

# Machine Learning Based Approaches for Automatic Sleep Disorder Detection

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## ABSTRACT –

The Word Sleep apnea (SA) in the term of Obstructive sleep apnea (OSA) is becoming the most ordinary respiratory disorder during sleep, which is distinguish by stopping of airflow to the lungs. These interrupt in breathing must last for more than 10 seconds to be considered an apnea event. Apnea occurrence may occur 5 to 30 times an hour and may occur up to four hundred times per night in those with severe Sleep Apnea. The most frequent night symptoms of SA can mainly include the activities like snoring, nocturnal arousals, sweating, restless sleep and many more. Moreover, sleeping disorders, symptoms of sleep apnea do not occur just during the night. Daytime symptoms also can range from morning headaches, depression, impaired concentration and excessive sleepiness which cause mortality from traffic and industrial accidents. This survey paper aims to bring the different techniques to identify sleep apnea syndrome by using the different features of an individual, because dependent features have been found most effective and efficient to detect the sleep apnea disorders. In this paper a comparative analysis has been prepared between the different techniques used.

**Keywords:** Sleep Apnea, Obstructive sleep Apnea (OSA), Convolution Neural Network (CNN)

## I. INTRODUCTION –

Sleep apnea is a potentially serious sleep disorder that occurs when a person's breathing is interrupted during sleep. Sleep apnea is a potentially serious sleep disorder that occurs when a person's breathing is interrupted during sleep. Sleep apnea is a potentially serious sleep disorder that occurs when a person's breathing is interrupted during sleep. Actually, Sleep Apnea is not a issue to be taken gently, since it is related with a major

risk factor of health implications and expand cardiovascular disease and sudden death.

## Sleep Apnea Syndrome → Medical Definition

**Sleep Apnea Syndrome:** SAS is a sleep disorder characterized by breathing stops during sleep. Breathing stops for more than 10 seconds is said to be apnea. It is diagnosed as SAS by a professional physician using data from specialized instruments.

The severity of symptoms is as follows: if the apnea is happened

- 5 to 14 times per hour is mild;
- 15 to 29 times per hour is moderate;
- more than 30 times per hour is severe.

## Overview Of Sleep Stages And The Classification Structure

There are five stages of sleep that has been proved: stage 1, stage 2, stage 3, stage 4, rapid eye movement (REM) [8]. To facilitate the assessment of sleep apnea, only two categories are essential: deep sleep (DS) and light sleep (LS). The average DS and LS distribution of normal people and sleep apnea patients is represented in following figure;

LS is responsible for body relaxation normally before DS. However, sleep apnea patients suffer from long term LS renders inefficient sleep quality. Moreover, lack of DS also renders insufficient sleep. Therefore, in this paper, LS and DS are newly defined based on the conventional sleep stages:

- **LS: Sleep stage 1:** typically soon after "sleep action"; body is not inhibited yet; breath slow down; blood pressure and brain temperature decreases.
- **Sleep stage 2:** slower heart rate than sleep stage 1; brain starts to emit large waves; more metabolic functions slow down.

- **DS: Sleep stage 3 & 4:** brain waves become slow down and larger than sleep stage 2; most potential sleep disturbances can be ignored.
- **REM:** eyes move rapidly; dreams usually happen; increase of heart rate

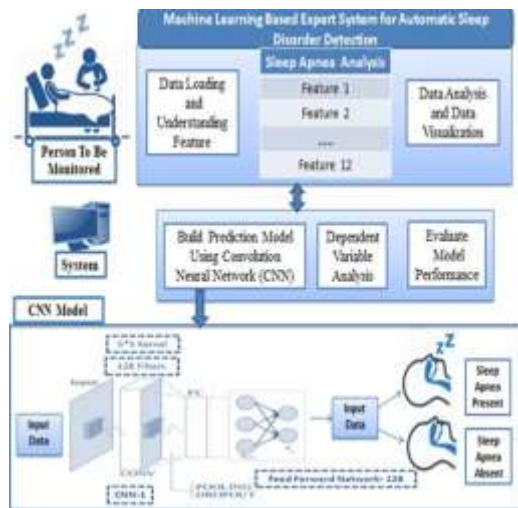


Figure : Architecture diagram

## II. IMPLEMENTATION –

- **Data Uploading and feature understanding** The data downloaded from National Sleep Research Resource is preprocessed first so that we can extract important features that are quite essential to detect 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. The main features used to apnea prediction are as follows.

- **Dependent Variable Analysis:** Dependent variables or Predicted variable are the one 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. For example the employee ID or employee count has nothing to do with the attrition rate. So here by using the dataset we achieve the terms or the factor that are mostly affect the employee attrition rate. The analyzed data is visualized for word to vector formation and on this fine-tuned data we can apply algorithm to get the final result.
- **Analytics Exploratory Data Analysis** is an initial process of apnea and hypopnea, in which you can summarize characteristics of

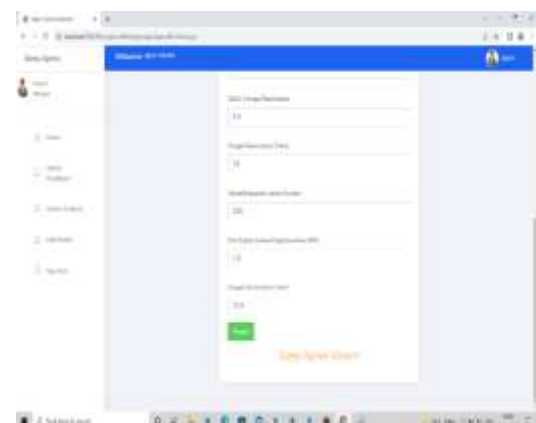
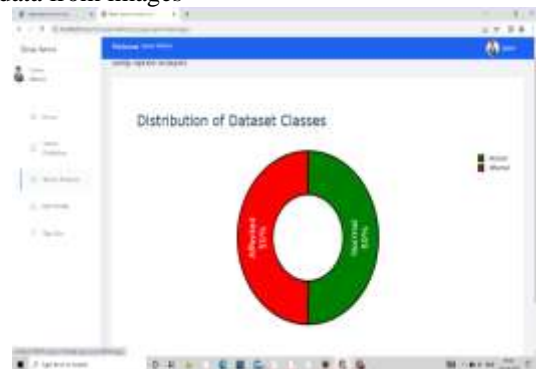
data from which we can predict the probability of the sleep apnea in an individual.

- **Built Prediction Model using Convolution Neural Network (CNN)** The system builds a prediction model by using Convolution Neural Network (CNN) technique. Input for CNN is taken from National Sleep Research Resource website <https://sleepdata.org/datasets/shhs/files>

Output :-Prediction for an individual has apnea or not, according to the following scale: 0 – Sleep Apnea is Absent

1 – Sleep Apnea is Present

A CNN consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of Convolutional layers, pooling layers, fully connected layers and normalization layers. CNN will be used to train the images analytics engine for recognizing important data from images





### III. CONCLUSION:

Over the last decades, obstructive sleep apnea syndrome detection has attracted lots of interest for the researchers. In this present review paper, we have analyzed papers from an engineering and medical background. It is observed that OSA disorder identification is difficult, because of the complex medical data sets and the OSA includes changes in it as well. In this survey paper shows that there is an interconnection between the parameters in the dataset and obstructive sleep apnea syndrome event. Mostly machine learning approaches like Support vector machine classifiers and so on are used in order to differentiate between sleep apnea disorder signals to normal breathing parameters. Various automated models, techniques and algorithms were developed for the detection of obstructive sleep apnea syndrome events based on features, which helps in selecting the best detection technique or algorithm for identifying the sleep apnea syndrome events with high performance results while implementing in various real time home applications.

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