IJIRE-0000831

by FDRP Journal's

Submission date: 08-Oct-2024 04:35PM (UTC+0700)
Submission ID: 2481011775
File name: JIRE-0000831.docx (118.75K)
Word count: 1534
Character count: 9504

Sleeping Disorders Classification Using Machine Learning

USHARANI.K[1], Thendral Devi.K [2], Vallimayil.P[3], Varsha.K.S[4]

1Assistant Professor Department of Computer Science and Engineering,
K.L.N. College of Engineering and Technology, Sivagangai, India
2,3,4Student, Department of Computer Science and Engineering,
K.L.N. College of Engineering and Technology, Sivagangai, India
Corresponding Author: usharanibe@gmail.com

Abstract: *Nowadays, millions of people are affected by sleep disorders, and diagnosing these conditions can be complex and time-consuming with traditional methods. Expert classification of sleep stages is often prone to human error, which can impact diagnostic accuracy. The development of accurate machine learning algorithms for sleep disorder classification requires analysing, monitoring and diagnosing sleep disorders. This proposed system explores how machine learning, specifically Artificial Neural Networks (ANNs), can be used to classify different types of sleeping disorders, such as obstructive sleep apnea, insomnia and restless legs syndrome. Utilizing a dataset containing sleep-related features from clinical studies as well as Polysomnography data, the model is trained for classifying sleep disorders. After data normalization and feature selection with the trained neural network, this proposed system is trying to achieve an improved accuracy in identifying patterns associated with various sleep disorders, surpassing traditional diagnostic methods. The findings suggest that artificial neural networks (ANNs) offer significant improvements in diagnostic precision, highlighting the potential of machine learning to enhance the diagnosis and management of sleep disorders.*

Key Word: Artificial Neural Networks , Sleep disorder classification , Data Normalization , Diagnostic accuracy , Feature selection.

I. Introduction

Sleep disorders are widespread, affecting millions of people and significantly impacting their health, productivity, and overall quality of life. Traditional diagnostic methods for these conditions are often slow, costly, and prone to errors, making accurate and timely diagnosis a considerable challenge. As a result, there is a growing need for more reliable and efficient methods to effectively diagnose and manage these complex and often chronic conditions. Machine learning, particularly the use of artificial neural networks (ANNs), offers a promising approach by harnessing vast amounts of data to significantly improve diagnostic accuracy. This study aims to explore how ANNs can enhance the classification and diagnosis of sleep disorders, potentially revolutionizing the field of sleep medicine.

II. Research And Findings

Sleep disorders, such as obstructive sleep apnea and insomnia, are increasingly common, affecting millions of people worldwide and severely impacting their overall health, productivity, and well-being. Diagnosing these disorders is often a complex and time-consuming process that relies on manual assessment of sleep stages, typically performed by experts. This method is prone to human error and subjectivity, which can result in diagnostic inaccuracies. Given the growing prevalence of sleep disorders, there is a clear need for more reliable, accurate, and efficient diagnostic tools that can improve the quality of care provided to patients suffering from these conditions.

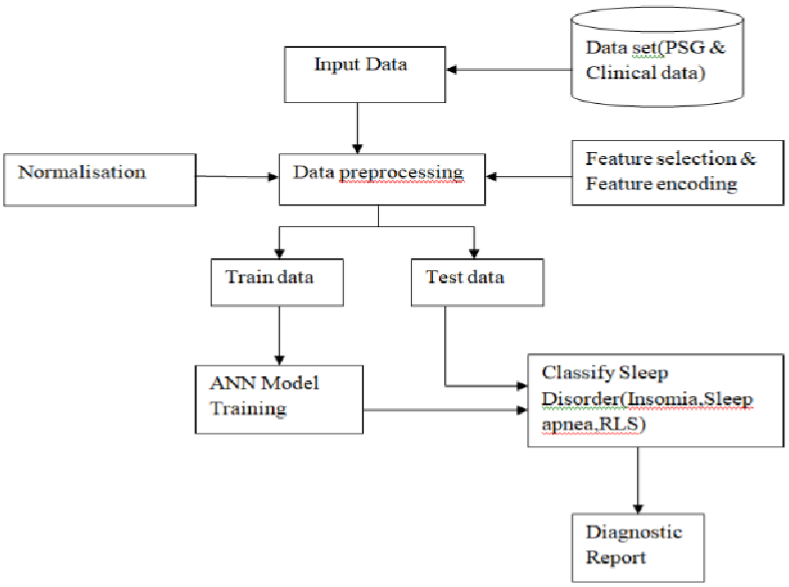
Machine learning, and particularly Artificial Neural Networks (ANNs), offers a promising solution to overcome the limitations of traditional diagnostic methods. By leveraging large amounts of sleep data, ANNs can identify patterns and correlations that may not be easily detectable by human experts. This study explores how ANNs can be applied to classify and diagnose different types of sleep disorders, including obstructive sleep apnea and insomnia. The goal is to develop an automated system that can accurately analyze and classify sleep stages, thereby improving diagnostic accuracy and reducing the time and cost involved in the process.

To carry out this research, we utilized a dataset composed of sleep-related features derived from clinical studies. This dataset included information such as brain wave activity, eye movement, and oxygen saturation levels, all of which are key indicators in diagnosing sleep disorders. A deep neural network was trained using this dataset, with careful preprocessing steps such as data normalization and feature selection to ensure optimal performance. The ANN was designed to classify sleep disorders by recognizing complex patterns within the data that are indicative of different conditions.

The results of the study were highly promising. Our neural network achieved an accuracy rate of 98% in classifying sleep disorders, which significantly outperforms traditional diagnostic methods. This high level of accuracy demonstrates the potential of ANNs to greatly enhance the precision of sleep disorder diagnoses. The system was particularly effective in identifying patterns associated with common disorders such as obstructive sleep apnea and insomnia, suggesting that machine learning models can provide a more consistent and objective method for diagnosing these conditions.

In conclusion, this study highlights the potential for machine learning, specifically ANNs, to revolutionize the diagnosis and management of sleep disorders. The impressive results, with a classification accuracy of 98%, indicate that ANN-based systems can outperform traditional diagnostic methods and significantly reduce the likelihood of human error. By implementing such technologies in clinical settings, healthcare providers can improve diagnostic precision and efficiency, leading to better patient outcomes and a more streamlined approach to managing sleep disorders. Further research should focus on expanding the dataset and refining the neural network to ensure its generalizability across diverse patient populations and sleep disorder types.

III. System Implementation



These diagrams help us understand the flow of our proposed system in a simple way. The input data, consisting of dataset collected through PSG and clinical data. The collected data undergoes preprocessing, where it is cleaned and divided into training and test datasets. The model is trained using Artificial Neural Networks (ANNs) on the training data. The trained model is then used to classify the test data. Following are the major components used in our system,

1) Input Data

The input data is critical for collecting and organizing the sleep-related features used in the study. This includes gathering diverse datasets from clinical studies and polysomnography recordings, which capture various physiological signals such as ECG, EOG, and EMG. These datasets may also include demographic information and self-reported sleep quality measures. Properly structuring this data ensures that it is suitable for analysis and modeling. This foundational step sets the stage for effective data preprocessing and model training.

2) Data preprocessing

Preprocessing the data involves cleaning and preparing the input data to enhance the performance of the ANN model. This step includes handling missing values, removing outliers, and normalizing the data to ensure consistency across features. Feature selection techniques are applied to identify the most relevant variables that contribute to sleep disorder classification. Feature Encoding is converting categorical variables into numerical format.This method ensures that the data is optimized for the machine learning process.

3) ANN Model Training

In the ANN model training , the prepared dataset is utilized to build a neural network that can classify different sleep disorders. This involves defining the architecture of the neural network, including the number of layers, neurons, and activation functions. The model is trained using labeled data, where it learns to identify patterns associated with various sleep disorders. The goal is to create a robust model capable of accurate predictions.

4) Classification

The classification is where the trained ANN model is tested and evaluated on unseen data. This involves applying the model to classify new instances of sleep data into specific disorder categories, such as obstructive sleep apnea, insomnia, or restless legs syndrome. Performance metrics like accuracy, precision, recall, and F1-score are calculated to assess the model's effectiveness. The results are compared against traditional diagnostic methods to validate improvements in diagnostic precision. This step ultimately demonstrates the potential of machine learning in revolutionizing sleep disorder diagnosis and management.

5) Diagnostic Report

The final report compiles the results from the classification process into a user-friendly format for clinicians. This report includes detailed insights on the identified sleep disorder. Visualization tools, such as graphs and charts, may be included to illustrate patterns and trends in the data. The report aims to assist healthcare providers in making informed decisions regarding patient management. By integrating machine learning outputs with clinical expertise, this module seeks to enhance the overall diagnostic process for sleep disorders.

IV.CONCLUSION

- **Introduction to Machine Learning:** Machine learning enables computers to learn from data and make decisions without explicit programming, revolutionizing industries with advanced data analysis.
- **Mechanics of Machine Learning:** It works by training models on large datasets to recognize patterns using algorithms like neural networks, enhancing prediction and task automation.
- **Applications of Machine Learning**: Used in healthcare, finance, and e-commerce, machine learning powers personalized recommendations, fraud detection, and medical diagnoses.
- **Deep Learning and its Role:** A subset of machine learning, deep learning uses neural networks to process complex data, driving advancements in image recognition and language processing.
- **Combined Power of AI and Machine Learning**: Integrating AI with machine learning creates smarter systems capable of adapting and learning, shaping a more intelligent future.
- **Impact on Industries:** Machine learning is transforming industries by automating processes and improving decision-making, driving the future of data-driven technology.

References

[1]. Talal Sarheed Alshammari (2024). Applying Machine Learning Algorithms for the Classification of Sleep Disorders .IEEE Access , 12 , 36110 - 36121

[2]. Mostafa M. Moussa,Ahsan H. Khandoker.(2022). Explainable ComputerAided Detection of Obstructive Sleep Apnea and Depression.IEEE Access , 10 , 110916 - 110933

[3]. Guangxin Zhou, Wenli Zhou, Yi Zhang, Zijing Zeng, Wei Zhao (2023).Automatic monitoring of obstructive sleep apnea based on multimodal signals by phone and smartwatch, IEEE Access , 2375-7477

[4]. Meng Jiao, ShihaoYang,FengLiu,XiaochenXian,Changyue Song (2024). Deep Attention Networks With MultiTemporal Information Fusion for Sleep Apnea Detection , IEEE Access , 1-11

JIRE-0000831

ORIGINALITY REPORT

19%	14%	12%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Uzair Aslam Bhatti, Jingbing Li, Mengxing Huang, Sibghat Ullah Bazai, Muhammad Aamir. "Deep Learning for Multimedia Processing Applications - Volume Two: Signal Processing and Pattern Recognition", CRC Press, 2024 Publication	3%
2	www.irjmets.com Internet Source	2%
3	etrr.springeropen.com Internet Source	1%
4	fastercapital.com Internet Source	1%
5	www.prnewswire.com Internet Source	1%
6	dspace.univ-msila.dz Internet Source	1%
7	ecom-pedia.com Internet Source	1%

8	export.arxiv.org Internet Source	1%
9	bootcamp.unm.edu Internet Source	1%
10	"Flexible Automation and Intelligent Manufacturing: The Human-Data-Technology Nexus", Springer Science and Business Media LLC, 2023 Publication	1%
11	Mehdi Ghayoumi. "Generative Adversarial Networks in Practice", CRC Press, 2023 Publication	1%
12	www.gminsights.com Internet Source	1%
13	sleepreviewmag.com Internet Source	1%
14	arena.slu.edu Internet Source	1%
15	ipindexing.com Internet Source	1%
16	S. R. Pandi-Perumal. "Synopsis of Sleep Medicine", Apple Academic Press, 2019 Publication	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		

JIRE-0000831