Mental Health At Work Prediction Using Neural Networks *

Abstract. Being healthy is a very important aspect of one's life and should not be taken very lightly. Physical and mental health are both incredibly vital. Physical health can be maintained by exercise and if there is any problem with it, it can be resolved in a short span of time. But if one's mental health gets disturbed, it takes a lot amount of time and patience to get cured. Mental health can be affected anywhere there's not a certain place for mental health to deteriorate, but stress at the workplace plays a huge role in making its condition worse. Curing mental health takes a lot of time, medicines and effort which starts to impact one's physical health too which causes harm to the most crucial aspects of one's life i.e. being healthy. Many machine learning and deep learning techniques such as the machine learning classification techniques and the deep learning's neural network techniques are used to predict the mental health of one. The main aim of the paper is to show which neural network technique works best to solve this problem in the terms of accuracy

Keywords: mental health at work, deep learning , comparative analysis, artificial neural network, convolutional neural network

1 Introduction

People prefer to spend more time on social media platforms while they are at home for an extended period, resulting in a surprising increase in interaction on these platforms. At the same time, as a result of the coronavirus infection, people begin to experience a weird form of worry, dread, and anxiety as a result of being placed in such an unclear situation. According to the World Health Organization, 1 out of every 13 persons suffers from anxiety even before the epidemic (WHO). Anxiety disorders are the most frequent mental illnesses globally, according to the WHO, with a particular fear, major depression, and social phobia being the most common. In the research and clinical psychology sector, reviews of the literature and research surveys focusing on applications of machine learning for mental health have come to be viewed in recent years. Existing research evaluates algorithm correctness, dependability, and efficacy, as well as the potential and obstacles of using them in reality. A large portion of the work focuses on algorithms utilized in neuroscience, especially in neuroimaging studies. Mental health is a reflection of an individual's emotional, psychological, and social well-being. It impacts how a person thinks, feels, and responds to events.

Positive mental health makes it easier to work efficiently and reach one's full potential. Mental health is vital at all stages of life, including childhood, adolescence, and maturity. Stress, social anxiety, depression, obsessive-compulsive disorder, substance addiction, and personality disorders are all elements that contribute to mental health issues that lead to mental disease. To preserve good life balance, it is becoming increasingly important to detect the start of mental disease. Machine learning algorithms and Artificial Intelligence (AI) may be used to completely harness the nature of machine learning algorithms and AI for predicting the beginning of a mental illness.

2   Related Work

The most frequent ML techniques were sensor-based. The bulk of studies in this category described how mobile phone sensors were used to collect data or how audio signals were evaluated. The text was the second-largest data source, with most of it coming from social media and, in a few cases, SMS or text messaging, as well as clinical or suicide notes. The examination of surveys and health records were among the structured data papers. Several publications described complicated sensory systems or frameworks based on ordinary technology, robot interactions, or life form agent interactions[1].According to study by Daffodil International University ,Among the past, numerous approaches for identifying mental issues and depression in social media users were applied. Many of them employed use volume as a measurement for diagnosing suspected SNMD (Social Network Mental Disorder) (Social Network Mental Disorder). That is to say, they had a different aim in mind than we had. Yet, these models aided us in finding the feature extraction and establishing a better cluster classification. The approaches used to assess the emotions on social media include affective content analysis of online depression community by thin nguyen, tensor techniques applied in multiple online social networks.During the research, the researchers had selected the 10 most used social media platforms namely. Facebook, YouTube, Instagram, Twitter, Tiktok, Weibo, Snapchat, Pinterest, QQ, and Qzone[2].Employee mental wellbeing is crucial to the success of the firm. Providing a safe and healthy work environment for everyone, including employees with mental disorders, is the most effective method to support and attract productive and talented workers. Researchers have identified several characteristics of a safe and healthy workplace: personal development is encouraged and supported; optimal mental health obstacles are identified and addressed; diversity is valued; sick/stress leave and staffing levels are low; employee loyalty is high, and employees are productive members of the team. Some of the most viewed Mental Stress Disorders include stree, eating disorder and insomnia[3].

3 Methodology

3.1 Data preparation

The authors have taken the dataset from the IBM mental health survey, which includes the survey related to mental health at a workplace. This dataset has 26 features (or columns) with 1259 data (or observations). A dataset is a collection of data. It is a structured collection of data which shows data in an understanding way.Some of the features are Timestamp, Age, Gender, Country, state, selfemployed, familyhistory, treatment, workinterfere, noemployees, remotework, techcompany, benefits, careoptions, wellnessprogram.

	Timestamp	Age	Gender	Country	state	self_employed	family_history	treatment	work_interfere	no_employees
0	2014-08-27 11:29:31	37	Female	United States	IL	NaN	No	Yes	Often	6-25
1	2014-08-27 11:29:37	44	M	United States	IN	NaN	No	No	Rarely	More than 1000
2	2014-08-27 11:29:44	32	Male	Canada	NaN	NaN	No	No	Rarely	6-25
3	2014-08-27 11:29:46	31	Male	United Kingdom	NaN	NaN	Yes	Yes	Often	26-100
4	2014-08-27 11:30:22	31	Male	United States	TX	NaN	No	No	Never	100-500

Fig. 1. Dataset overview

3.2 Data Preprocessing:

Dataset is analysed (or preprocessed) before making any conclusion and training ML models because if we avoid that then some unwanted data will also be trained which will affect our ML model and its accuracy which we won't want to happen. After analysing each features of the given dataset we concluded that there are 26 categorical features and1 numerical feature in the given dataset. Categorical features are those features whose explanations or values are chosen from a predetermined list of alternatives. Colors of a house, animal types, and months of the year are examples of categorical values. Positive, negative, neutral, etc.; true/false; positive, negative, neutral, etc. Numerical features are those type of features which have values continuous or integer related. Features like "state", "selfemployed" , "workinterfere" and "comments" have null values. Especially column "comments" has 70 percent of null values since it was optional ad that is why it will be dropped. "Timestamp" column will also be dropped. "state" column was filled only if the employee was from United States otherwise the column is left empty. Some countries have only one entries which doesn't make sense at all. So we will be also dropping columns "Country" and "state" too for better accuracy."Age" has lots of garbage values for example someone has written their age in negative or more than 100 years or below 15 years which doesn't makes sense at all. For this we apply data transformation on data to make look more understandable and easy for ML model to train. We drop the

values in "Age" column less than 15 and more than 100. In "Gender" column there are many values other than male and female are transformed to "Other" and values like "Cis Male" or "M" are converted to "Male" so does for "Female".
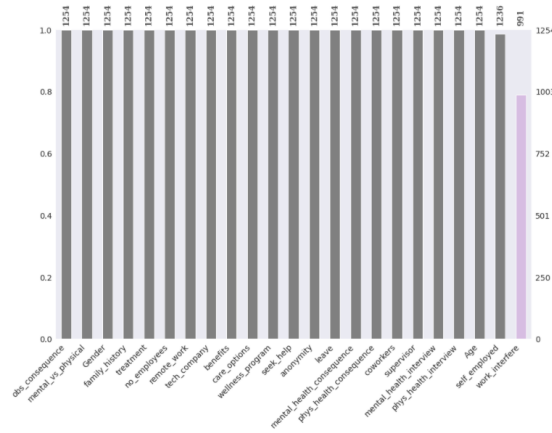

Fig. 2. Features will null values

3.3   Feature Visualisation

The features are the import portion and has to be taken care of. There are numerous visualisation strategies which has to be integrated to have a thorough understanding about all the features and what do each feature give. For that the author produced a visualisation of the correlation matrix which reveals how each characteristic is associated to each other which may aid in the best output gaining.

3.4   Model Architecture

Neural networks are a collection of algorithms that identify patterns and are loosely designed after the human brain. They utilize a form of machine perception to interpret sensory inputs, classifying or grouping raw data. All real-world input, whether pictures, music, text, or time series, must be translated into the patterns they recognize, which are numerical and represented in vectors.The authors have used different neural networks such as convolution neural network,artificial neural network and recurrent neural network. Starting with CNN it is multiple layers of artificial neurons make up convolutional neural networks. Artificial neurons are mathematical functions that compute the sum of
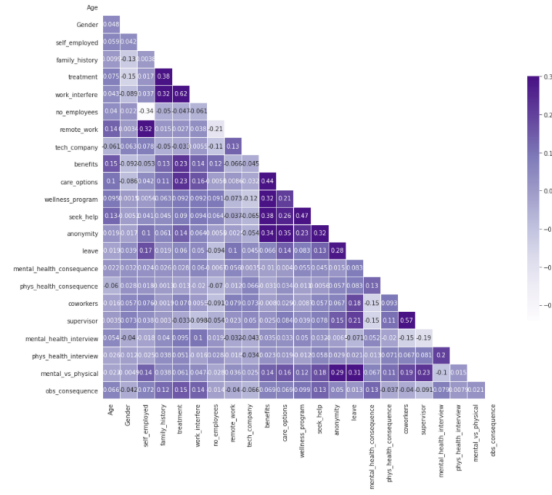
Fig. 3. features importance

numerous inputs and output an action value, similar to their biological counter-
parts. A recurrent neural network (RNN) is a sort of artificial neural network
that is intended to operate with data series or sequence data. Ordinary feed-
forward neural networks are only intended to handle data elements that are
unconnected to one another. However, if we have data in a sequence where one
data point is reliant on the previous data point, we must update the neural net-
work to account for these dependencies.In the area of AI, an Artificial Neural
Network seeks to recreate the network of neurons that make up a human brain
so that computers can comprehend things and make choices in a human-like way.
Computers are taught to operate like linked brain cells to construct an artificial
neural network.

4   Experimental results

The authors finished all the main processes that were required for obtaining the
result and a difference between the neural network techniques and transfer learn-
ing supports the community in getting to know which neural network strategy
may perform better in the given case. The process of acquiring a larger accuracy
is assisted by the epoch cycle the more the epochs the more is the model taught
and consequently the accuracy is going to grow.The authors received an whoop-
ing accuracy of 91 percent for artificial neural network followed by 89 percent
for convolution neural network and 86 percent for recurrent neural network.

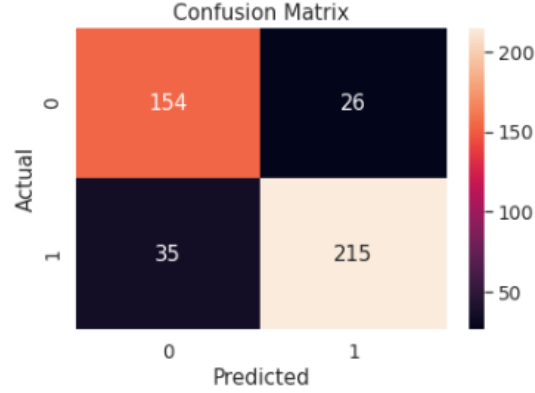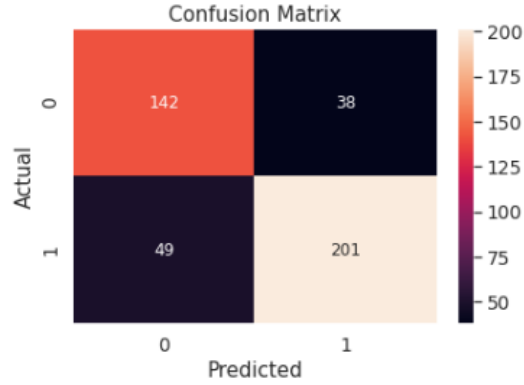| Model Name	Accuracy
Artificial Neural Network	92.2%
Convolution Neural Network	89.1%
Recurrent Neural Network	86.9

Fig. 4. ANN confusion Matrix

Fig. 5. CNN confusion Matrix

5   Conclusion

Mental Health is the most disregarded ailment by the people, as we take care of our body, we have to take care of the mental health also. After the authors completed the neural networks, it needs to be observed that they obtained a whooping accuracy to figure out whether the mental health of the worker is at it's best or not. By this paper various firms and all the organisations would be assisted to carry out this model in their workplace and improve the development through it.
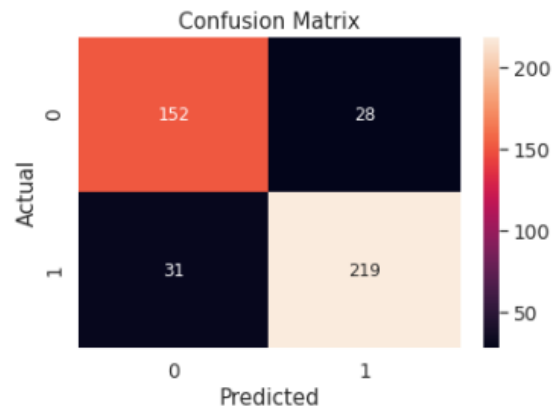
Fig. 6. RNN confusion Matrix

Future work

This dataset helps in seeing whether the company is providing the treatment for mental health or not and is it suitable for any employee working there or not. With this dataset and ML model applied to it, we can take strict action against companies that don't take care of their employees. This can be implemented by making a web app that merges ML and JavaScript together with the help of python libraries like stream lit.

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