

Name of Guide: Mrs.B.D.Shendkar

Area of topic: Artificial Intelligence/Machine Learning.

Title of the topic: Touchless Heart Rate Detection using Image Processing.

Introduction: The heart rate (HR) of a person represents the number of heart beats per minute. It is an essential physiological parameter, a source of information related to the entire cardiovascular system. People who are less physically active are expected to have a higher heart rate, as their heart muscle has to work harder to maintain a constant cardiac rhythm. Also, there are situations in which continuous heart rate monitoring is required but skin contact is problematic, and the patient feels uncomfortable to be continuously connected to a pulse measuring apparatus. So there is a need to design a system which will continuously monitor the condition of patient's heart rate. It is useful for patients/doctors safety and also reduces the spread of covid-19. This system is composed of: Monitoring Devices like webcam/Camera required at the monitoring environment. Web server/Cloud platforms provide a multiple of services that can be integrated with web apps to rapidly develop features. These can be hosted on a cloud service and accessed virtually.

Motivation: In situations like Covid-19, it is very necessary to maintain social distancing and it has become very difficult with the old traditional methods to maintain distancing for doctors also to treat their patients. So we have decided to ease the process by using a touch less technique to detect heart rate of patients. Moreover, in this current scenario of COVID-19 physical contact should be avoided in all possible ways.

Problem Statement: To monitor and detect the Heart Rate using Image processing, cloud technology and wireless networks in order to provide a real time system in the medical field.

Objectives:

- 1) To measure the rate of heartbeat of person, without any physical contact.
- 2) To observe multiple persons heart rate at the same time.
- 3) To monitor and analyze rate of heart beat in real time condition.

Methodology: During the heartbeats the blood is pumped throughout the body, causing skin color variations. These changes cannot be observed with the naked eye but can be detected in a video stream. To implement the image processing algorithms, it is necessary to choose a region of interest, which is relevant in the sense of being able to observe how the pixels in the selected area change their intensity. By averaging the intensity of the skin color and extracting the frequencies that appear in the signal, a clear peak/spike will appear which represents the frequency of the heart beats. The Region of Interest selected is divided into 3 parts and for each of them, the pixels' mean values are calculated. To obtain a clear signal, the Independent Component Analysis (ICA) is implemented, after which peak detection is used to determine the heart rate value out of the video processed, for which we will use *Fast Fourier Transform*. The image acquisition is made using a laptop camera, and the HR calculation method is also based on the

skin color variation. There would be variation in the skin color, where we will use the Color Magnification Algorithm to identify the variation in the color. The variation of colors is seen between red, green, blue i.e. (RGB). By this model the change in redness is imperceptible to the human eye, but is detectable when analyzed on a computer. By amplifying these small changes in video by say x100, then adding back to the original video, one can see that reddening of the face.

Summary: Among all the pulse monitoring methods, the non-contact ones are considered to be safest now days. The approach we have presented is solving any problems of heart rate monitoring. An analysis will be performed on the facial video and frequency beat of heart that affect directly on the performance and accuracy of the application. Finally, we propose a system application for monitoring the heart rate of an individual and can also make a mobile application for future implementation.

References:

- [1] Heart Rate Measurement Using Face Detection in Video Conference Paper · June 2018
- [2] H. Rahman, Hamidur, M. Ahmed, S. Begum, and P. Funk: “Real time heart rate monitoring from facial RGB color video using webcam,” 9th Annual Workshop of the Swedish Artificial Intelligence Society, 2016.
- [3] M. Lewandowska, J. Rumiński, T. Kocejko and J. Nowak, “Measuring pulse rate with a webcam — A non-contact method for evaluating cardiac activity,” Federated Conference on Computer Science and Information Systems, Szczecin, pp. 405-410, 2011.
- [4] L.K. Mestha, S. Kyal, B. Xu, and H.J. Madhu, “Video-based estimation of heart rate variability,” US8977347, 2015.
- [5] Fotonation Limited, “Digital image processing using face detection and skin tone information,” <https://patents.justia.com/patent/9516217>, 2014.

