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AI Mental Health Tracker and Analyzer Using Machine Learning Technique

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Abstract: ***Mental health problems are one of the major concerns of the 21st century in the field of healthcare. One of the major reasons behind this problem is lack of awareness among masses. The increase of mental health problems and the need for effective medical health care have led to an investigation of machine learning that can be applied in mental health problems. Early detection of mental health issues allows specialists to treat them more effectively and it improves patient's quality of life. Mental health is very important at every stage of life, from childhood and adolescence through adulthood. This study amalgamates insights from diverse research endeavours to present a comprehensive systematic review of machine learning (ML) applications in the mental health domain. In this research paper techniques like Logistic Regression, K-NN, Decision Trees, Random Forest, and Support Vector were compared, with Random Forest proving most accurate at 73.16% prediction accuracy.***

Keywords: Mental health, Anxiety, Depression, NLP, Machine Learning, Prediction, Text Processing, Mobile Application

I. INTRODUCTION

Mental health is a state of internal well- being that enables people to manage with the stresses of life, realize their capacities, learn well and work well, and contribute to their community. Prolonged isolation and uncertainty during the pandemic has increased stress and anxiety for many people. Financial problems, unemployment and social restrictions worsen mental health problems. Unfortunately, fear of judgment prevents people from seeking help, causing some to turn to drug addiction as a solution. Breaking the stigma surrounding mental health is important to encourage open discussion and provide support to those who need it. According to WHO internal health is "further than the absence of internal diseases." Peak internal health is about managing active conditions and maintaining heartiness and happiness. According to government statistical data out of the whole population of India, 130 million people could be suffering from some kind of internal illness.

A large quantum of India's population is living below the poverty line; these people don't have access to proper sanctum, food, water, drug, etc. For them proper treatment of internal illness is still a distant dream. Indeed for the top 10 percent of the population, treatment is expensive. According to world health association data India has 0.75 psychologists and psychiatrist per 100,000 people, when compared to Argentina which is a world top leader in this has 106 psychologists per 100,000 people. To overcome this implicit epidemic of internal illness, the government has to take some strong and necessary way towards healthcare, furnishing a sufficient budget towards internal health. The main reason behind such a huge number of people suffering from internal illness is our atrophied healthcare system. Anxiety and depression are serious public health issues that affect people each over the world. They affect people of all periods, from children to the senior, including both men and women.

Machine literacy is a fashion that aims to construct systems that can ameliorate through experience by using advanced statistical and probabilistic ways. It's believed to be a significantly useful tool to help in prognosticating internal health. In this paper, the main ideal is to give a methodical literature review, critical review, and summary of the machine literacy ways that are being used to prognosticate, diagnose, and identify internal health problems. Some of the major internal health diseases, similar as habitual conditions, bipolar complaint, and schizophrenia they don't suddenly arise out of nowhere; they frequently develop over time and produce symptoms that can be honoured in the early stages similar diseases could be avoided or controlled more successfully. If abnormal internal countries are discovered beforehand in the complaint's course when redundant treatment and care can be handed. Technological advancements similar as smart phones, social media, neuroimaging, and wearable have enabled experimenters of internal health and croakers to gather a tremendous quantum of information at a rapid-fire rate. Machine literacy has developed as a dependable tool for assaying these of all Classifiers more fluently and rightly discovered, as well as more accurate prognostications from data sources. Natural language processing, speech recognition, computer vision, and Artificial intelligence have all served from machine literacy, which allows inventors and experimenters to prize pivotal data from datasets,

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deliver substantiated gests, and develop intelligent systems. In disciplines like bioinformatics, ML has backed substantial progress by allowing for quick and scalable analysis of complicated data.

II. LITERATURE REVIEW

In 2015, Filip Dabek and Jesus J Caban introduced a groundbreaking neural network model designed to predict psychological conditions post-concussion with remarkable accuracy. By leveraging this model, they aimed to enhance preventive care for individuals with mild traumatic brain injury (mTBI). Their study not only demonstrated high predictive accuracy ranging from 73% to 95% but also outperformed previous methodologies. This innovation presented a significant step forward in clinical applications, potentially revolutionizing how psychological conditions are addressed and managed in patients recovering from mTBI.

A subsequent pilot study conducted in 2023 by Mahr F, Waschbusch D A, and Vgontzas delved into the efficacy of prazosin as a treatment for PTSD-related nightmares in women with bulimia nervosa. This study addressed a crucial gap in understanding the interplay between bulimia nervosa, PTSD, and the efficacy of prazosin in alleviating associated symptoms. While acknowledging its limitations, the study provided promising results, indicating a positive impact on nightmare intensity and frequency. However, it underscored the necessity for further research with larger sample sizes and the exploration of combined treatment approaches such as cognitive-behavioral therapy (CBT) alongside prazosin.

In 2019, Gyeongcheol Cho, Jinyeong Yim, Younyoung Choi, Jungmin Ko, and Seoung-Hwan Lee conducted a comprehensive review of machine learning (ML) algorithms for diagnosing mental illness. Their analysis focused on commonly employed ML techniques such as Support Vector Machines (SVM), Gradient Boosting Machines (GBM), Random Forest, k-Nearest Neighbors (KNN), and Naïve Bayes. Through a systematic organization of findings, they shed light on the applications and effectiveness of these algorithms in various mental health domains, including PTSD, schizophrenia, depression, Autism Spectrum Disorder (ASD), and bipolar disorder. This review provided valuable insights into the utilization of ML in mental health research, emphasizing the potential of supervised learning for classification tasks in diagnosing and managing mental illnesses.

Machine learning, as underscored by M. I. Jordan and T. M. Mitchell in 2015, has undergone a profound transformation from a scientific curiosity to a commercially prevalent technology. Its evolution has led to widespread adoption across diverse sectors, including computer science, user services, and supply chain management. This shift highlights the efficiency and practical utility of machine learning in addressing complex challenges and optimizing processes in various industries. As machine learning continues to advance, its impact on society and its applications in critical areas such as healthcare are expected to grow exponentially, promising further innovations and improvements in patient care and management of psychological conditions.

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III. METHODOLOGY

The methodology for developing the AI-powered mental health tracker and analyzer focuses on leveraging machine learning techniques and behavioral therapy principles to create a comprehensive tool for mood tracking and mental health management.

A. Proposed System

The main compass of our design is to describe mental health vaticination and to design a bracket model with a help of a machine learning algorithm.

B. Data Pre-manipulation

This particular scrap of the report will graft the data, and examine the standard of data cand also trim and clean the given dataset for analysis.

C. Data Graphing

The data set collected for prognosticating given data is resolve into the training set and a testing set. Generally, 73 rates are applied to split the Training set and Test set. The Data Model which was created using machine literacy algorithms is applied to the Training set and grounded on the test affect delicacy. Then matplotlib is used for data visualization.

D. Designing the Classification model

Classification is a supervised machine learning fashion that group records into sets of homologous compliances associated with particular classes. Different classifiers or bracket algorithms are available. In this study, six different classifiers were trained, including k-nearest neighbor, naive Bayes, random forest, decision tree, logistic regression.

1) Logistic Regression algorithm

It's a classification algorithm in the fashion of machine learning which is used to describe the possibilities of a categorical dependent variable. The purpose of logistic retrogression is to find the exact model to unfold the association between the bifurcate specific of interest (measured variable = reply or final output variable) and a set of variables.

2) Decision Tree Classifier algorithm

Decision- tree algorithm is one of the most effective order and well familiar order of supervised learning algorithms. It's suitable for nonstop and categorical variables of the affair. Decision tree constructs classification or regression models and assembles it in a confirmation of a tree. It breaks down the sets of data into inferior and inferior subsets while coincidently anco-related decision tree is incrementally designed. A root knot has two or further branches and a splint knot which represents a classification or a categorical decision. It's designed in a top-down recursive approach and in a peak and- conquer manner. i.e., 80 percent of it goes for training the model and the rest 20 percent is used to test the delicacy of the model. Through exploration we've named the following machine learning algorithms to find the stylish possible algorithm that could give us the most delicacy.

3) Random Forest Algorithm

It's an algorithm that comes under supervised form of learning. The working principle is to produce multiple decision trees and all of them are combined to get precise prognostications. Hence, it's considered a popular machine learning algorithm.

4) Decision Tree Algorithm

A decision tree comes under supervised learning algorithms where data is continuously resolve according to the parameter. The tree consists of two effects i.e., decision bumps and leaves. Decision knot is the stage where data is resolve and all the choices made are the leaves.

5) K- Nearest Neighbor Algorithm

Also known as a lazy or non parametric algorithm. The algorithm is actually grounded on point similarity. The vaticination is done according to the computation of the nearest data points. As it stores all of the training data, it can be computationally precious when working on a large dataset.

6) Naive Bayes Algorithm

It's a classifier which is grounded upon tentative probability models. These classifiers are a set of classification algorithms that are grounded on Bayes Theorem. It’s a group of algorithms where a common principle is participated between them be categorical. The Naive Bayes algorithm is an intuitive system that uses the chances of each trait belonging to each class to make a vaticination. Naive bayes simplifies the computation of chances by assuming that the probability of each trait belonging to a given class value is independent of all other attributes

Work Flow Model

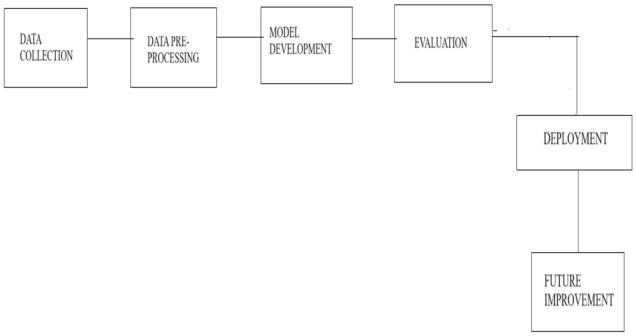


Figure 1 Workflow Model

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IV. EXPERIMENTATON AND RESULT ANALYSIS

A. *Dataset used*

Our analysis leveraged a self-reported survey dataset. This survey gathered data from a group of participants through a series of questions. The questions explored various aspects of their lives that might influence mental health, including family environment, family history of mental illness, employment status, workplace environment and culture, and co-worker behaviour.

B. *Data Cleaning*

Our personal survey data is rigorously reviewed to ensure its quality. We addressed missing values by interpolating the data, including the mean (for skewed data) and modulated categorical data (most values). Inconsistencies such as irregular gender entries ("male," "not male") are normalized within a single type (male, female, transgender). We remove unimportant attributes such as address, date of birth and carefully check whether the item can be removed or a profit can be made (limited to very valuable items). Finally, systemspecific scaling or normalization techniques are applied to ensure that all features are on par with machine learning metrics. This cleaning process prepares the data for the development of a good, comprehensive model

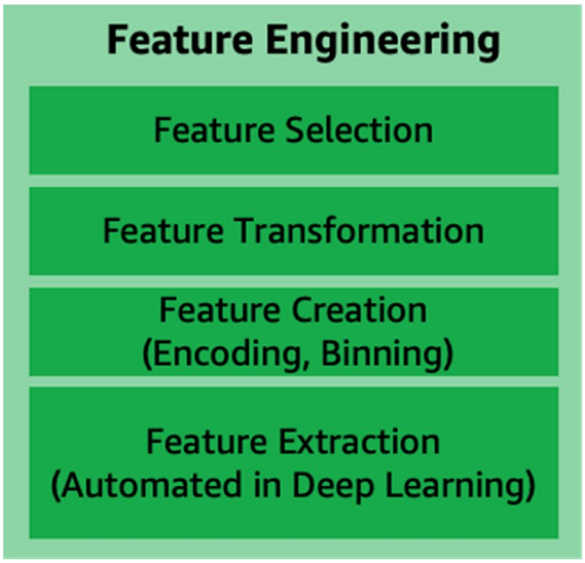


Figure 2 Feature Engineering

C. *Heatmap*

A Heatmap is a graphical representation of data that uses a system of color coding to represent different values. Heatmap are used in various forms of analytics but are most commonly used to show user behaviour on specific web pages or webpage templates. Heatmap can be used to show where users have clicked on a page, how far they have scrolled down a page, or used to display the results of eye-tracking tests

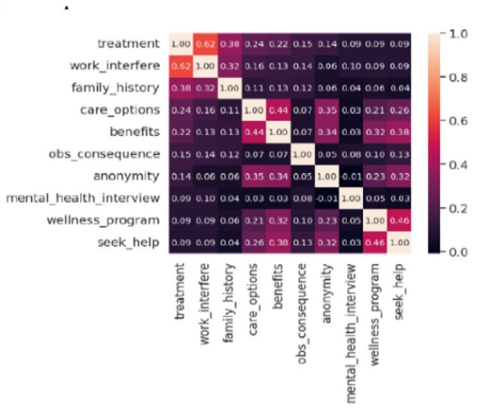


Figure 3 Heatmap

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D. Distribution Plot

A distribution plot is a visualization of data distribution that compares observed data with expected outcomes. It can be used in data analysis and machine learning to help detect outliers and skewness, and to get an overview of measures of central tendency

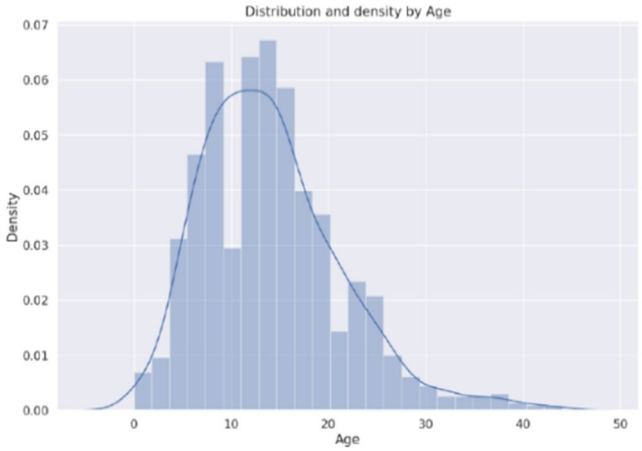


Figure 4 Distribution Plot

E. Feature Selection

Feature selection is the process of identifying and selecting the most important features from a dataset to improve model performance. It aims to reduce the difficulties caused by the potentially negative dimension. The best techniques for selection include correlation analysis, feature extraction, and content analysis. In our model, we use special options to simplify the data size and focus on specific features that contribute to good model accuracy and performance.

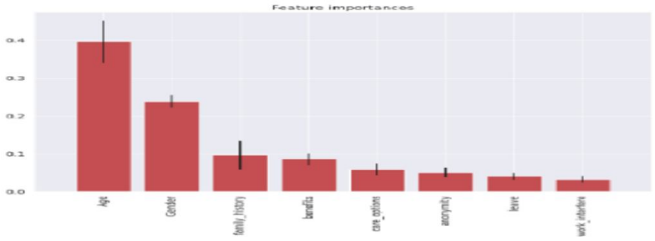


Figure 5 Feature Selection

V. CONCLUSION AND FUTURE SCOPE

Mental health significantly impacts our daily functioning and overall well-being, influencing both personal and professional lives. Depression, recognized by the World Health Organization as a leading global mental health issue, underscores the importance of prioritizing mental wellness.

Many individuals understand the need for mental health care but hesitate to seek professional help. Innovations like the Mental Health Tracker app bridge this gap by providing an accessible platform for users to explore their mental state. Through targeted questions, the app helps users articulate their thoughts and feelings, generating personalized tasks and activities accordingly. It also offers visual progress tracking through weekly graphs, enhancing user understanding of their mental health patterns.

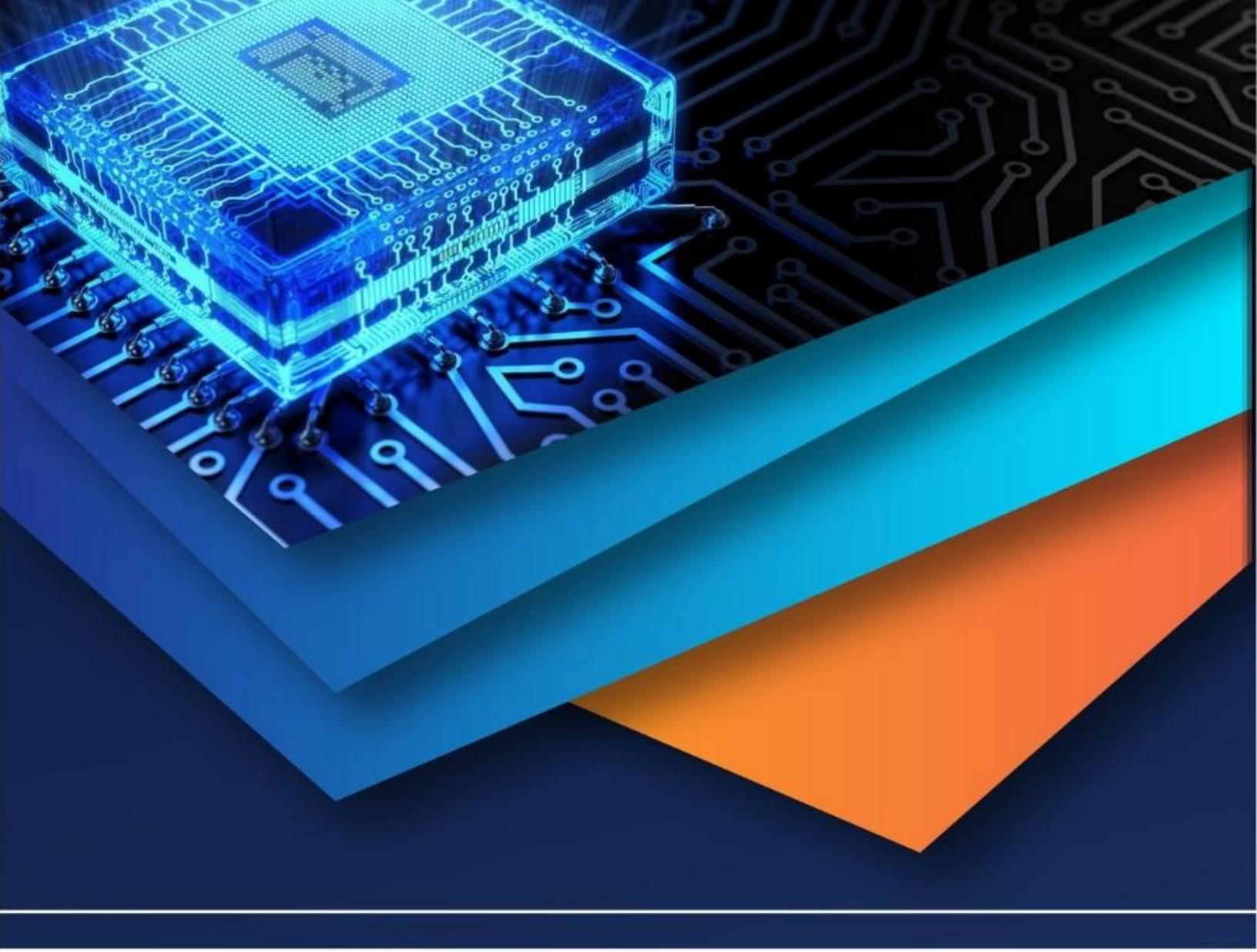
Leveraging technology, such apps can identify symptoms of depression and deliver customized guidance, potentially improving users' mood and overall health. Collaboration with mental health professionals ensures these tools are effective and meet user needs. Empowering individuals to manage their mental health is essential for fostering a healthier, more productive society.

Current research in brain diagnosis using machine learning focuses predominantly on one type of data. However, future advancements could see improved accuracy from integrating multiple data sources such as speech patterns, facial expressions, EEG data, and social behavior analysis. Developing new models capable of synthesizing these diverse inputs, alongside specialized information systems for audiovisual analysis in mental health, will be crucial. Such advancements could lead to earlier interventions, enhanced treatments, and ultimately better mental health outcomes.

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