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Psychological Stress Level Detection Based on Electrodermal Activity

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Abstract: This paper presents a method for detecting psychological stress levels. It aims to explore the feasibility of using a single physiological signal to create a more practical alternative for detecting stress in people than current multiple physiological signals approaches involve. In particular, the approach explored uses linear discriminant analysis (LDA) based on the electrodermal activity (EDA) signal which aims at discriminating between three stress levels: low, medium and high. We used the MIT Media lab 'stress database' from which we selected eleven 'foot' based EDA data sets for our experiments. Using this eighteen EDA features were extracted from (sixty-six) five-minutes data segments equating to three driving conditions: at rest, on the open road (highway) and city driving. After that, Fisher projection and Linear discriminant analysis (LDA) were used to classify the stress levels with feature vectors, that included both leaving one out and test cross-validation strategy. The results showed that these methods achieved recognition rate of 81.82% which we argue, while less that multiple signal systems, may be a better balance between recognition performance and computational load, that could be a promising line of research for the development of practical personal stress monitors.

Keywords: stress classification, electrodermal activity, Fisher projection, linear discriminant analysis

1. Introduction

Nowadays, more and more people are suffering from psychological stress. Surveys show that there is a strong link between the overall health of people and stress. The effective and timely detection of a person's psychological stress provides an effective way for people to better treat their stress [1]. According to a survey by American Psychological Association [2], more than half of the American population have reported stress as a source of personal health problems and believed stress can cause many major diseases, such as depression, heart disease and obesity and even sudden death, particularly in people who already have cardiovascular illness. Stress level is still high and even exceeds what Americans consider to be healthy level, with studies showing that timely management may be a significant barrier preventing people from taking necessary actions to improve their health. Research [3] has shown that there are about seven hundred and sixty incidences of work related depression, stress or anxiety per one hundred thousand 100,000 workers. What is more, while most people will agree that stress can have a negative impact on health, they do not know how to prevent stress or treat it well. Surveys [4] [5] have shown that prolonged psychological stress can cause disorders on the psychological and physiological functions, and then people will be more susceptible to disease which, in addition to causing illness can lead to more stress in their life. Effectively detecting stress levels can provide a useful way for people to better manage their health, by providing people with more concrete and accurate data for stress management.

In recent years, effectively detecting stress of people, based on psychological sensors, has been a hot research topic. Current discoveries indicate that physiological signals of human beings can provide a metric