



Using Image Processing and Machine Learning to Identify IT Workers' Stress Levels

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Abstract:

Our project's overarching goal is to identify IT workers experiencing stress via the use of advanced machine learning and image processing methods. By incorporating live detection and periodic analysis of employees, we are able to detect both physical and mental stress levels. We then provide survey forms on a regular basis to help employees manage their stress, which is an improvement over previous stress detection systems that did not include personal counseling. In order to get the most out of our workers when they are on the clock, our approach is primarily concerned with stress management and creating a healthy, spontaneous work atmosphere.

Keywords

Image processing, KNN classifier, one-hot encoding Resume Viewer, Automated learning under supervision, Dataset intended for training purposes.

1. Introduction

With the introduction of cutting-edge technology and innovative goods, the IT industry is now establishing a new benchmark in the market. Employee stress levels are also shown to be elevated in this research. The problem is out of hand, even though many companies provide programs to help their workers with mental health. To get to the bottom of this issue, we set out to identify patterns of stress in the workplace using image processing and machine learning methods. Our goal was to identify the specific factors that have the most impact on employees' stress levels. Stress is classified using Machine Learning methods such as KNN classifiers. At the first level of detection, the camera takes a picture of the employee and uses it as input for the image processing system. picture processing involves digitizing a picture and doing various operations on it in order to either improve the image or extract valuable information from it. The process begins with video frames as input and ends with either a picture or some related features. The three main components of image processing are: Using tools for acquiring images to import them. Examining and modifying the picture. The end product of this process is a modified picture or report that has been generated by image analysis. Machine learning, a subfield of AI, grants systems the capacity to learn and grow autonomously via self-experiences, independent of human programming. Machine Learning creates software with the ability to learn on its own by analyzing data. Using Machine Learning, explicit programming creates a mathematical model using "training data" to carry out the job based on predictions or judgments. Image mining is a technique for discovering previously unseen patterns in images, as well as for associating seemingly unrelated pieces of data. Data Mining, Image Processing, Machine Learning, and Datasets are all interconnected parts of this

subject. Medical textbooks conservatively estimate that stress is the root cause of half of all physical disorders. The main cause of cardiovascular illnesses is thought to be stress. Numerous health problems, including diabetes, ulcers, asthma, migraines, skin diseases, epilepsy, and erectile dysfunction, may be exacerbated by stress. Like a plethora of other illnesses, they are all psychosomatic, meaning that they are influenced by or brought on by mental factors like stress. The impacts of stress are three-pronged: Some of the subjective impacts of stress might include emotions such as guilt, shame, worry, hostility, or annoyance. Other symptoms include fatigue, anxiety, nervousness, irritability, moodiness, and loneliness. Stress may manifest itself in observable changes in how a person acts. Increased accident rates, substance abuse, inappropriate laughing, extreme impulsivity, hyperactivity, and binge eating and drinking are all symptoms of behavioral stress. Some of the consequences of cognitive stress include loss of mental capacity, decreased decision-making, hasty judgments, forgetfulness, and/or extreme sensitivity to criticism.

2. Need of work

One of the first symptoms of depression is stress. Problems with money, job, relationships, etc., may all contribute to stress. Most people who work in the business sector have no idea what factors contribute to stress on the job. Chronic stress is often disregarded, yet it is consistently noticeable in the IT industry. In the past, businesses would have their workers take out a survey and use the results to make predictions about how stressed out they would be. Manually distributing paperwork was not only laborious but also time-consuming. The goal of the Stress Detection System is to help workers deal with the things that are causing them stress by providing them with alternatives for preventive stress management. As part of our work, we have developed a system that can take pictures of employees at certain intervals and subsequently distribute the standard survey forms. Time and effort spent on physical labor will be decreased. Through the use of our custom-made questionnaires, this method of organizational analysis may be used to the problem of employee stress in order to diagnose it.

3. Objectives

To foretell when a person is stressed out based on their monitored symptoms. The employee's stress levels will be examined. In order to help the individual overcome their stress, we will provide them answers and cures.

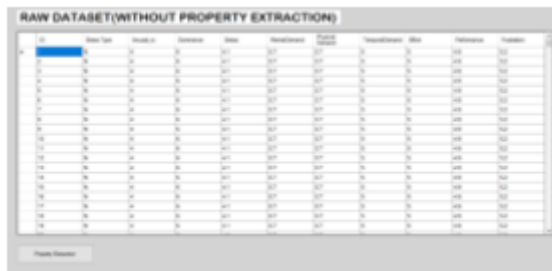
4. Methodologies

Before processing the image, set $G(i, j) = \alpha$. The gain and bias parameters, denoted as $F(i, j) + \beta$, where $\alpha > 0$ and β are used for picture brightness and contrast. In this case, the input image pixel F and the output image pixel G are defined. Changes to individual pixels: In image processing, pixel transformation is a method for obtaining pixel values. Generic and diversified images are created with this process. When a picture is transformed into a grayscale image, it goes from being color to being black and white or a variety of shades of grey. To transform a grayscale picture into a binary one, we look for the image's threshold and set each pixel's value to 1 if it's higher than the threshold, and 0 otherwise. Just one hot encoding: We assigned numerical weights to each written answer based on its relevance. The value of "yes" is 1 while the value of "no" is 0. Label encoder was used to transform the category data into numerical form. Decoding into binary code is accomplished using a decoder. Because the n th bit must be high for the machine to be in the n th state, a decoder is unnecessary for a one-hot state machine.

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

A kind of predictive analysis, logistic regression is similar to other regression approaches. It comes in use when there are several independent factors that affect a single binary variable. Statistical models that use a binary dependent variable are known as logistic regressions. Estimating the parameters of a logistic model is what logistic regression [8] is all about in regression analysis. In a binary logistic model, the dependent variable may take on one of two alternative values—"0" or "1"—represented by an indicator variable. Descent using Mini-Batch Gradients: It takes into account a subset of training, which may take advantage of vectorization's speed and perform rapid changes to the model's parameters. The changes may be done based on the batch size. It is a resilient approach since Mini Batching is utilized to establish the threshold value, which is updated by gradient. When it comes to regression analysis and classification, K-Nearest Neighbor (KNN) is the way to go. Predicting whether a patient need therapy is the job of this supervised learning system. The K-Nearest Neighbors (KNN) classification algorithm uses the degree of similarity between the dependent and independent variables to identify instances that fit the model. Dataset: The dataset initially includes a grid view of an existing dataset with many properties[8]. However, after using Principal Component Analysis to select features, a newly designed dataset with only numerical input variables—called Conditions (No stress, Time pressure, Interruption), Stress, Physical Demand, Performance, and Frustration—emerges.



The image shows a screenshot of a software interface displaying a 'RAW DATASET(WITHOUT PROPERTY EXTRACTION)'. The interface features a grid with numerous columns and rows of data. The columns are labeled with various attributes, and the rows represent individual data points. The data appears to be a mix of numerical and categorical values. The interface includes a search bar at the top and a 'Filter Results' button at the bottom.

Fig. 2. Dataset without property extraction

Many of the attributes found in the raw information are useless, such as Temporal Demand, Heart Rate, Effort, Mental Effort, Nasa TLX, Mental Demand, and many more.

ID	Stress Type	Stress	Physical Demand	Performance	Frustration
1	Stress	0.5	0.5	0.5	0.5
2	Stress	0.5	0.5	0.5	0.5
3	Stress	0.5	0.5	0.5	0.5
4	Stress	0.5	0.5	0.5	0.5
5	Stress	0.5	0.5	0.5	0.5
6	Stress	0.5	0.5	0.5	0.5
7	Stress	0.5	0.5	0.5	0.5
8	Stress	0.5	0.5	0.5	0.5
9	Stress	0.5	0.5	0.5	0.5
10	Stress	0.5	0.5	0.5	0.5
11	Stress	0.5	0.5	0.5	0.5
12	Stress	0.5	0.5	0.5	0.5
13	Stress	0.5	0.5	0.5	0.5
14	Stress	0.5	0.5	0.5	0.5
15	Stress	0.5	0.5	0.5	0.5
16	Stress	0.5	0.5	0.5	0.5
17	Stress	0.5	0.5	0.5	0.5
18	Stress	0.5	0.5	0.5	0.5
19	Stress	0.5	0.5	0.5	0.5
20	Stress	0.5	0.5	0.5	0.5

Fig. 3. Dataset after property extraction

In order to construct a new dataset with extracted attributes, the following are taken from the original dataset: Condition (No stress, Time pressure, Interruption), Stress, Physical Demand, Performance, and Frustration.



Fig. 4. Architecture diagram of stress detection system

Figure 4 depicts the stress detection system's architecture and operation; the system consists of three distinct components. The first module is responsible for staff registration, alert sending, and the provision of survey forms. The image capture, coordinate conversion, and mapping processes in the second module allow for stress prediction; the data is then converted to binary values in the third module, which detects stress levels and provides solutions based on those levels.

5. Conclusion

By keeping an eye on the photos taken by verified users, the Stress Detection System can foretell when workers may start to show signs of stress. As soon as the authenticated user logs in, the system begins to automatically capture images at predetermined intervals. Using the user's stress levels as input, the recorded pictures undergo typical image processing and conversion procedures. After that, the system will assess the levels of stress using Machine Learning algorithms, which provide more effective outcomes.

References

[1] G. Giannakakis, D. Manousos, F. Chiarugi, "Stress and anxiety detection using facial cues from videos," *Biomedical Signal processing and Control*, vol. 31, pp. 89-101, January 2017.

[2] T. Jick and R. Payne, "Stress at work," Journal of Management Education, vol. 5, no. 3, pp. 50-56, 1980.

[3] Nisha Raichur, Nidhi Lonakadi, Priyanka Mural, "Detection of Stress Using Image Processing and Machine Learning Techniques", vol.9, no. 3S, July 2017.

[4] Bhattacharyya, R., & Basu, S. (2018). Retrieved from 'The Economic Times'.

[5] OSMI Mental Health in Tech Survey Dataset, 2017 [6] U. S. Reddy, A. V. Thota and A. Dharun, "Machine Learning Techniques for Stress Prediction in Working Employees," 2018 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC), Madurai, India, 2018, pp. 1-4. [7] <https://www.kaggle.com/qiriro/stress>