Holistic Wellness Tracking with Stress Detection using Machine learning

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Abstract- Stress is a prevalent mental health issue affecting individuals worldwide, leading to various physical and psychological health problems. Early detection and intervention are crucial in managing stress effectively. Machine learning (ML) techniques offer promising approaches for detecting stress based on various data sources, including physiological signals, behavioral patterns, and textual data.

The Stress Detection project leverages Python libraries such as Pandas, NumPy, Matplotlib, NLTK (Natural Language Toolkit) and machine learning algorithms like Naïve Bayes to detect stress in human beings. By employing count vectorizer we can convert a collection document into a matrix format. Converting text data into numerical format can be used as input to the machine learning algorithms (Naïve Bayes, etc).

INTRODUCTION

This project is designed to detect the stress using machine learning techniques and offers guidance for researchers and practitioners in developing more effective and scalable stress detection solutions for real-world applications.

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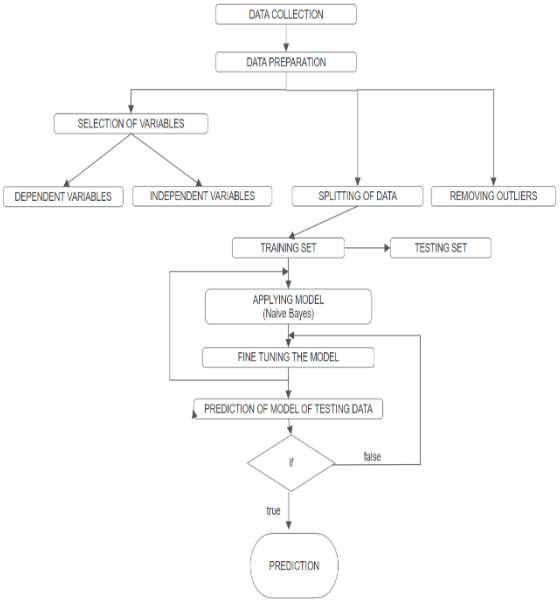
The main purpose of detecting stress is to promote early intervention, support mental health, enhance performance, prevent health complications, and provide personalized treatment to individuals experiencing stress.



LITERATURE SURVEY

1.Stress detection using deep neural networks Published on 30December 2020 by Russell Li & Zhandong Liu

Prior research has shown that analyzing physiological signals is a reliable predictor of stress. Such signals are collected from sensors that are attached to the human body. Researchers have attempted to detect stress by using traditional machine learning methods to analyze physiological signals. Results, ranging between 50 and 90% accuracy, have been mixed. A limitation of traditional machine learning algorithms is the requirement for hand-crafted features. Accuracy decreases if features are misidentified. To address this deficiency, we developed two deep neural networks: a 1-dimensional (1D) convolutional neural network and a multilayer perceptron neural network. Deep neural networks do not require hand-crafted features but

instead extract features from raw data through the layers of the neural networks. The deep neural networks analyzed physiological data collected from chest-worn and wrist-worn sensors to perform two tasks. We tailored each neural network to analyze data from either the chest-worn (1D convolutional neural network) or wrist-worn (multilayer perceptron neural network) sensors. The first task was binary classification for stress detection, in which the networks differentiated between stressed and non-stressed states. The second task was 3-class classification for emotion classification, in which the networks differentiated between baseline, stressed, and amused states. The networks were trained and tested on publicly available data collected in previous studies. The deep convolutional neural network achieved 99.80% and 99.55% accuracy rates for binary and 3-class classification, respectively. The deep multilayer perceptron neural network achieved 99.65% and 98.38% accuracy rates for binary and 3-class classification, respectively. The networks' performance exhibited a significant improvement over past methods that analyzed physiological signals for both binary stress detection and 3-class emotion classification.

2. Stress Monitoring Using Machine Learning, IoT and Wearable Sensors by Abdullah A. Al-Atawi in 10 October 2023

The Internet of Things (IoT) has emerged as a fundamental framework for interconnected device communication, representing a relatively new paradigm and the evolution of the Internet into its next phase. Its significance is pronounced in diverse fields, especially healthcare, where it finds applications in scenarios such as medical service tracking. By analyzing patterns in observed parameters, the anticipation of disease types becomes feasible. Stress monitoring with wearable sensors and the Internet of Things (IoT) is a potential application that can enhance wellness and pre-ventative health management. Healthcare professionals have harnessed robust systems incorporating battery-based wearable technology and wireless communication channels to enable cost- effective healthcare monitoring for various medical conditions. Network-connected sensors, whether within living spaces or worn on the body, accumulate data crucial for evaluating patients' health. The inte-gration of machine learning and cutting-edge technology has sparked research interest in addressing stress levels. Psychological stress significantly impacts a person's physiological parameters. Stress can have negative impacts over time, prompting sometimes costly therapies. Acute stress levels can even constitute a life-threatening risk, especially in people who have previously been diagnosed with borderline personality disorder or schizophrenia. To offer a proactive solution within the realm of smart healthcare, this article introduces a novel machine learning-based system termed "Stress-Track".The device is intended to track a person's stress levels by examining their body temperature, sweat,and motion rate during physical activity. The proposed model achieves an impressive accuracy rate of 99.5%, showcasing its potential impact on stress management and healthcare enhancement.

EXISTING SYSTEM

In the existing system work on stress detection is based on the digital signal processing, taking into consideration Galvanic skin response, blood volume, pupil dilation and skin temperature. And the other work on this issue is based on several physiological signals and visual features (eye closure, head movement) to monitor the stress in a person while he is working. However these measurements are intrusive and are less comfortable in real application. Every sensor data is compared with a stress index which is a threshold value used for detecting the stress level.

Disadvantages:

- Physiological signals used for analysis are often pigeonholed by a Non-stationary time performance.
- The extracted features explicitly gives the stress index of the physiological signals.
- The ECG signal is directly assessed by using commonly used peak j48 algorithm
- Different people may behave or express differently under stress and it is hard to find a universal pattern to define the stress emotion.

PROPOSED SYSTEM

"Why Detecting Stress Using Machine Learning Algorithms?"

- Machine learning techniques can process large volumes of data efficiently, making them suitable

for analyzing diverse sources of information such as physiological signals, behavioral patterns, and textual data from social media.

- Machine learning models can be trained to predict stress levels in real-time or in advance based on historical data, enabling proactive interventions and support strategies to mitigate stress-related risks.
- Overall, detecting stress using machine learning algorithms offers a data-driven, scalable, and personalized approach to understanding and addressing stress, with the potential to improve mental health outcomes and well-being for individuals and populations.

Advantages:

1. Machine learning algorithms can detect subtle changes in behavior and performance that may be difficult for humans to notice.
2. Machine learning algorithms can be used to analyze data related to the performance of employees and detect subtle changes in their performance that may indicate increased stress levels.
3. By recognizing the patterns, the algorithm can suggest changes in the workplace environment or working practices that could help reduce employee stress levels.
4. Machine learning can be used to monitor the impact of changes made in the workplace environment or working practices on employee stress levels.
5. By tracking changes in performance over time, the algorithm can provide feedback to employers on the effectiveness of the changes they have implemented.

CONCLUSION

This project is developed by taking random texts we are able to predict the accuracy of stress by using different machine learning algorithms. Detecting stress using machine learning holds immense promise for both individuals and healthcare providers. Through the analysis of various physiological and behavioral markers, machine learning algorithms can provide accurate and timely assessments of stress levels. This technology offers the potential to revolutionize how we understand and manage stress, enabling early intervention and personalized interventions. By harnessing the power of data-driven insights, we can empower individuals to take proactive steps towards better mental and physical well-being. As research in this field continues to advance, the integration of machine learning into everyday devices and healthcare systems could lead to a future where stress detection is not only seamless but also instrumental in fostering healthier lifestyles and reducing the burden of stress-related illnesses.

FUTURE SCOPE

The scope of detecting stress is multidimensional, encompassing a wide range of physiological, behavioral, contextual, and technological factors. It involves interdisciplinary collaboration across fields such as psychology, medicine, computer science, and engineering to develop comprehensive approaches for understanding and addressing stress in individuals and populations.

REFERENCE

[1]” Segerstrom SC, Miller GE. Psychological stress and the human immune system:a meta-analytic study of 30 years of inquiry. Psychol Bull. 2004;130:601–30.

[2]” Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. JAMA. 2007;298:1685–7.

[3]” Steptoe A, Kivimaki M. Stress and cardiovascular disease: an update on current knowledge. Annu Rev Public Health. 2013;34:337–54.

[4]” Van Praag HM. Can stress cause depression? Prog Neuropsychopharmacol Biol Psychiatry. 2004;28:891–907.

[5]” Heraclides AM. Work stress, obesity and the risk of type 2 diabetes: gender specific bidirectional effect in the Whitehall II study. Obesity. 2012;20:428–33.

[6]” Mitra A. Diabetes and stress: a review. Stud Ethno-Med. 2008;2:131–5.

[7]” Al’Absi M. Stress and addiction: biological and psychological mechanisms. 1st ed. Cambridge: Academic Press; 2006.

[8]“ Tzirakis P, Trigeorgis G, Nicolaou M, Schuller BW, Zafeiriou S. End-to-end multimodal emotion recognition using deep neural networks. IEEE J Sel Top Signal Process. 2017;11:1301–9.

[9]” Daily Life. https://www.stress.org/daily-life [cited 2020 Feb 29].

[10]" Mirsamadi S, Barsoum E, Zhang C. Automatic speech emotion recognition using recurrent neural networks with local attention. In: Proceedings of the 42nd IEEE international conference on acoustics, speech, and signal processing; 2017 March 5–9; New Orleans, USA. New York: IEEE; 2017. https://www.ieeexplore.ieee.org.