

CS395 Spring 2018—Final Project Report

Heart Rate Prediction with Deep Video Regression

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1 Introduction

Millions of Americans are afflicted with panic disorder [1], a psychiatric disorder in which debilitating fear and anxiety arise with no apparent cause [2]. There are several clinically available methods to treat panic disorder, many of which involve either medication or intensive psychotherapy [3]. Past research [4] in the biomedical field has shown that by simply showing a panic disorder victim their heart rate on the onset of or during a panic attack, their episode was significantly mitigated or weakened in intensity.

Allowing people afflicted with panic disorder to access vitals such as heart rate and respiratory rate could not only benefit the longer term management of the disorder, but mitigate the risks and side effects of a live panic attack.

In order to expose this treatment method to as many victims of panic disorder as possible, we explore an element of the solution by making use of the ubiquitous smartphone. There is promising evidence that suggests pulse is detectable by processing videos in smartphone cameras. By pressing a finger against a smartphone camera with the flashlight activated, we can obtain a highly resolved clip of the blood pulsating within the finger. This project aims to leverage deep learning techniques in order to predict a patient's heart rate from such a video.

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2 Problem Definition

2.1 Task Definition

Our objective is to produce a fast, accurate within a small squared error, model that, given a sequence of the above described frames S of images $X_i \dots X_n$, we output a value hr , the heart rate of the individual who submitted the sequence.

This problem is specifically intriguing not only for its real world application but because the task is vastly more dependent on the the temporal axis than other neural video processing tasks.

The dataset used by this project has been provided by Dr. Ryan McGinnis of the University of Vermont Biomedical Engineering department. Video data was collected by sampling 31 separate subjects; each patient recorded two videos of their finger– one at a resting heart rate, and one after an intense 60 second workout. All of the raw videos gathered during the study are around 30 seconds long. For each sample V , the heart rate h_r and respiratory rate rv for each were also recorded and are provided along with the video data.

2.2 Algorithm Definitions