**LITERATURE SURVEY**

## 1) Stress and anxiety detection using facial cues from videos

**AUTHORS: G. Giannakakis, D. Manousos, F. Chiarugi**

# This study develops a framework for the detection and analysis of stress/anxiety emotional states through video-recorded facial cues. A thorough experimental protocol was established to induce systematic variability in affective states (neutral, relaxed and stressed/anxious) through a variety of external and internal stressors. The analysis was focused mainly on non-voluntary and semi-voluntary facial cues in order to estimate the emotion representation more objectively. Features under investigation included eye-related events, mouth activity, head motion parameters and heart rate estimated through camera-based photoplethysmography. A feature selection procedure was employed to select the most robust features followed by classification schemes discriminating between stress/anxiety and neutral states with reference to a relaxed state in each experimental phase. In addition, a ranking transformation was proposed utilizing self reports in order to investigate the correlation of facial parameters with a participant perceived amount of stress/anxiety. The results indicated that, specific facial cues, derived from eye activity, mouth activity, head movements and camera based heart activity achieve good accuracy and are suitable as discriminative indicators of stress and anxiety.

# 2) Detection of Stress Using Image Processing and Machine Learning Techniques

**AUTHORS:**  **Nisha Raichur, Nidhi Lonakadi, Priyanka Mural**

Stress is a part of life it is an unpleasant state of emotional arousal that people experience in situations like working for long hours in front of computer. Computers have become a way of life, much life is spent on the computers and hence we are therefore more affected by the ups and downs that they cause us. One cannot just completely avoid their work on computers but one can at least control his/her usage when being alarmed about him being stressed at certain point of time. Monitoring the emotional status of a person who is working in front of a computer for longer duration is crucial for the safety of a person. In this work a real-time non-intrusive videos are captured, which detects the emotional status of a person by analysing the facial expression. We detect an individual emotion in each video frame and the decision on the stress level is made in sequential hours of the video captured. We employ a technique that allows us to train a model and analyze differences in predicting the features. Theano is a python framework which aims at improving both the execution time and development time of the linear regression model which is used here as a deep learning algorithm. The experimental results show that the developed system is well on data with the generic model of all ages.

# 3) Machine Learning Techniques for Stress Prediction in Working Employees

**AUTHORS** **: U. S. Reddy, A. V. Thota and A. Dharun**

Stress disorders are a common issue among working IT professionals in the industry today. With changing lifestyle and work cultures, there is an increase in the risk of stress among the employees. Though many industries and corporates provide mental health related schemes and try to ease the workplace atmosphere, the issue is far from control. In this paper, we would like to apply machine learning techniques to analyze stress patterns in working adults and to narrow down the factors that strongly determine the stress levels. Towards this, data from the OSMI mental health survey 2017 responses of working professionals within the tech-industry was considered. Various Machine Learning techniques were applied to train our model after due data cleaning and preprocessing. The accuracy of the above models was obtained and studied comparatively. Boosting had the highest accuracy among the models implemented. By using Decision Trees, prominent features that influence stress were identified as gender, family history and availability of health benefits in the workplace. With these results, industries can now narrow down their approach to reduce stress and create a much comfortable workplace for their employees.

# 4) Classification of acute stress using linear and non-linear heart rate variability analysis derived from sternal ECG

**AUTHORS** : **Tanev, G., Saadi, D.B., Hoppe, K., Sorensen, H.B**

Chronic stress detection is an important factor in predicting and reducing the risk of cardiovascular disease. This work is a pilot study with a focus on developing a method for detecting short-term psychophysiological changes through heart rate variability (HRV) features. The purpose of this pilot study is to establish and to gain insight on a set of features that could be used to detect psychophysiological changes that occur during chronic stress. This study elicited four different types of arousal by images, sounds, mental tasks and rest, and classified them using linear and non-linear HRV features from electrocardiograms (ECG) acquired by the wireless wearable ePatch® recorder. The highest recognition rates were acquired for the neutral stage (90%), the acute stress stage (80%) and the baseline stage (80%) by sample entropy, detrended fluctuation analysis and normalized high frequency features. Standardizing non-linear HRV features for each subject was found to be an important factor for the improvement of the classification results.

**5)** **HealthyOffice: Mood recognition at work using smartphones and wearable sensors**

**AUTHORS**: **Zenonos, A., Khan, A., Kalogridis, G., Vatsikas, S., Lewis, T., Sooriyabandara**

Stress, anxiety and depression in the workplace are detrimental to human health and productivity with significant financial implications. Recent research in this area has focused on the use of sensor technologies, including smartphones and wearables embedded with physiological and movement sensors. In this work, we explore the possibility of using such devices for mood recognition, focusing on work environments. We propose a novel mood recognition framework that is able to identify five intensity levels for eight different types of moods every two hours. We further present a smartphone app ('HealthyOffice'), designed to facilitate self-reporting in a structured manner and provide our model with the ground truth. We evaluate our system in a small-scale user study where wearable sensing data is collected in an office environment. Our experiments exhibit promising results allowing us to reliably recognize various classes of perceived moods.