ANALYZING THE IMPACT OF SLEEP TRAIT IN THE DETECTION AND PREDICTION OF STRESS THROUGH MACHINE LEARNING

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ABSTRACT

People are thriving towards perfection, performance, and profit in the society which in-turn is leading to disturbances among them both mentally and physically. One issue faced by most of the people irrespective of the age groups is “Stress”. With the onset of Covid-19 pandemic, Stress has become a disastrous disorder faced by most of the people today. Most of the people are unaware that they are suffering from such a disorder. Stress lays in the hands of at-most all people either knowingly or unknowingly. There are numerous methods to detect stress manually. People don’t come forward to take up treatments for stress. This disorder peeps out of humans through various symptoms like irritation, loss of appetite, agitation, depression, anxiety, reduced performance, sleep disturbance, etc. Among the afore mentioned symptoms, sleep disturbance is the major and most influential parameter in detecting and predicting stress. The SaYo Pillow is the “Smart-Yoga Pillow” which assists in concerning the relationship pertaining to sleep and stress. Although there are other methods to track sleep like Fitbit trackers to track sleeping patterns, SaYo Pillow stands out as it detects the psychological behaviors that occurs during sleep. This tracking of psychological behavior is lacking in case of other devices like Fitbit used for sleep pattern detection. The data obtained from this pillow can be used to study how stress can affect sleep. Machine Learning methods are applied to the data to detect if the person is stressed or not. Thereby adding to it, prediction is also done to understand will the person be stressed in near future. Machine Learning algorithms such as Support Vector Machine (SVM), Random Forest Classifier and Gradient Boosting Classifier was used to detect and predict stress among the individuals. The performance of these algorithms was compared to identify the best performing algorithms. After identifying the best performing algorithm, the same was applied to the data to detect and predict the occurrence of stress. In addition to that, an application was developed which suggests some activities to the candidate to overcome stress.

Key terms: Stress, Irritation, Agitation, Depression, Anxiety, Sleep disturbance SaYoPillow, Fitbit Trackers, Machine Learning, Support Vector Machine (SVM), Random Forest Classifier, Gradient Boosting Classifier

1. INTRODUCTION

Stress has become one of the prominent buzzwords in the genre of diseases that are spread wide across the world today. Millions of people are suffering from this disorder. Amidst many, only a few people get proper treatment on time whereas the others fail out miserably. A report revealed by Linkedln on World Health Day of 2021 said that about 55% of the Indian employees are stressed. There are a variety of causes for stress like money, work, economy, family responsibilities, relationships, personal health issues, housing costs, job stability, family health problems, personal safety, etc. With its serious impact towards health, stress has become one of the thrust areas of concern in the medical domain.

There are several studies suggesting the various works carried out in the field of psychology. Most of the studies show that stress is detected using the sensor data. Various parameters are taken into consideration. In this study, the impact of stress on sleep alone is considered. Machine Learning Algorithms help in gaining better in-sight towards the data.

The SaYoPillow is an edge device which is composed of a model to analyze the psychological factors that occur during sleep[1]. The disturbance in sleep is the first and foremost outcome of stress. The data associated with sleep such as snoring rate of the user, body temperature, respiration rate, limb movement rate, blood oxygen levels, eye movement, duration of sleep, heart rate and stress levels are captured using the Smart-Yoga Pillow (SaYoPillow). Based on the data obtained from the SaYoPillow, the stress is predicted for the following day. A sample data for the same is available in the Kaggle which is used for stress detection and prediction in the proposed work.

2. Literature survey

A work by Elena Smets et.al., compares different machine learning techniques for the measurement of stress based on physiological responses in a controlled environment. Electrocardiogram (ECG), galvanic skin response (GSR), temperature and respiration were measured in this work. Six machine learning algorithms were used for the study. This work demonstrated that dynamic Bayesian network and generalized support vector machines promoted best classification results. [4]

Data was collected from three-axis acceleration, electrocardiogram (ECG), blood volume pulse, body temperature, respiration, electromyogram and electrodermal activity. The three physiological conditions – amusement, neutral and stress states were taken from WESAD dataset. The accuracies for the three-class (amusement, baseline, stress) and binary (stress and non-stress) were compared and evaluated using machine learning techniques like K-Nearest Neighbour, Linear Discriminant Analysis, Random Forest, Decision Trees, Adaboost and Kernel Support Vector Machine. [5]

The effect of stress was investigated by using accelerometer and gyroscope sensor data of the writing behavior on a smartphone touchscreen panel. The smartphone data including two states (stress and calm) were collected from 46 participants. These sensor signals were divided into interval windows to develop different datasets and features. These features were ranked by Gain Ratio feature selection algorithm. The writing behaviors was classified by C4.5 Decision Trees, Bayesian Networks and k-Nearest Neighbor methods and the results were evaluated by using accuracy. [6]

The biological data was collected such as respiration, GSR Hand, GSR Foot, Heart Rate and EMG from different candidates in different situations and places while they were driving. Data Segmentation for various time intervals is performed for different stress levels. The statistical features were extracted from the segmented data and these features are fed into the available classifier. The classifiers KNN, K-nearest neighbor and Support Vector Machine were used. The stress was classified into low, medium, and high levels. This showed that stress level can be detected with a good accuracy for each of the time intervals. [7]

A work by Shruti Gedam et.al., investigates the stress detection approaches adopted by considering the sensory devices such as wearable sensors, Electrocardiogram (ECG), Electroencephalography (EEG), and Photoplethysmography (PPG) depending on various environments like driving, studying, and working. A multimodal stress detection system using a wearable sensor-based deep learning technique has also been proposed. [8]

This study focuses on ECG monitoring which can be performed with minimally invasive wearable patches and sensors, to develop an efficient and robust mechanism for accurate stress identification. A unique aspect of this research is personalized individual stress analysis including three stress levels - low, medium and high. Machine Learning algorithms are applied to the ECG signals and the performance is evaluated. [9]

Electrocardiogram (ECG) was considered as the primary candidate because it is easier to record. The features of ECG are distinct, and the collection is also cost-efficient. The RR interval, QT interval, and EDR features are derived from the ECG for the model development. SVM was chosen for classification and the results were evaluated with Gaussian Kernel function. [10]

The data from wrist sensor such as accelerometer and skin conductance, mobile phone usage like call, short message service, location and screen data and surveys were used for capturing stress, mood, sleep, etc. Correlation Analysis was used to find statistically significant features that are associated with stress and machine learning algorithms were used to classify if the candidate has stress or not. The sensor data promoted an increase in the accuracy compared to those provided by surveys. [11]

3. Background

The existing method to detect stress is to meet a psychiatrist and the psychiatrist provides a questionnaire to be answered by the candidate. Elucidated from the answers given from the candidate, stress is measured. This well-known method has its own limitations. Major limitation is that people tend give false answers to the questions provoked by in the

questionnaire. With fake answers, the report doesn't come out to be appropriate to the patient's health. Another prevalent method to detect stress is to use fit bits to capture the data passively from the candidates and analyze the data to study stress disorder. This method fails to study stress by considering the psychological changes caused during sleep. This factor is in fact the most essential one to have a fine-grained approach to detect stress. Stress cannot be detected unless and until the person susceptible to stress takes a stand and volunteers himself.

The prevalent signs of stress include depression, disturbance in sleep cycles, hypertension, anxiety, mistakes in the work, lack of concentration and apathy. In addition to this, there exist physical symptoms such as headaches, fatigue, loss of appetite, pain in the areas of chest, neck and back. If stress is not concerned at the earlier stage, it leads to other tedious health issues like psychological disorders and mental illness. Henceforth, it is of greater importance to take essential steps to manage stress and take effective medications to overcome it. Sometimes, doctors advise patients to take pills to manage stress which is the worst side of stress.

Sleep is a vital function of the human body as it promotes the human brain to recharge and allows the body to rest. Sleep is the only thing that promotes peace to the body both internally and externally. Even a small deviation in sleep can influence judgement, memory and mood. Sleep and Stress are interlinked with each other. Though, stress seems to have a multi-dimensional facet, the first and foremost symptom that peeps out as the result of stress is the reduction in the number of hours of sleep. Stress has an adverse effect on the quality of sleep and lack of sleep can have a high impact on stress. Both factors are interlinked with each other to a high degree. The deficiency of sleep and increased levels of stress can lead to physical and mental health problems. People suffering from these issues cannot tackle it by themselves. They require foster care to overcome these inefficiencies.

The sleep data collected from SaYoPillow is analyzed to detect the person who are having Stress and in addition to that prediction is done to find out the individuals who are susceptible to Stress soon. This will provide an alarming call to the individuals to take up proper treatment at the earliest opportunity. For analysis, the algorithms such as Support Vector Machine, Random Forest Classifier and Gradient Boosting Classifier are applied to the data to study which algorithm performs better. This would in-turn provide an opportunity to automate the system by building a pipeline which could detect and predict itself and report the candidates who are profound to have stress.

Initially, stress detection was done manually by consulting doctors. Manually detecting stress can be wrong at times. If unexperienced professionals are counselling patients, they can lead to mistaken results. Machine Learning plays a vital role in automating the manual tasks. Amidst the ocean of algorithms available in the domain of Machine Learning, these algorithms were selected due to the unique capabilities that each pertains to. Each algorithm stands its own way with varying advantages and disadvantages. The reason behind using classifiers is that they designate the data into one or more classes automatically. Although a number of features can be used to study stress, but sleep is considered to be the most influential parameter of stress.

4. PROPOSED METHODOLOGY

There are various methods to detect stress. And quite a few methods to detect stress. Stress management comes out to be another side of research interest. The proposed system tries to collate detection and prediction of stress. In addition to this, an android application has been suggested to manage and relieve stress. The overall architecture of the proposed system is shown in the following figure.

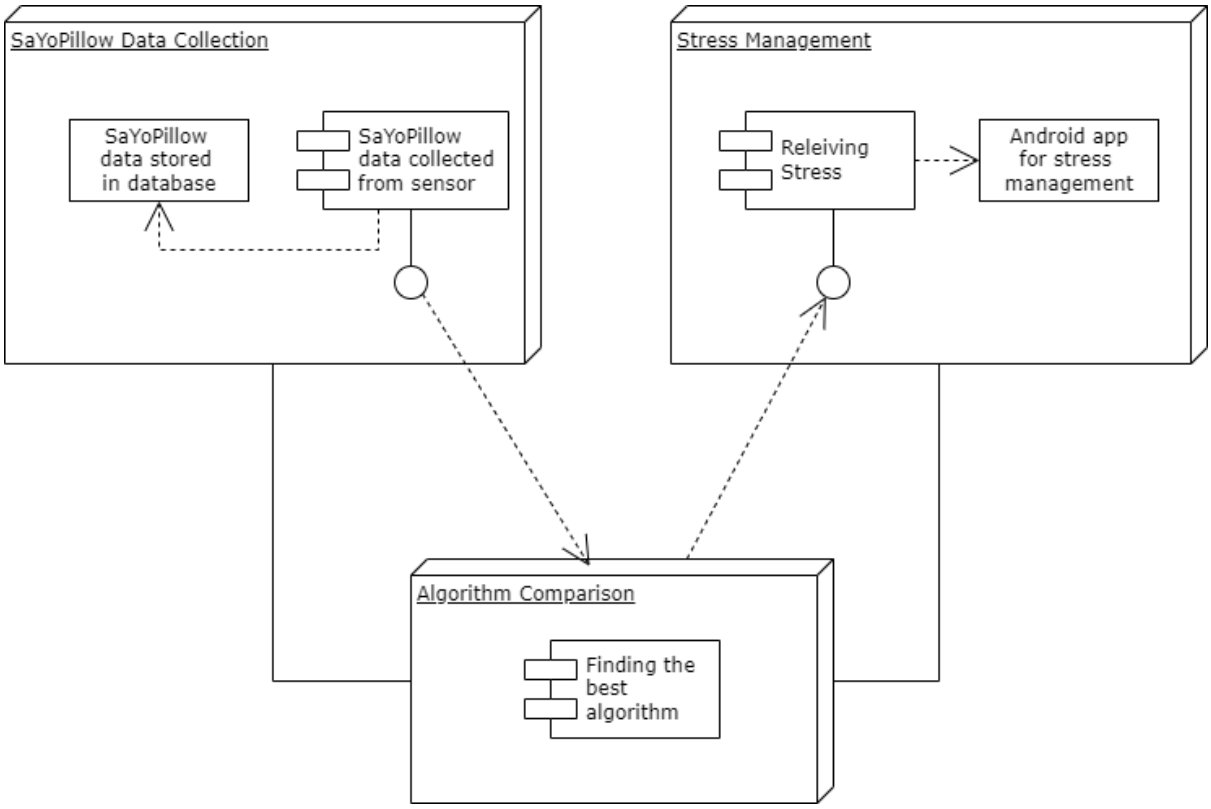

Fig 1: Architecture of the proposed system

From figure 1, it can be understood that the data collected from the SaYoPillow is stored in the database. For this dataset, the classification algorithms are applied. The best performing algorithm is found. Based on the stress level, the application installed in the candidate's phone suggests some measures to relieve stress.

4.1 Data Collection

The Smart Pillow ("SaYoPillow") designed by Laavanya et.al [1] is used to study the dependency between the quality of sleep and the variations in stress. The complete aim of smart pillow is to promote "Smart-Sleeping" that is delivering a sleep that encounters the ideal requirements possessed by the body. Smart Pillow is one of the Internet of Medical Things (IoMT) application. Adding to its features, smart pillow is intended to inculcate the user with the advantages of sleep and to enforce the correlation existing between sleep and stress to the users. Changes in the body temperature, heart rate, and blood pressure, which affects stress levels during the day are observed throughout the different stages of sleep [3]. Once after the person lies in the smart pillow, the sensors attached to the pillow gets activated which in turn activates other sensors in the tracker affixed to the person's hand. All these sensors together

give the necessary data relating to sleep such as – number of hours of sleep, snoring sound range, respiratory rate range and heart rate range.

Fig 2: Data Collection using SaYoPillow

The common technique to detect various stages of sleep is composed of electroencephalography - the technique used to study brain, electromyography – method to evident muscle tones and electroculography – technique ascertaining to eye movement. This is quite a tedious task to obtain the insights of sleep patterns. This smart pillow provides an easy mechanism to study the sleep patterns in a cost-effective manner. The data collected through the sensors fitted to the smart pillow is stored in the database. These data can be analyzed by applying machine learning techniques and psychological changes associated with sleep can be studied thereby detecting and predicting the individuals affected with stress.

4.2 Methodology

In the proposed method, three machine learning algorithms in specific classifiers are used to detect and predict stress. This will help to gain an insight into the algorithms use in psychological perspective. The performance of each of the algorithms are evaluated based on the accuracy gained. Three algorithms namely – Gradient Boosting Classifier, Random Forest Classifier and Support vector machines were applied to the data and their performance on the data was analyzed to choose the best model to evaluate the psychological changes occurring during sleep because of stress.

Hypothesis for the proposed work is considered as follows:

H0: The person is suffering from stress

H1: The person does not have stress

Confusion Matrix

		True class	
		Positive	**Negative**
Actual Class	**Positive**	The person has stress and is predicted as the person has stress.	The person does not have stress and is predicted as the person has stress.
	Negative	The person has stress and is predicted as the person does not have stress.	The person does not have stress and is predicted as the person does not have stress.

4.3 Gradient Boosting Classifier

The reason behind choosing this algorithm is that this algorithm constructs model sequentially and in the following models, it endeavors to decrease the errors of the previous model. This is done by constructing the new model on the errors of the prior one. Also, Gradient Boosting algorithm can be used for both regression and classification. Gradient Boosting is an ensemble learning algorithm which means that a strong model is developed by using a collection of weak models that are learnt iteratively from the weaker ones. In Gradient boosting, there exists three elements – Loss function, Weak Learner, and Additive Model.

i. Loss Function – utilized to evaluate the performance of the model in regard to making predictions with existing data.
ii. Weak Learner – assorts the data but has a poor performance.
iii. Additive Model – Incremental and consecutive approach in which weak learners are added to the tree by considering single step at a time.

To detect and predict stress, the sleep data is collected through SaYoPillow. As there is lack of awareness about which parameter detects the best, Gradient Boosting Classifiers is used because it has a good performance over the weak learners also. It was used because it requires less pre-processing compared to other algorithms. GBC can be used with various loss functions which makes the model highly flexible. The major issue faced with training a model is missing values. Gradient boosting classifiers has its own way of handling these missing values and provide better accuracy to the model. It does not require any explicit handling of these missing values making the human task easier. The steps involved in the development of this algorithm is given as follows:

Step 1: Initialize the input and output variables.

Step 2: For the data, fit either a linear regressor or a decision tree.

Step 3: Compute the residuals by considering target value and predicted value. [residuals = target value – predicted value]

Step 4: Taking into account the error residuals, fit a new model on that as target variable and considering the same input variables.

Step 5: Sum up the predicted residual to the previous predictions

Step 6: On the left-over residuals, fit a new model. Proceed with the repetition of steps 2 to 5 until there is overfitting or the summation of residuals begin to remain constant.

Fitting the data by using the above stated steps, the behaviour of sleep was studied.

For the sample data used, this algorithm promoted an accuracy of 96% for both detection and prediction of stress among the individuals.

4.4 Random Forest Classifier

To have an in-depth understanding of the psychological changes occurring during sleep and to analyze whether there is any other algorithm performing better than Gradient Boosting Classifier, Random Forest Classifier was used for the same sample data. Random forest classifier is composed of numerous individual decision trees that steer together as an ensemble. Each of the individual trees provide a class prediction and the class having higher prediction becomes the prediction of the model. The overall concept of random forest is that numerous uncorrelated trees that are working as a group will perform better than any of the individual trees. There exists low correlation between the models. The models with low correlation can generate ensemble predictions which are highly accurate than the discrete predictions. The reason for this is that the independent trees save each other from the discrete errors. Though few trees may fail, most other trees will be right which promotes the batch of trees to be successful in prediction and detection. As there exists some actual signs existing in the features such that the models built using those features can perform better guessing. In addition to that the predictions made by the independent trees have low correlation with each other. The steps involved in the construction of random forest algorithm are given as follows:

Step 1: A dataset composing of k records, n number of random records are taken for constructing random forest.

Step 2: For each sample, independent trees are constructed.

Step 3: Independent decision trees will produce output.

Step 4: Concluding output is considered based on Majority Voting for Classification.

The model parameters applied to this algorithm are stated as given below:

The noteworthy features for contemplating Random Forest for the analysis of the SaYoPillow data are diversity, there is a split between the test and train data, parallelization, and stability. Also, this algorithm enriches the execution and power of prediction of the models with the use of hyperparameters. By applying this algorithm to the dataset, the accuracy was increased to 98.4% in comparison to Gradient Boosting Classifier.

4.5 Support Vector Machines

Support Vector Machines belongs to the category of supervised learning algorithms which can be used for both regression and classification. In addition to that, SVM can be used for outliers' detection as well. SVM stands distinct from other classification algorithms in the way they select the decision boundary which maximizes the distance between the data points of all classes. Maximum margin hyperplane or maximum margin classifier is the decision boundary constructed by SVM. SVM detects the extreme points /vectors that assist in the construction of hyperplane. These extreme cases are known as support vectors and henceforth, the algorithm is known as Support Vector Algorithm.

This algorithm was taken into account especially to gain an in-sight towards increasing the accuracy. In addition to that, SVM performs completely different compared to other classification algorithms. The steps involved in the Support Vector Machine Classification Algorithm are as follows:

Step 1: Plot the data item as data pints in a n-dimensional space where n corresponds to features.

Step 2: Construct hyperplanes for the data points.

Step 3: Find out if any classes existing between the data points.

Step 4: Identify the closest point of the lines from both the classes.

Step 5: Perform classification by analyzing which hyperplane is dividing the data points into two classes.

The model parameters taken for study are as follows:

{'C': 1.0,

'break_ties': False,

'cache_size': 200,

'class_weight': None,

'coef0': 0.0,

'decision_function_shape': 'ovr',

'degree': 3,

'gamma': 'scale',

'kernel': 'rbf',

'max_iter': -1,

'probability': False,

'random_state': None,

'shrinking': True,

'tol': 0.001,

'verbose': False}

Although there exists a number of lines / decision boundaries which seclude the classes in n-dimensional space, it is of greater importance to detect the best decision boundary assisting in classification of data points. This best decision boundary will be considered as the hyperplane of SVM. In this case, there are 2 classes to be detected such as whether the person has stress or not. Hence, the hyperplane is the straight line. After analyzing these psychological changes caused during sleep because of stress, the accuracy of the algorithm was found to be 99.5% outperforming the other algorithms taken for the study.

4.6 Enhancement done to existing system

After analyzing the best performing algorithm, a modification was made to the system that is existing. The data collected from the SaYoPillow was analyzed using the Support Vector Machine Classification Algorithm. From the output gained from the algorithm, the candidate with stress was detected. The possibility of stress recurring in the future was predicted using the SVC algorithm. In addition to that, an android application was developed. If the candidate was prone to have stress in the near future, then appropriate measures were taken to manage stress. There are various methods to tackle stress. Among the numerous strategies available, few of those are employed in the application to study if the there is any possibility to manage stress.

4.7 Features of the Android application

There are numerous applications available in the market for managing stress. For each of the individual symptoms, the applications are available like Calm for meditation, Breathwrk for breathing techniques, etc. Rather than installing numerous applications to overcome stress, incorporating features that could handle all these symptoms would be an efficient application for stress management. With this consideration, the application was developed to employ all the required features to manage stress.

If a candidate is predicted to have stress, then this application suggests some activities to overcome that stress. This application has been developed to test if it is able to manage stress. For consideration, a few basic activities are initially built in the application. If the patient has so many disruptions in the sleep which is calculated based on the movements, then the patient is advised to take some physical activities. Based on the stress level calculated, the candidate will be notified to perform some basic workouts probably in the evening slot. This will help the candidate to sleep thereby controlling stress.

If the stress level is ranging to be medium, then the application suggests some fun videos and music to divert the candidate’s mind so that the individual does not face any tedious health related issues. For timely consideration, some funny videos are incorporated into the application. The pandemic has forced human to stay indoors. Most of the people were feeling out of place and had complaints of severe stress, depression and anxiety. With an intense search between all the chaos, experts said that people were overcoming depression by watching movies, short videos, engaging themselves in social media. Also, one of the research studies says that re-watching the favorite shows can relieve stress. Music has a significant impact on decreasing the cortisol levels. An overview study shows that music is useful in mental health treatment inclusive of the most tedious issues like depression, bipolar disorder, etc. thereby promoting 68.5% positive results.

If the stress level of the candidate is low, then the candidate is suggested to do meditation by the application. A notification is generated to indicate the candidate to perform meditation before going to sleep based on the timing stored in the database already. A duration of 10 minutes is fixed initially for testing purposes. Once when the candidate clicks the notification, a timer is started for 10 minutes indicating the individual to meditate. After the completion of 10 minutes an alarm rings indicating the candidate to finish his meditation. Once after this, the individual can take a peaceful sleep. This will take up a control over stress.

There are other measures to manage stress like solving interesting puzzles, visiting new places, chatting with friends, making time for hobbies, etc. Addition to that, there are some handy exercises to be carried out to relieve stress and take a control over anger. Few of which are listed below:

- Breathing exercise
- Rotating fists
- Bending and releasing elbows.
- Rolling the neck side to side by pressing the head back.
- Face exercise like frowning the eyebrows, clenching the jaws.
- Shrugging and relaxing the shoulders.

For testing purpose, few of the activities are only considered for stress management. The most widely suggested measures are taken into account and those activities which have earlier studies depicting their performance are used for relieving stress. The overall flow of the proposed work is shown in the following figure.

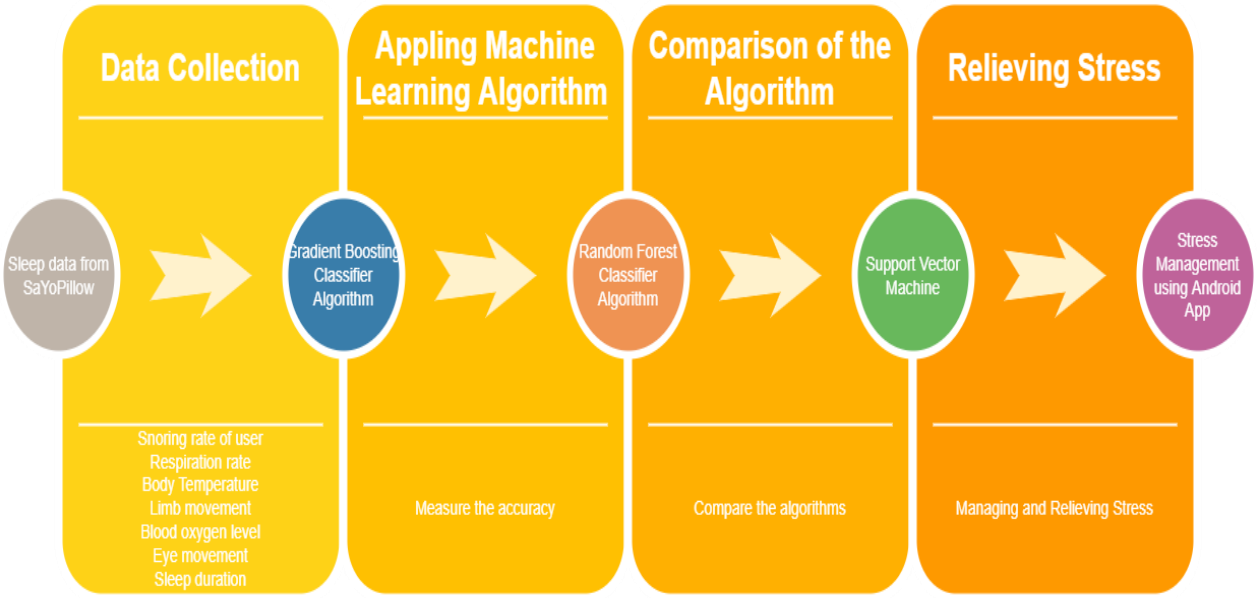

Fig 3: Flow of the processes involved in the proposed system.

From the above framework, it can be assured that candidates who have stress can be detected effectively and those who are prone to stress can be predicted easily. The proposed application provides productive results for relieving and managing stress promoting better lifestyle for the individuals.

5. RESULT EVALUATION

5.1 Dataset Description

A sample data collected by using the SaYoPillow is available in the Kaggle to study the behavior of sleep in impacting the stress factor. The interrelation between the attributes – snoring range of the user, respiration rate, body temperature, limb movement rate, blood oxygen levels, eye movement, number of hours of sleep, heart rate and stress levels (0 – low/normal, 1 – medium low, 2 – medium, 3 – medium high, 4 – high) is available in the dataset. Stress has a direct impact on sleep. The disturbance in sleep can be measured through the above stated attributes. Each of these attributes can be taken as a feature to study stress. These symptoms can be accurately treated to reduce stress at the initial stage itself. The data was split into 75% of train data and 25% test data. For the purpose of study only the sample data is considered. In future, the real-life data can be used to detect and predict stress.

5.2 Gradient Boosting Classifier:

Initially for the study, Gradient Boosting Classifier was used to evaluate the dataset to detect and predict stress among the individuals. Gradient Boosting Classifier is incorporated because it minimizes loss in general. At each iteration, estimators are calculated. For each estimator, graphs are computed. The graph for estimator 0 is shown in the following figure.

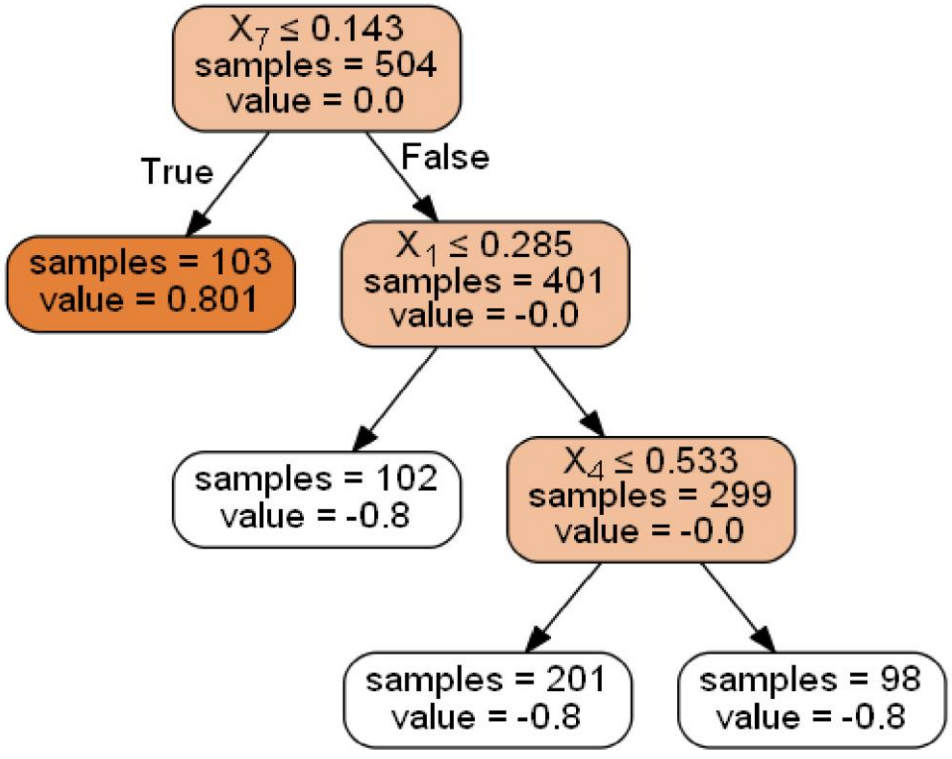

Fig 5: Graph for estimator 0 of gradient boosting classifier.

For each of the iteration, residuals are calculated. Stress is detected and predicted by applying GBC and the performance accuracy was found to be 96.6%.

5.3 Random Forest Classifier

To increase the accuracy, random forest classifier was applied to the dataset. Random Forest Classifier works by calculating the decision tree for each estimator. Based on the voting gained by each of the decision tree, the model is evaluated. The decision tree for estimator 0 is shown in the following figure.

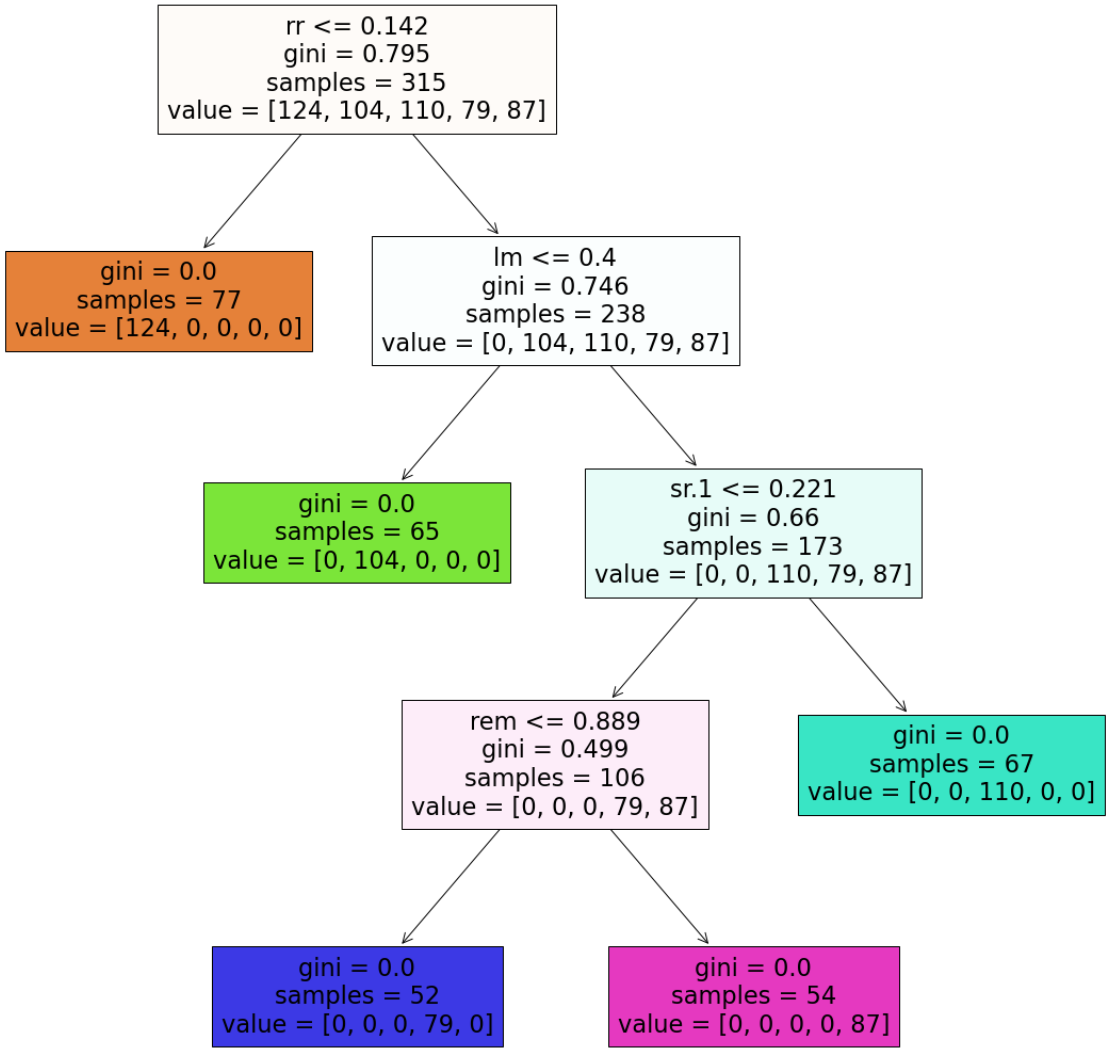

Fig 6: Decision Tree for estimate 0 of Random Forest Classifier.

The final output of the model is achieved with the accuracy of 98.4%. The accuracy gained in this model was found out to be quite acceptable in comparison with the Gradient Boosting Classifier.

5.4 Support Vector Machine

To check if there is any increase in the accuracy to get a deeper insight towards the data, Support Vector Machine Classification Algorithm is used. It was applied to the dataset and the model was constructed.Initially, for this algorithm a hyperplane is constructed. The

following figure depicts the hyperplane is generated by taking the linearly separable data with support vectors.

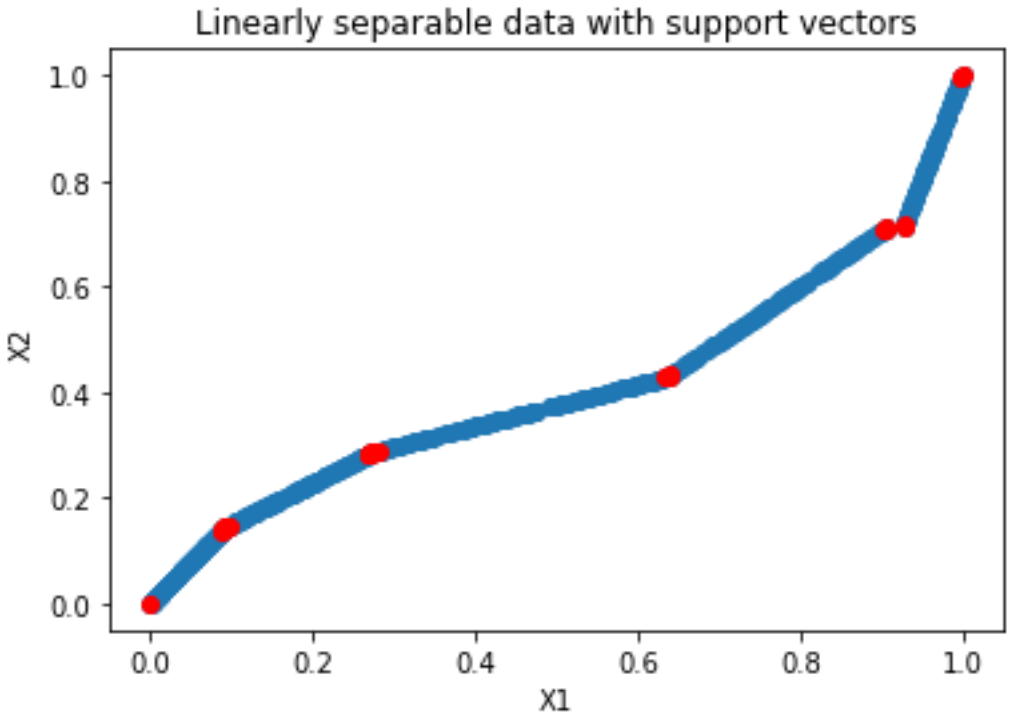

Fig 7: Hyperplane for the dataset generated using SVM.

The performance of the algorithm is studied, and the accuracy is found to be 99.5%. The performance of SVM algorithm is found to be better than the other two algorithms specified.

5.5 Inference

The following table depicts the comparison of the three algorithms based on execution time and storage.

Table 1: Comparison of Algorithms based on Time and Storage

Algorithm	**Time (microseconds)**	**Storage (kb)**
Gradient Boosting Classifier	476797	381
Random Forest Classifier	132420	133
Support Vector Machine	4218	5

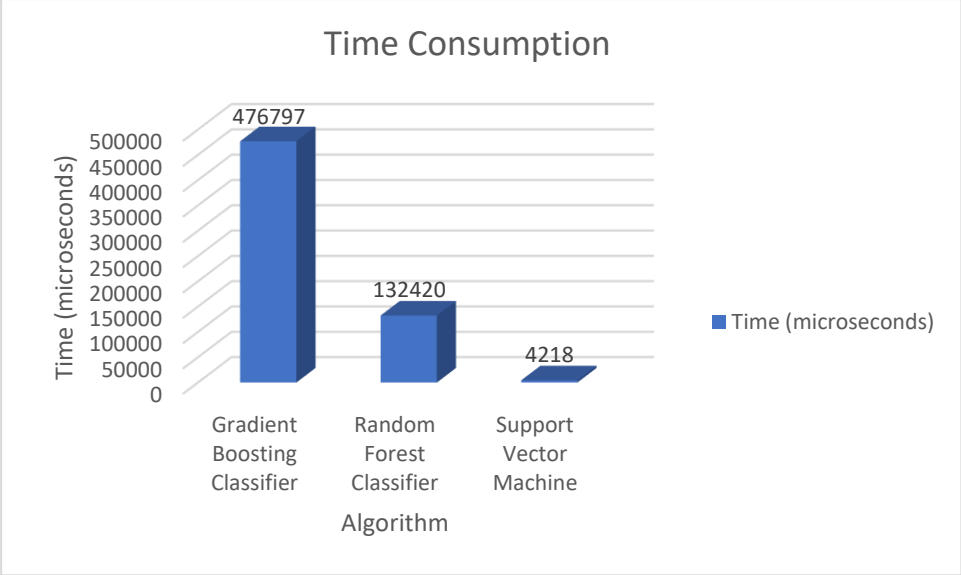

Fig 8: Graph depicting the comparison of time consumption of the three algorithms

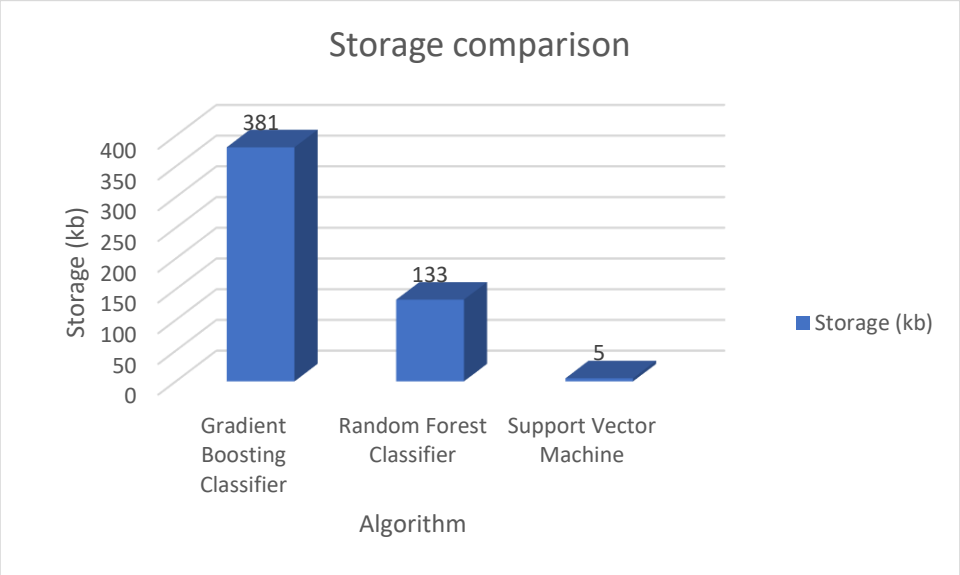

Fig 9: Graph depicting the comparison of storage used by the three algorithms

5.6 Performance comparison of the three algorithms:

The algorithms were implemented in the dataset each separately and the performance of each algorithm are evaluated. The table shows the detection and prediction score of each of the algorithm.

Table 2: Comparison of three algorithms based on performance

Algorithm	**Detection and Prediction Score**

Gradient Boosting Classifier	96.6%
Random Forest Classifier	98.4%
Support Vector Machine	99.5%

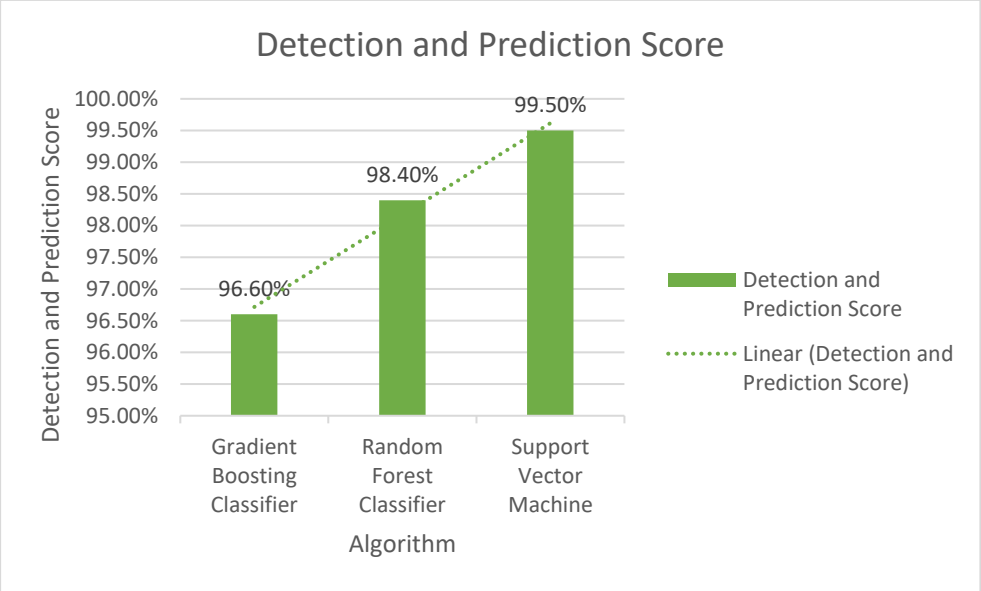

Fig 10: Graph depicting the comparison of three algorithms

By evaluating the performance of all the three algorithms it was found that the performance of SVM algorithm was better than the other two algorithms specified. SVM has a high number of special characters making SVM to best performing algorithm.

6. Conclusion and Future Enhancement

From the stated work, it can be understood that the Support Vector Machine Classification Algorithm works better with the sleep data in comparison to other classification algorithms. An update is made to the existing work by developing an Android application that suggests measure to overcome stress based on the stress level. The system detects and predicts stress based on the data obtained from the SaYoPillow.

As an enhancement to the existing work, a pipeline will be designed to detect and predict stress by leveraging the weak features and promoting better performance. In addition to that, various other measures to relieve stress will incorporated into the application to aid in management of stress to the candidates thereby providing fostering care and assistance to them.

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