the passive stereo using two infrared cameras. By projecting the dot matrix pattern on the chest surface using a laser projector, it is possible to capture minute shape change due to heart beat based on the principle of the active stereo. The proposed system is expected to be useful as a visualization tool for easy mechanical phenomena of the heart..

Hirooki Aoki, "Non-contact Heartbeat Measurement by Hybrid Method of Passive Stereo and Active Stereo "[5]We propose a system which simultaneously measures 3-D shape of chest and minute change of chest shape by heartbeat by a hybrid stereo method combining the passive stereo and the active stereo. Specifically, the 3-D shape of the chest is measured by the passive stereo using two infrared cameras. By projecting the dot matrix pattern on the chest surface using a laser projector, it is possible to capture minute shape change due to heart beat based on the principle of the active stereo. The proposed system is expected to be useful as a visualization tool for easy mechanical phenomena of the heart.

IV. SYSTEM ARCHITECTURE



The main objective of this project is to make a desktop application that will identify an anomalous activity by a human being in a particular premise. The flow of this project will be as given below: This will start with video pre-processing using algorithm, which will enhance video quality for better accuracy. After this we will detect the movement in that particular premise, using motion vector estimation. Once we have detected the motion in a particular part of the video, the application will sense if the moving object is human using algorithm. Now if that moving object comes out to be a human this application will track the activity made by that human, and if it is restricted in that premises an alert message will be generated for the same.

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V.OBJECTIVE

- Creating a real time , multi parameter measurement platform based on this technology will be the subject of future work. You would be able to use this technology on a phone, laptop or device with a camera..

VI. ALGORITHM

Convolutional Neural Networks: These are used with an untrained CNN, which implies that every pixel of every feature and every weight in every fully linked layer is randomly assigned. Then, one by one, we start feeding images through it. CNN receives a vote for each image it processes.

Step 1: Convolution.
Step 2: Pooling.
Step 3: Flattening.
Input image (starting point)
Convolutional layer (convolution operation)
Pooling layer (pooling)
Input layer for the artificial neural network (flattening)Because of its great accuracy, CNNs are employed for picture categorization and recognition. The CNN uses a hierarchical model that builds a network, similar to a funnel, and then outputs a fully-connected layer in which all neurons are connected to each other and the output is processed.

VII.CONCLUSION

To accurately detect heartbeat even with the low HR (Heart Rate), e.g., lower than 50 bpm (Beats Per Minute), we proposed a Doppler sensor-based heartbeat detection method by heartbeat signal reconstruction with convolutional CNN and Haarcascade (Long Short-Term Memory). Specifically, we construct a deep learning model with convolutional CNN and Haarcascade to reconstruct a heartbeat signal. As an input to convolutional CNN and Haarcascade, to reconstruct a heartbeat signal based on the periodicity of heartbeat and the spectrum distribution peculiar to heartbeat, suc cessive spectrograms within the frequency range that might be related with heartbeat is used. Furthermore, for better heartbeat signal reconstruction, the RRI estimated just before is also used as a feature. The experimental results showed that even in situation where the detection range gets longer, e.g., 2.0 m, our proposed method achieved the small AAE (Average Absolute Error) of 3.84 bpm against 17 subjects including 5 subjects with the HR lower than 50 bpm

VIII.RESULT

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