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Stress Detection in IT Professionals by Image Processing and Machine Learning

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***Abstract*: The main motive of our project is to detect stress in the IT professionals using vivid Machine learning and Image processing techniques .Our system is an upgraded version of the old stress detection systems which excluded the live detection and the personal counseling but this system comprises of live detection and periodic analysis of employees and detecting physical as well as mental stress levels in his/her by providing them with proper remedies for managing stress by providing survey form periodically. Our system mainly focuses on managing stress and making the working environment healthy and spontaneous for the employees and to get the best out of them during working hours.**

***Keywords*: Image processing, KNN classifier, One-hot encoding, Open CV, Supervised machine learning, Training dataset.**

1. Introduction

Nowadays as IT industries are setting a new peek in the market by bringing new technologies and products in the market. In this study, the stress levels in employees are also noticed to raise the bar high. Though there are many organizations who provide mental health related schemes for their employees but the issue is far from control. In this paper we try to go in the depth of this problem by trying to detect the stress patterns in the working employee in the companies we would like to apply image processing and machine learning techniques to analyze stress patterns and to narrow down the factors that strongly determine the stress levels.

Machine Learning algorithms like KNN classifiers are applied to classify stress. Image Processing is used at the initial stage for detection, the employee's image is clicked by the camera which serves as input. In order to get an enhanced image or to extract some useful information from it image processing is used by converting image into digital form and performing some operations on it. By taking input as an image from video frames and output may be image or characteristics associated with that image. Image processing basically includes the following three steps:

- Importing the image via image acquisition tools.
- Analyzing and manipulating the image.
- Output in which result is altered image or report that is based on image analysis.

System gets the ability to automatically learn and improve from self-experiences without being explicitly programmed using Machine learning which is an application of artificial intelligence (AI). Computer programs are developed by Machine Learning that can access data and use it to learn for themselves. Explicit programming to perform the task based on predictions or decisions builds a mathematical model based on "training data" by using Machine Learning. The extraction of hidden data, association of image data and additional pattern which are unclearly visible in image is done using Image Mining. It's an interrelated field that involves, Image Processing, Data Mining, Machine Learning and Datasets.

According to conservative estimates in medical books, 50-80% of all physical diseases are caused by stress. Stress is believed to be the principal cause in cardiovascular diseases. Stress can place one at higher risk for diabetes, ulcers, asthma, migraine headaches, skin disorders, epilepsy, and sexual dysfunction. Each of these diseases, and host of others, is psychosomatic (i.e., either caused or exaggerated by mental conditions such as stress) in nature. Stress has three prong effects:

- Subjective effects of stress include feelings of guilt, shame, anxiety, aggression or frustration. Individuals also feel tired, tense, nervous, irritable, moody, or lonely.
- Visible changes in a person's behavior are represented by Behavioral effects of stress. Effects of behavioral stress are seen such as increased accidents, use of drugs or alcohol, laughter out of context, outlandish or argumentative behavior, very excitable moods, and/or eating or drinking to excess.
- Diminishing mental ability, impaired judgment, rash decisions, forgetfulness and/or hypersensitivity to criticism are some of the effects of Cognitive stress.

2. Need of work

Stress is called as an initial stage of depression. stress can be related to finance, work, relationships etc. In corporate world employees are unaware of stress leading conditions while

working. It is always observed mostly in It employees chronic stress is often ignored. Companies use to give a survey form to the employees to fill and then use to predict stress based on that form. It was not only time consuming but needed whole lot of efforts as forms where distributed manually. Stress Detection System enables employees with coping up with their issues leading to stress by preventative stress management solutions which is concerned with eliminating stress and improving employee health. In our work we have designed a system which will capture images of the employee based on the regular intervals and then the tradition survey forms will be given to the employee. This will reduce the manual efforts and time. This organizational technique can be used to help improve employee stress by diagnosis through our specially designed Questionnaires.

3. Objectives

- To predict stress in a person by the symptoms calculated by monitoring.
- To analyze the stress levels in the employee.
- To provide solutions and remedies for the person to recover his/her stress.

4. Methodologies

Image Pre-processing: G (i, j) = α. F (i, j) + β, α > 0 and β are called as gain and bias parameters, these are used to bright and contrast the image. Here G (i, j) is output image pixel and F (i, j) is input image pixel.

Pixel transformation: Pixel transformation is a technique used in image processing to obtain pixel values. This transformation is used to make image generic and diverse. The image is converted into Gray scale image that is a color image is converted into black and white or in shades of grey. Threshold of the image is found which is used to convert gray scale image into binary form, If the pixel value is greater than threshold pixel value is set to 1 otherwise 0.

One hot encoding: All the textual responses were given numerical weights according to their significance. 'Yes' is taken to be 1, 'no' to be 0. The categorical data was converted into numeric using label encoder. A decoder is used to decode into binary code. Though a one-hot state machine, does not need a decoder as machine is in the nth state if and only if the nth bit is high.

Binary	Gray code	One-hot
000	000	00000001
001	001	00000010
010	011	00000100
011	010	00001000
100	110	00010000
101	111	00100000
110	101	01000000
111	100	10000000

Fig. 1. Values after one-hot encoding operation

Logistic Regression: Like all regression methods, the logistic regression is a predictive analysis. It is used in scenarios where one binary variable is dependent on one or more independent variables. A logistic regression can be called as a statistical model that uses a binary dependent variable. In regression analysis, logistic regression [8] is estimating the parameters of a logistic model. Mathematically, a binary logistic model has a dependent variable with two possible value, which is represented by an indicator variable, where the two values are labeled "0" and "1".

Mini-Batch Gradient Descent: A subset of training is considered; it can make quick updates in the model parameters and can also exploit the speed associated with vectorizing the code. Depending upon the batch size, the updates can be made. Mini Batching is used to set the threshold value updated by gradient which makes it a robust algorithm.

KNN Classifier: K-Nearest Neighbor (KNN) is used for classification as well as regression analysis. It is a supervised learning algorithm which is used for predicting if a person needs treatment or not. KNN classifies the dependent variable based on how similar it is; independent variables are to a similar instance from the already known data.

Dataset: Dataset contains grid view of already stored dataset consisting numerous properties[8], by Property Extraction newly designed dataset appears which contains only numerical input variables as a result of Principal Component Analysis feature selection transforming to 6 principal components which are Condition (No stress, Time pressure, Interruption), Stress, Physical Demand, Performance and Frustration.

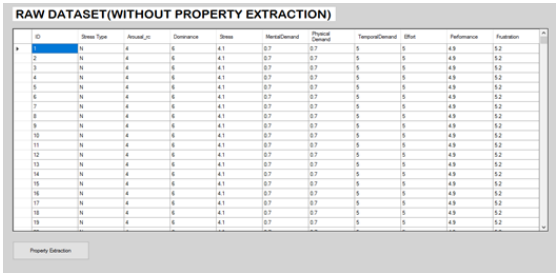

Fig. 2. Dataset without property extraction

Raw dataset contains numerous unusable properties like Temporal Demand, Heart Rate, Effort, Mental Effort, Nasa TLX, Mental Demand etc.

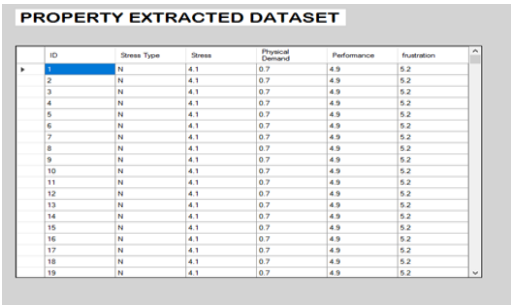

Fig. 3. Dataset after property extraction

Essential properties namely Condition (No stress, Time pressure, Interruption), Stress, Physical Demand, Performance and Frustration from raw dataset are extracted to build a new property extracted dataset.

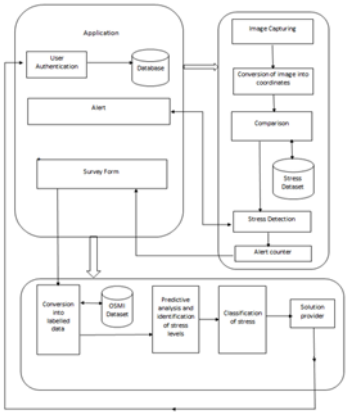

Fig. 4. Architecture diagram of stress detection system

The flow and working of the stress detection system is explained in Fig. 4, the system is divided into three modules the first module registers the employee, sends alerts and later provides survey forms. Second module works on image capturing, conversion of image into coordinates and then mapping the image and getting a prediction about stress and the third module converts data into binary values, based on which stress level is detected and based on the level solution is provided for overcoming stress.

5. Conclusion

Stress Detection System is designed to predict stress in the employees by monitoring captured images of authenticated users which makes the system secure. The image capturing is done automatically when the authenticate user is logged in based on some time interval. The captured images are used to detect the stress of the user based on some standard conversion and image processing mechanisms. Then the system will analyze the stress levels by using Machine Learning algorithms which generates the results that are more efficient.

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