Stress Detection using Machine Learning

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Abstract— In today's era, Stress is being intuited as the most important element in person's success. Stressor impose a major influence upon mood, our sentiency of well-being, demeanor and wellness. However, if the threat is unremitting, particularly in older or unhealthy individuals, the long-term impression of tension can damage health. The relationship between psychological stressor and physiological stressors greatly affect emotional stress vibes and stress patters in an individual's life. Psychosocial interventions have proven useful for treating stress related upsets and may influence the course of chronic disease. Stress is a feeling of strain, pressure or tension exerted due to the demanding circumstances. Also this is one type of psychological pain. The proposed Stress detector differentiates a stressed person from a normal one by obtaining their physiological signals using sensors like Electrocardiogram, heartrate sensors and psychological signals through Socio-Stress Assessment scores. The result helps to detect the factor that caused the increased stress level. The signals are processed to classify the features which indicates the stress level in working individuals. The power of Support Vector Machine comes from the kernel representation allowing a nonlinear mapping of the input spaces to a higher dimensional feature spaces. Support Vector Machine is used to classify these acquired feature set. An attempt is made to achieve maximum stress classification accuracy.

Index Terms— Electrocardiogram (ECG), Support Vector Machine (SVM), Socio-Stress Assessment, Psychosocial

1 INTRODUCTION

IN our world of technology stress conducts a major vital role in people's life. Stress is a mental health problem that affects the life of one in four citizen defined by World Health Organization (WHO) [1]. Human stress may lead to mental as well as socio-fiscal problems, lack of work clarity, poor working relationship, and depression and finally results in suicide in severe cases. Stress is a common part of daily life which most people struggle in different occasions. However, having stress for a long time, or a high level of stress will jeopardize our safety, and will disrupt our normal life. Consequently, performance and management ability in critical situations degrade significantly. Therefore, it is necessary to have information in stress cognition and design systems with the ability of stress cognition. Stress is a feeling of strain and pressure. Also this is one type of psychological pain. Small amounts of stress may be desired, beneficial, and even healthy. This case demands providing counselling to the stressed individuals to cope up against stress. Avoiding stress is impossible but its preventive actions can helps individuals to overcome the stress [2]. Presently, only medical and physiological experts can determine whether one is under depressed state (stressed) or not. A traditional method to detect stress is based on questionnaire [3]. This method completely depends on the individuals answers, people will be quavering to say whether they are stressed or normal. Automatic detection of stress will minimize the risk in health issues and improves the welfare of the society. This provides a way for the necessity of a scientific tool, which uses physiological signals thereby automating the detection of stress levels in individuals.

2 LITERATURE SURVEY

Stress detection is discussed in various literatures as it is a significant societal contribution that enhances the life style of individuals. Ghaderi [4] analyzed stress using Respiration, Heartrate (HR), facial electromyography (EMG), Galvanic skin response (GSR) foot and GSR hand data with a conclusion that, features pertaining to respiration process are substantial in stress detection. Maria Viqueira [5] describes mental stress prediction using a standalone stress sensing hardware by interfacing GSR as the only physiological sensor. David Liu [6] proposed a research to predict stress levels solely from Electrocardiogram (ECG). Automated stress and emotion detection is made possible by several pattern recognition algorithms. Every sensor data is compared with a stress index which is a threshold value used for detecting the stress level. Various features are extracted from the commonly used physiological signals such as ECG, EMG, GSR, BVP etc., measured using appropriate sensors and selected features are grouped into clusters for further detection of anxiety levels. In [8], it is concluded that smaller clusters result in better balance in stress detection using the selected General Regression Neural Network (GRNN) model. This results in the fact that different combinations of the extracted features from the sensor signals provide better solutions to predict the continuous anxiety level [4]. In 2016, Gjoreski created laboratory based stress detection classifiers from ECG signal and HRV features [1]. Features of ECG are analyzed using GRNN model to measure the stress level [8]. It is noticed that Support Vector Machine (SVM) was used as the classification algorithm predominantly due to its generalization ability and sound mathematical background [6]. Various kernels were used to develop models using SVM and it is concluded in [7] that a linear SVM on both ECG frequency features and HRV features performed best, outperforming other model choices [8].

As per the analyses Bipolar disorder (BD) is characterized by an alternation of mood states from depression to hypomania. Mixed states, i.e., a combination of depression and mania symptoms at the same time, can also be present. The diagnosis of this disorder in the current clinical practice is based only on subjective interviews and questionnaires, while no reliable objective psycho-physiological markers are available [4]. Till now the proposed methodologies were able to predict the mood state with acceptable reliability. Those systems had feature which were useful to clinicians because pharmacological treatments were often administered on a trial and error base. The medical world has seen strong correlations between stress and emotion, heart disease, cancer and such terminal illnesses. Further stress has been analyzed to weaken immune systems, as well as drop performance in all metrics of success. Stress cannot be quantified and was considered difficult to detect [1].

3 PROPOSED SYSTEM

The proposed Stress detector classifies a stressed person from a normal person by acquiring their physiological signals through sensors such as ECG Sensor, Heart rate and Socio Assessment System. The first model is a physiological classifier that predicts whether changes in physiology represent stress. Since the impact of stress may affect the person psychologically longer than the physical effects, we propose a stress model to predict perception of stress. It uses the output of the physiological classifier to model the accumulation and gradual decay of stress in the mind. To account for wide between-person differences, both models self-calibrate to each subject.

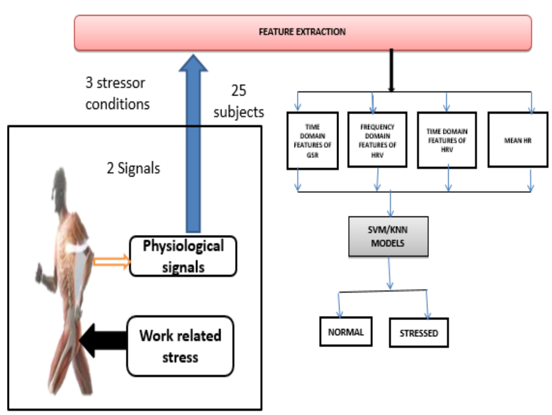

Fig 3.1 Physiological System Flow

The large scale multimodal action data titled Accubits train dataset generated from knowledge workers and few relevant hospital data's were collected to train the system. The Support Vector Machine algorithm allowed to map the non-linear space of input to higher dimensional featured spaces. Any stressed individual are subjected to the physiological stress approach and based on the stressed patterns generated the individual are subjected to psychological stress assessment. The psychological stress assessment provides unsupervised learning technique where the level of questionaries' are based on the system analyze or study over the subject in different levels.

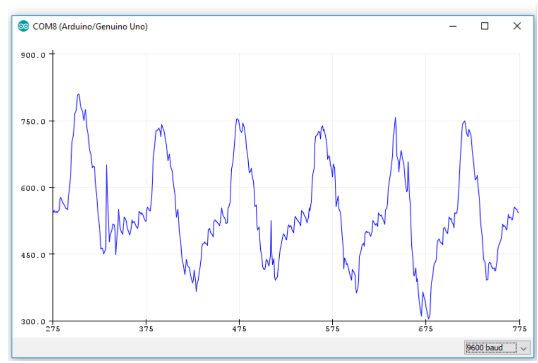

Fig 3.2 Stress patterns detected using sensors like ECG and Heartrate

The Support Vector Machine (SVM) is the parametric classifier used and classification is performed using two types of kernel functions,

(i) Linear kernel

(ii) Radial Basis Function (RBF) non-linear kernel

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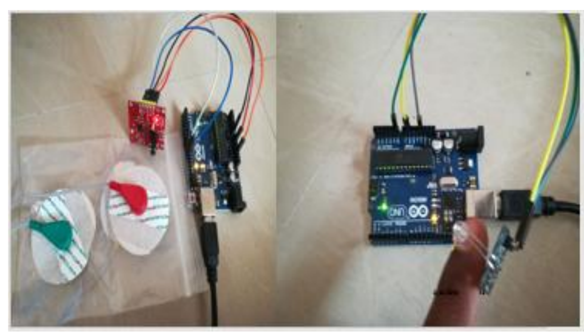

Fig 3.3 ECG and Heartrate sensors

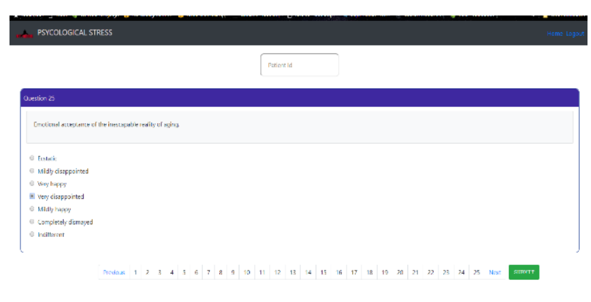

Fig 3.4 Psychological Stress Assessment

A stressed individual is regularly monitored using the

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physiological sensors and the valued results are analyzed and based on the analyzed reports the individual is subjected to psychological test.

4 CONCLUSION

The stressed individuals were monitored continuously help users to understand their stress patterns better and provide physicians with more reliable data for interventions. The Support Vector Machine Algorithm was generated. It focuses on recent developments in machine learning which have made significant impacts in managing stress. The first model is a physiological classifier that predicts whether changes in physiology represent stress. As the psychological effect of stress remain longer than its acute effect on physiology, we propose a perceived stress model to predict perception of stress. It uses the output of the physiological classifier to model the accumulation and gradual decay of stress in the mind. To account for wide between-person differences, both models Physio and Psycho models are self-calibrated to each subject.

5 FUTURE WORK

Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions. Authors are strongly encouraged not to call out multiple figures or tables in the conclusion—these should be referenced in the body of the paper.

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