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EXPERT SYSTEM FOR AUTOMATIC SLEEP DISORDER DETECTION

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Abstract: *Sleep apnea (SA) is the most common respiratory sleep disorder, leading to some serious neurological and cardiovascular diseases if left untreated. Sleep apnea is an obstructive sleep apnea disorder that affects a large proportion of the population. Our proposed System helps to analyze and detect the Presence of the apnea and hypopnea in the individual using CNN.*
A convolutional neural network (CNN) is a kind of deep neural network that can automatically learn effective feature representation from training data and has been successfully applied in many fields. In this system we have considered 12 features that are mainly responsible for the sleep apnea. There are some dependent variables or Predicted variable that helps to get the factors that mostly dependent on key variables that mainly includes Apnea-Hypopnea Index (AHI), Central apnea, Oxygen Desaturation and Hypopnea.

Keywords: Obstructive sleep Apnea, Convolution Neural Network, Dependent Variable Analysis, Feature Understanding, Exploratory Data Analysis, Apnea Hypopnea Index, Central apnea, Oxygen Desaturation and Hypopnea

I. INTRODUCTION

Sleep apnea (SA), also known as obstructive sleep apnea (OSA), is the most prevalent respiratory illness that affects people while they sleep. It is characterized by a blockage of airflow to the lungs. Apnea is described as a prolonged stoppage in breathing lasting more than 10 seconds. Apnea can happen 5 to 30 times each hour, and in individuals with serious Sleep Apnea, it can happen up to 400 times per night. Snoring, nocturnal arousals, perspiration, restless sleep, and other activities are among the most common nighttime symptoms of SA.
Furthermore, sleeping disorders and sleep apnea symptoms do not occur only at night. Morning headaches, depression, decreased focus, and excessive tiredness are all common daytime symptoms that contribute to fatality in traffic and industrial accidents. Using the National Sleep Research Resource dataset, an attempt is made to construct a system that can detect sleep apnea in an individual. Using the Convolution Neural Network approach, the system creates a prediction model.
Sleep apnea (SA) is the most prevalent respiratory sleep condition, and if left untreated, it can lead to catastrophic neurological and cardiovascular diseases. Sleep apnea is an obstructive sleep apnea disorder that affects a large percentage of the population. Using CNN, our proposed system analyses and detects the presence of apnea and hypopnea in an individual. Convolutional neural networks (CNNs) are a sort of deep neural network that can automatically learn effective feature representation from training data and have been employed in a variety of applications.

II. PROBLEM DEFINITION

To implement a system i.e., “Analyzing and predicting sleep apnea using CNN” to analyze and detect the Presence of the apnea and hypopnea in the individual using CNN. To detect apnea events to alert the patient.

Early detection of sleep apnea can avoid the damaged to person's health. To create a system that could evaluate a patient's breathing data and detect apnea in the patient.

III. LITERATURE SURVEY

[1] An automatic sleep disorder detection based on EEG Cross-frequency coupling and random forest model**.** The goal of this study is to analyse EEG Sleep activity using complementary cross-frequency coupling (CFC) estimates, which are then fed into a classifier to differentiate between sleep disorders. The researchers used an available EEG database with recordings divided into seven sleep disorders and a healthy control group. A 74 percent multiclass accuracy was attained using a random forest (RF) classification model based on CFC patterns collected from non-cyclic alternating pattern epochs.

[2] Sleep Apnea Detection Algorithm.

This paper records numerous signs from the patient's body for at least one night and calculates the Apnea-Hypopnea Index (AHI), or the number of symptom or respiration occurrences per hour. This value is then used to help patients understand their OSA severity levels. Easy data collecting, rapid OSA seriousness identification, and successful part extraction are the main focuses of the proposed technique, which does not rely on space learning from ability.

[3] Contactless Sleep Apnea Detection on Smartphones.

This study proposed a revolutionary contactless technology that operates in the sleep environment and tracks chest and abdomen motions on smartphones. It works with the phone away from the user and can capture many users' breathing movements at the same time. They use this design to create the apnea app, a smartphone-based solution for detecting sleep-related respiratory events such as hypopnea (when the subject's breathing becomes shallow), obstructive apnea (when the subject's airway is completely or partially blocked), and central apnea (when the subject's airway is completely or partially blocked) (when the subject holds his or her breath)

[4] Internet of things for sleep quality monitoring system: A survey.

To begin, the writers compiled information and references on sleep quality monitoring and IoT technologies. Second, they looked at the importance of sleep quality and disorder, as well as the monitoring element. Finally, they create a model of the IOT system as well as a logical flowchart for monitoring sleep quality. Finally, they looked at the future research trends in this subject, and our study goal for a sleep apnea monitoring system that can accurately recognise facial expressions is 1-3 milliseconds. The results, which were gained through simulation and experimentation, show that the current system is capable of accurately recognising facial expressions.

[5] Sleep Apnea Syndrome Detection based on Biological Vibration Data from Mattress Sensor.

The new WAKE detection approach for sleep apnea syndrome: SAS patients was proposed in this study. Because WAKE is detected by only one threshold in many non-contact methods for sleep stage assessment, it is difficult to identify WAKE in SAS patients because their Heart Rate Variability: HRV, Body Movements: BM, and Respiratory Variability: RV are different from healthy participants. SAS patients also had a higher rate of sudden WAKE than healthy people. We used a mattress-type pressure sensor to gather bio-vibrations and Random Forest to detect WAKE in SAS patients: RF to detect WAKE since the rules it generates can be interpreted.

IV. PROPOSED SYSTEM

This system is designed to detect sleep apnea in an individual using National Sleep Research Resource dataset. The Convolution Neural Network CNN technology is used to create a prediction model. It provides a graphical representation of all parameters used in the study. It detect apnea events to alert the patient, which could analyze the breathing data of the patient and detect the apnea in the patient. It also spreads awareness related to sleep apnea.

V. SYSTEM ARCHITECTURE DIAGRAM

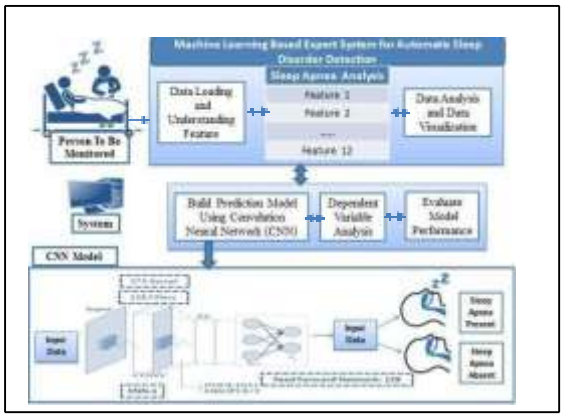

Figure 1: System Architecture Diagram

1. Data Uploading and feature understanding:

The data from the National Sleep Research Resource is first pre-processed so that we can identify key elements that are crucial for detecting sleep apnea. This Sleep apnea data from National Sleep Research Resource is used as input to the system to find features that are responsible for sleep apnea and learn to predict the probability of sleep apnea in the individual.

2. Dependent Variable Analysis:

Dependent variables, also known as predicted variables, are those that aid in the identification of elements that are primarily dependent on important variables, such as the Apnea-Hypopnea Index (AHI),Central apnea, Oxygen Desaturation and Hypopnea. The analyzed data is visualized for word to vector formation and on this fine-tuned data we can apply algorithm to get the result.

3. Analytics:

Exploratory Data Analysis is an initial process of apnea and hypopnea, in which you can summarize characteristics of data from which we can predict the probability of the sleep apnea in an individual.

4. Built Prediction Model using:

Convolution Neural Network (CNN): Using the Convolution Neural Network (CNN) approach, the system creates a prediction model. CNN gets its information from the National Sleep Research Resource website.
Output: - Prediction for an individual has apnea or not, according to the following scale:
0 – Sleep Apnea is Absent
1 – Sleep Apnea is Present
An input and output layer, as well as several hidden layers, make up a CNN. Convolutional layers, pooling layers, fully connected layers, and normalization layers are common hidden layers in CNNs. The images analytics engine will be trained using CNN to recognize relevant data from photos.

VI. CONCLUSION

One of the most important factors in determining human health and well-being is sleep quality. Sleep quality monitoring is one approach for maintaining sleep quality and avoiding chronic diseases, mental illnesses, and accidents caused by sleep disorders. The purpose of this research was to come up with a new method for detecting Sleep Apnea. The system generates a prediction model using the Convolution Neural Network (CNN) technique. The proposed method can uncover useful information for interpreting AHI in sleep apnea patients (SA). By inspecting the individual, this procedure will give us with a useful system for diagnosing sleep apnea. The sleep recordings of individuals will be utilized to detect apnea and hypopnea.

VII. REFERENCES

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