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Determining Stress Risk From Short-Term Tweets Using Multiple Approaches

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Abstract— One way to explain stress is as the body's attempt to exert control over itself in reaction to changes in the surrounding environment. This is accomplished via the utilisation of mental, physical, and emotional responses to these shifting conditions. It is possible to characterise stress as the body's attempt to exert control over itself. When experiencing continuous periods of extreme stress, there is a potential that a person's physical and mental well-being may be placed in peril. This is because of the cumulative effect of the stress. This might, over the course of a longer period of time, raise the probability of developing physiological ailments such as hypertension, as well as psychological problems such as anxiety disorder inside the individual. In addition to this, it has the potential to have a detrimental impact on the individual's performance in their place of job. People of all ages are feeling the impacts of psychological stress at an increasing rate, which is becoming a rising source of worry for the community all over the world. It is feasible that a trustworthy and cost-effective acute stress detection system might give its users with the capacity to better monitor and manage their stress, hence reducing the detrimental impacts that stress has on their long-term health. This would be a significant benefit. Stress is becoming an increasingly major problem not just in the area of academics, but also in the realm of people's everyday interactions with one another. Additionally, stress is becoming a problem in the realm of academics. People are becoming more and more aware of this problem and the influence it has on a variety of elements of their lives, including their health, their social lives, their careers, and their overall quality of life experience. This awareness is growing at an alarming rate. Applications that enable real-time monitoring and management of stress have become increasingly popular as a direct result of this trend. These applications let stress measurement and management to be performed in real time. The present technical and scientific advancements have been the driving force behind this heightened interest, which has resulted in the introduction of new ways of thinking and methods. In order to develop a Windows application that makes use of the Python programming language for the purpose of stress detection, this project will include posing questions to users and taking pictures of their faces. A component of this project will be the development of the application.

Keywords: stress detection, emotion detection, python and windows application.

I. INTRODUCTION

In this survey, it is feasible to characterise a person's perception of stress as a reaction to unfavourable external events that put the individual's regular adaptive skills to the test [1]. This is one way that stress might be described. Despite the fact that positive stress, also known as eustress, assists an individual in maintaining their concentration in the face of adversity, negative stress, also known as distress, is responsible for the activation of the hypothalamic-pituitary-adrenal (HPA) axis, which is responsible for regulating the synthesis of hormones. This axis is responsible for the regulation of hormone production. When the HPA axis is activated for an extended period of time, it has the potential to induce disorders that are both physiological and psychological in nature [2-3]. In addition, it has been demonstrated that psychological stress has an impact on physiological processes, that it has a detrimental impact on the performance of workers in their day-to-day jobs, and that it is believed to have an impact on the economy of the nation. It is possible that monitoring negative stress levels may offer a chance to take the appropriate steps in order to prevent it from occurring again in the future. This is in addition to the fact that monitoring levels of negative stress not only gives essential information for determining the origin of stress, but also provides this information. The following are the two unique impacts of negative stress: (i) physiological stress, also known as "objective" stress; and (ii) psychological stress, also known as "subjective" stress, also known as perceived stress. Both of these types of stress are characterised by the presence of stress. Both of these forms of stress may be differentiated from one another based on the features that they possess. The presence of objective stress is characterised by a shift in physiological indicators, which may include, but are not limited to, increased levels of cortisol, higher blood pressure, and accelerated heart rate, amongst other symptoms. Subjective stress is a term that relates to the perception that an individual has pertaining to whether or not a given condition is stressful. Subjective stress is a concept that has been around for quite some time. The application of stress questionnaires, such as the DASS 21 (Depression, Anxiety, and Stress Scale - 21 Items), the STAI (State-Trait Anxiety Inventory), and the POMS, are the

measures that are utilised the most commonly in order to assess the amount of perceived stress. These include the DASS 21 and the STAI. Two of the most often used physiological indicators for stress are cortisol, which is a hormone that is related with stress, and physiological signal assessments, which include the Galvanic Skin Response (GSR), Electrocardiogram (ECG), and Electroencephalogram (EEG). Electroencephalogram is the most common of these physiological markers. Within the context of [4], we talked about the many physiological manifestations of stress, as well as the technologies that are utilised to assess stress measures in real time. In addition, a discussion of was given in [4].

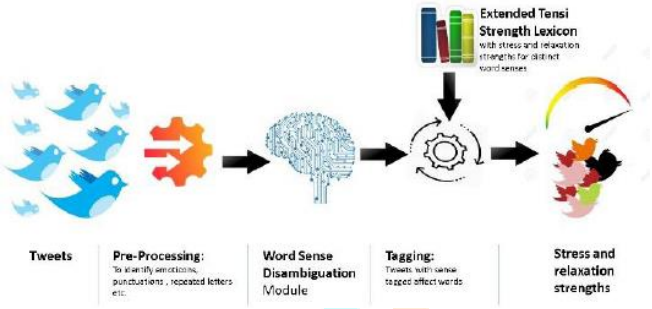

Figure 1: Stress Detection.

A review that we have written on the different sensors and pieces of equipment that are now on the market for the aim of detecting stress in [5] may also be found below. You can view it if you are interested. Python is going to be used as the programming language for the creation of a Windows application that will be used for the purpose of stress detection. In order to positively identify the person who is experiencing stress, this application will make use of the responses to questions offered by users as well as the visual data provided by users.

II. Literature Survey

In this study, As is common knowledge, stress is currently one of the most significant issues facing modern civilisation. It has a negative impact on our health in a roundabout way, both physically and psychologically. Although it is damaging, stress may be averted and successfully managed if it is recognised and addressed in a timely manner. A general introduction to the newly developing topic of stress detection through the application of machine learning techniques is presented in this work. The identification of stress is a relatively new and exciting area of research that has emerged in recent times. Machine learning, which permits the analysis of enormous datasets and the discovery of non-linear trends, has been the subject of this research. Our approach takes into account the physiological, behavioural, and environmental cues of an individual in order to determine the amount of stress that they are experiencing. We may, for instance, train the models on numerous stress-related characteristics, such as the individual's age, blood pressure, and heart rate, in order to determine whether or not the individual is experiencing stress. This can be accomplished through the use of machine learning techniques. Some of the qualitative qualities that it may possess include gender, occupational classifications, and the level of stress experienced. The categorisation of human stress levels using labelled data may be accomplished by the use of a number of different models, including decision trees, random forests, KNN, and logistic regression, among others. It was also pointed out in these papers that there are potential and problems associated with the application of machine learning techniques for stress detection. a number of concerns, including the requirement for large and varied data sets, ethical issues, and the possibility of bias in the model. As a result of the fact that stress is a complicated problem, it is necessary to gain an understanding of it in order to assist in the resolution of this issue. And with the utilisation of technology, software in the case of its utilisation by individuals and communities to manage stress, and with a combination of these two, this is a new and emerging area of research and application to machine learning in the world, and the utilisation of technology by individuals and individuals makes stress detections possible.[1]

Suicidal ideation is a potential outcome of depression, which has emerged as a significant issue in Thailand's mental health situation. Early diagnosis of the degree of suicidal thoughts should be done since the strength of suicidal ideation might change and can lead to attempts at suicide. Examples of text categorisation models that can be used to predict the degree of suicidal thoughts are shown in this research. A number of different categorisation models were developed with the use of a dataset consisting of Thai-language tweets. Another thing that was done was the development of a prototype for a web application that could detect the degree of suicide ideation and provide its users with self-treatment based on cognitive behavioural therapy for the purpose of regulating negative automatic thoughts. While the user experience evaluation was being conducted, the application prototype was given feedback that was satisfactory. The findings of this study underline the significance of socio-technical systems, as well as the necessity of such systems, in order to assist with the early identification of suicidal thoughts and the early therapy of suicidal ideation in social environments when mental health assistance is inadequate.[2]

Stress is a fact of life in the contemporary world, and if it is not well controlled, it may pose serious dangers to one's health. The identification of stress at an early stage is of utmost importance in preventing unfavourable health consequences and fostering well-being. This work provides a unique method to the monitoring and management of stress that makes use of techniques from machine learning (ML) and physiological sensors that are worn by the individual. By analysing multimodal datasets, which include electrocardiogram (ECG) signals and other physiological indicators, the model that we have suggested seeks to reliably determine the amounts of stress that individuals are experiencing. Utilising low-cost wearable sensors and Internet of Things technologies, our solution offers consumers real-time feedback and alerts them to their stress levels. This enables individuals to take preventative measures to reduce the likelihood of adverse health effects. The purpose of our research is to contribute to the development of stress monitoring systems that are more efficient and effective. This is accomplished by doing a complete analysis of existing stress detection methodologies and integrating machine learning algorithms. This research has the potential to improve health outcomes and enhance quality of life in those who are dealing with issues connected to stress.[3]

The introduction of Industry 4.0 calls for a significant amount of interaction between humans and machines. This presents new issues when it comes to determining the levels of stress experienced by individuals who are employed in surroundings that are becoming increasingly complex. There is little question that stress brought on by one's place of employment has a substantial impact on the overall levels of stress experienced by individuals, which in turn can result in long-term health problems and negative effects on their quality of life. Despite the fact that psychological questionnaires have historically been used to evaluate stress, they are not able to

monitor stress levels in real time or on an ongoing basis. As a result, it is difficult to determine the factors that generate stress and the demanding parts of work. In order to overcome this constraint, an efficient solution lies in the analysis of physiological signals that may be continually recorded through the use of ambient sensors or wearable sensors. Previous research in this area has mostly concentrated on the evaluation of stress through the use of invasive wearable devices that are prone to noise and artefacts that reduce performance. An ambient hardware-software platform that is wearable and minimally invasive, capable of detecting human stress without obstructing regular work tasks, and marginally prone to artefacts owing to motions was shown in one of our articles that was published not too long ago. One of the limitations of this system is that it does not have a very high performance in terms of the accuracy of detecting numerous stress levels. As a result, the focus of this study was on enhancing the software performance of the platform by employing a deep learning technique. In order to accomplish this goal, three neural networks were put into operation. The one-dimensional convolutional neural network was found to have the highest performance, achieving an accuracy of 95.38% for the detection of two degrees of stress. This is a major improvement over the results that were produced in the past.[4]

Over the course of several decades, academics have pursued the prospect that robots may one day achieve the same level of language capabilities as humans. More advanced methodologies, such as sentiment analysis (SA), have recently gained substantial momentum on contemporary applications. This is due to recent advancements in the field of natural language processing (NLP), as well as a substantial increase in the amount of naturally occurring linguistic data that is available on social media platforms. This article is a compilation of what the authors feel to be some of the most significant ideas associated with SA, as well as the methods and procedures that are required for the various stages of its implementation.Furthermore, particular applications relating to the extraction and categorisation of data from social media platforms employing unique SA approaches are described and quantified. Particular attention is paid to the applications that were utilised for the detection of mental health deterioration during the COVID-19 pandemic. Last but not least, the authors give a number of conclusions that emphasise the most significant advantages and disadvantages of the approaches that were addressed. This is followed by a brief discussion of the potential future applications of particular methods that are of considerable interest.[5]

As a gigantic soapbox, cyberspace provides individuals with the opportunity to share everything that they observe in their day-to-day lives. Review, opinion, influence, or sentiment analysis are the most common uses for material that is shared on social media platforms. Based on the posts and comments that an individual shares on social networking sites, the purpose of this article is to expand sentiment and emotion analysis for the purpose of identifying the level of stress that an individual is experiencing. We achieve sentiment analysis by using large-scale datasets that contain tweets. This is accomplished with the use of machine learning techniques and a deep learning model known as BERT for the purpose of sentiment classification. Additionally, we utilised Latent Dirichlet Allocation, which is an unsupervised machine learning technique that allows for the scanning of a collection of documents, the identification of word and phrase patterns contained within those documents, and the collection of word groupings and similar phrases that most accurately portray a collection of these documents.

This allows us to make an educated guess as to which subject is connected to the textual data. We will be able to determine the feelings of people who are using the internet with the assistance of these models. In addition, these feelings might be utilised in the procedure of analysing stress or depression. As a conclusion, the ML models and a BERT model have a detection rate that is quite excellent. The findings of this research are beneficial to the mental health of individuals. The findings are analysed using a variety of metrics at both the macro and micro levels, and they reveal that the trained model is able to determine the status of emotions based on social interactions.[6]

There has been a lot of attention paid to the problem of suicides in today's culture, which has gotten increasingly concerning as time has gone on. One of the most prevalent causes of suicide is depression, according to widely held beliefs. However, there are a number of additional potential causes, including economic factors (such as unemployment), societal ones (such as dowry disputes), and illnesses that cannot be cured (such as AIDS), amongst others. To prevent people from taking their own lives, chatbots powered by artificial intelligence have been developed; nevertheless, the accuracy of these chatbots is only close to 75%. We employ machine learning algorithms to successfully forecast suicide attempts with a substantial degree of precision in order to reduce the number of people who intentionally take their own lives in the future. The preliminary examination of the data would provide us with insights into the statistics of suicide, as well as the link between the various components and the degree to which they contribute. This article provides a graphical depiction in order to better comprehend the patterns in suicide attempts. In this work, various methods that are currently in use for the development of suicide prediction models are presented. This article takes a more in-depth look at the benefits and drawbacks of various methods. An analysis of the efficacy of various algorithms is carried out in comparison to one another.[8]

A. STRESS is one of the most significant leading elements that contribute to health problems in the modern world. The heart rate, the galvanic skin reaction, the body temperature, and the blood pressure are the fundamental metrics that may be used to identify stress. These measures give precise information about the mental state of an individual. These criteria differ from one individual to the next based on a variety of factors, including the individual's age, gender, and the state of their body. In a variety of situations and states of mind, the primary objective of the system is to conduct an analysis of the mental stress through the use of physiological data obtained from an electrocardiograph. The technique of stress detection can be accomplished using a variety of pre-processing methods. A discrete wavelet transform may be utilised in the process of feature extraction. Classifiers such as artificial neural networks, support vector machines, Bayesian networks, and decision trees are being utilised by a multitude of individuals in order to get more accurate outcomes depending on accuracy. The availability of sensor-enabled portable, wearable, and implantable devices is becoming increasingly widespread in the expanding Internet of Things (IoT), which is leading to an increase in the significance of physiological sensors analytics. There have been effective attempts made to identify stress through the use of physiological multi-sensor research.[9]

The subject of suicide is a significant problem in today's culture.In order to save people's lives, problems involving the early diagnosis and prevention of suicide attempts should be addressed. approaches that are now being used to identify suicide thoughts include clinical approaches that are based on the interaction between social workers or specialists and the persons who are being targeted, as well as machine learning techniques that utilise feature engineering or deep learning for automatic detection based on online social contents. A full introduction and discussion of the approaches that fall under these categories is provided in this work, which is the first study of its kind. Suicidal ideation detection systems that are unique to a certain domain are evaluated based on the data sources that they employ, which include surveys, electronic health records, suicide notes, and online user material. For the purpose of making additional research easier to do, a number of particular tasks and datasets are presented and summarised. Finally, we present a summary of the limits of the work that has been done so far and an insight on the routes that subsequent study should take.[10]

Currently, the digitisation of the healthcare business is taking use of the developments that have been made in clinical healthcare providing services. The extensive growth in data for monitoring and analysing the outcomes of patients in predicting and diagnosing chronic diseases is lacking in traditional methods. These methods are being replaced by technologies that are able to gather the most relevant insights from medical data through the utilisation of predictive analytics with the very helpful tool of machine learning. The significance of incorporating machine learning algorithms into the diagnostic model demonstrates the machine's capacity to achieve a high classification accuracy rate while also reducing the amount of time required for calculation. The purpose of this work is to investigate the use of various machine learning approaches to the classification of chronic diseases such as cancer, diabetes, renal disease, and heart disease from many datasets. This is accomplished by lowering the dimensionality through the use of feature selection.
The selection of features is an important part of machine learning since it allows for the identification of the most important characteristics for the diagnosis of chronic illnesses. There are a number of measures that are used to evaluate the performance of the classifiers. These metrics include classification accuracy, sensitivity, specificity, precision, F1-measure, AUC (the area under the receiver operating characteristic (ROC) curve) criteria, and processing time.[11]

Managing stress is something that the majority of people have to do on a regular basis since it is an inevitable aspect of everyday living. On the other hand, experiencing stress that lasts for an extended period of time or that is of a high degree will make our lives less normal and put our safety at risk. Through early detection of mental stress, it is possible to avert many of the physical issues that are connected with stress. When a person is under stress, there are noticeable changes in a variety of biosignals, including thermal, electrical, impedance, auditory, and optical signals, among others. These biosignals may be used to determine the exact amounts of stress that a person is experiencing. The purpose of this research is to present several machine learning and deep learning strategies for the detection of stress on persons by utilising a multimodal dataset acquired by wearable physiological and motion sensors. These techniques have the potential to protect individuals from a variety of health issues that are associated with stress. The WESAD dataset contains information on sensor modalities such as three-axis acceleration (ACC), electrocardiogram (ECG), blood volume pulse (BVP), body temperature (TEMP), respiration (RESP), electromyogram (EMG), and electrodermal activity (EDA). These data are for three physiological states: the amusement state, the neutral state, and the stress state. Machine learning techniques such as K-Nearest Neighbour, Linear Discriminant Analysis, Random Forest, Decision Tree, AdaBoost, and Kernel Support Vector Machine were utilised in order to evaluate and compare the accuracy of three-class classifications (amusement versus baseline versus stress) and binary classifications (stress versus non-stress). In addition, a straightforward feed forward deep learning artificial neural network is shown for the purpose of implementing these three-class and binary classification functions. During the course of the research, the use of machine learning techniques resulted in accuracies of up to 81.65% and 93.20% for three-class and binary classification tasks, respectively. Furthermore, the application of deep learning resulted in accuracies of up to 84.32% and 95.21%, respectively.[12]

There has been a strong correlation between the fields of study that focus on mental health and social media. During the course of this investigation, a novel model known as the AD prediction model is presented for the purpose of predicting anxious depression in real-time tweets. The majority of people who suffer from this mixed anxiety-depressive disease have unpredictable mental processes, restlessness, and an inability to sleep. The feature set is defined by utilising a 5-tuple vector that includes the following elements: timing, frequency, sentiment, and contrast. This is done based on the language signals and the patterns of user posting. In order to identify the existence of anxiety indications, a vocabulary that is connected to anxiety is being constructed. Opinion polarity analytics is performed in order to identify inconsistencies in posting behaviour, and time and frequency of tweets are analysed for anomalies to identify irregularities. During the training process, the model is trained with three different classifiers, including multinomial naïve bayes, gradient boosting, and random forest. Additionally, majority voting is performed with an ensemble voting classifier. The suggested model obtains a classification accuracy of 85.09% when applied to the tweets of a sample of one hundred users, according to the preliminary findings that have been reviewed.[13]

III. Proposed Methodology

During the creation of the project, which will take the form of a Windows application, the programming language that will be utilised is going to be Python. The identification of stress will be accomplished through the use of question-and-answer exchanges between the system and the user himself. It is the information that is provided to the system in the form of questions and responses that is responsible for determining the effectiveness of the system. Due to the fact that we are going to use the web camera that is installed on the laptop, we will be required to make some adjustments in terms of precision when determining the emotions that the user is experiencing. In order to provide a comprehensive description of the module's functionality, the following two modes are utilised:
This is the first training module. Testing Module 2 (Testing).There are two phases that are included in the Training Module, specifically Phase I and Phase II.

In the first phase, we have made use of that data set (the contents of the data set are specified in the Data Structure) in order to preprocess each attribute and determine whether or

not the field is authentic. In addition, it is important to determine whether or not the features of each quality are genuine. Throughout the course of this processing, we have exhausted every possible option, from processing all of the data to verifying the value of every field.

Phase II: During this phase, we have trained all of the data sets by utilising a number of different algorithms, including Decision Tree, KNN, and SVM. Additionally, we have calculated the performance of each approach while taking into consideration the accuracy calculation.

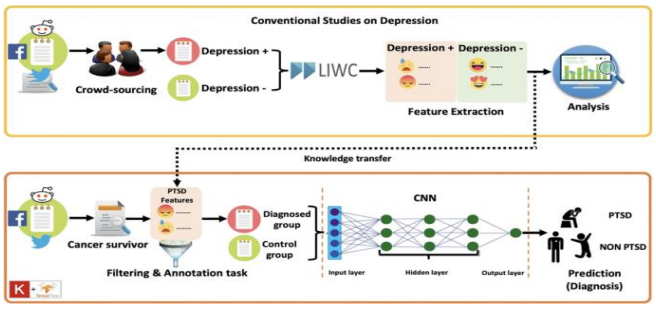

Figure 3.1: System Architecture

Python, a programming language, will be utilised in the construction of the project in accordance with the system that was suggested. The project will be developed as a Windows program when it is finished. The identification of stress will be accomplished through the use of question-and-answer exchanges between the system and the user himself. The information that is entered into the system, which often takes the form of questions and answers, is precisely what defines the level of efficiency that the system possesses. Due to the fact that we are going to use the web camera that is installed on the laptop, we will be required to make some adjustments in terms of precision when determining the emotions that the user is experiencing. Stress detection systems offer a wide range of applications and scopes since, in today's fast-paced world, no one has the time to focus on their mental health. As a result, these systems have several different applications and scopes. Individuals in today's culture are influenced by stress and despair to the extent that ninety-nine percent of them are affected. As a consequence of this, the stress detection system will be applicable to a wide range of different areas and applications.

IV. EXPERIMENTAL RESULTS

Python, a programming language, will be used to construct the project using the suggested system. The project will be produced as a Windows application. Through the use of question-and-answer exchanges between the system and the user, stress will be identified. The information that is put into the system, which consists of questions and answers, is exactly what determines how efficient the system is. In addition, because we are going to use the web camera on the laptop, we will have to make concessions in terms of precision when identifying the feelings of the user. Due to the fact that in today's fast-paced world, no one has the time to focus on their mental health, stress detection systems have a wide variety of applications and scope. Ninety-nine percent of individuals in today's society are affected by stress and despair. As a result, the stress detection system will have a broad variety of applications and domains of use. We begin with the outcomes, and then we go to the algorithms that are based on decision trees. Figure 4.1 illustrates.

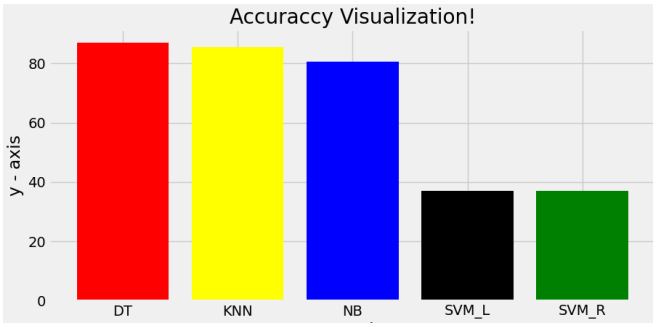

Figure 4.1: Accuracy Visualization

V. CONCLUSION

The Python programming language was utilised in the process of developing and implementing a system that is capable of detecting stressed individuals. For the purpose of the project, a mobile application that is compatible with Android has been built. Facial expressions will be used for the goal of recognising emotions such as happiness, fear, or melancholy, and a question-and-answer system will be used for the purpose of determining stress. Both of these methods will be utilised. We are going to make use of support vector machines (SVM), linear regression, and decision trees in order to achieve this objective.

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