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MENTAL HEALTH PREDICTION USING MACHINE LEARNING

PROJECT SYNOPSIS

OF MAJOR PROJECT

BACHELOR OF TECHNOLOGY
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Table of Content

Introduction

The field of mental health is of paramount importance due to its significant impact on individuals and society as a whole. Early detection and prediction of mental health conditions can greatly improve intervention and treatment strategies, leading to better outcomes for patients. This project aims to explore the application of machine learning techniques in predicting mental health conditions based on various input features.

Project Overview:

The primary objective of this project is to design and develop a predictive model that can identify potential mental health conditions in individuals based on a range of input features. Leveraging the prowess of machine learning, we intend to create a tool that enhances the accuracy and efficiency of mental health diagnosis, thereby enabling healthcare professionals to intervene in a timelier and more tailored manner.

Technology Utilized:

At the heart of this project lies the utilization of machine learning algorithms, a subset of artificial intelligence (AI) that equips systems with the ability to learn patterns and make predictions from data. Various machine learning algorithms, such as logistic regression, support vector machines, random forests, gradient boosting, and neural networks, will be explored and evaluated for their efficacy in predicting mental health conditions.

Specialized Field:

While this project draws upon techniques from both the healthcare and machine learning domains, its specialized focus lies in the amalgamation of these fields to address mental health challenges. The project will employ principles from clinical psychology and psychiatry to inform the selection of relevant input features, and subsequently, machine learning methods to process and analyze this information.

Why Needed?

In today's fast-paced and interconnected world, mental health has emerged as a significant global concern. The prevalence of mental health disorders is on the rise, and the associated personal, social, and economic burdens necessitate innovative approaches for early detection and intervention. The development of a mental health prediction model holds profound significance for several compelling reasons:

- Early Intervention and Prevention:
- Individualized Care
- Resource Optimization
- Reducing Stigma
- Advancing Research
- Remote and Accessible Support
- Comprehensive Assessment

In conclusion, the integration of machine learning into mental health prediction presents a transformative opportunity to revolutionize mental health care. The complexities of mental health disorders require innovative solutions, and the proposed model's ability to provide early detection, individualized care, optimized resource allocation, and reduced stigma makes it a potent tool in the fight against these challenges. By combining technology and compassionate care, this model has the potential to make a lasting impact on the well-being of individuals and society as a whole.

OBJECTIVE

The objectives of a mental health prediction system are multifaceted and address various aspects of mental health care, intervention, and support. The primary aim is to leverage data and technology to enhance the identification, understanding, and management of mental health conditions. The following are key objectives of a mental health prediction system:

Early Detection and Intervention: The system's foremost objective is to identify potential mental health issues at an early stage. By analyzing a combination of behavioral, psychological, and possibly biological factors, the system aims to detect signs of mental health conditions before they escalate, enabling timely intervention and support.

Accuracy and Reliability: The system should strive to provide accurate predictions based on reliable data analysis. Through robust machine learning algorithms and data validation processes, the goal is to minimize false positives and negatives, ensuring that individuals receive appropriate guidance and care.

Individualized Risk Assessment: Every individual's mental health journey is unique. The system should assess an individual's risk profile for specific mental health conditions, taking into account personal history, genetics, lifestyle, and other relevant factors. This individualized assessment can lead to personalized interventions and treatment plans.

Resource Allocation Optimization: Healthcare resources are finite, and mental health prediction systems can help allocate these resources more efficiently. By identifying individuals at higher risk, healthcare providers can prioritize interventions for those who need them most, reducing strain on the system.

Reduction of Stigma: Mental health prediction systems can contribute to destigmatizing mental health discussions. When individuals understand that predictions are based on objective data analysis rather than personal biases, they may be more inclined to seek help and engage with mental health services.

Preventive Strategies: The system can provide insights into potential triggers and risk factors associated with mental health conditions. Armed with this knowledge, individuals can take proactive steps to manage their mental well-being and minimize the risk of developing certain conditions.

Clinical Decision Support: Mental health prediction systems can serve as tools for healthcare professionals, aiding them in making informed clinical decisions. The predictions and insights generated by the system can guide professionals in tailoring treatment plans and interventions.

Research and Insights: Aggregated and anonymized data from the system can contribute to research efforts in the field of mental health. Researchers can gain insights into the prevalence, trends, and underlying factors of various mental health conditions, potentially leading to advancements in treatment and prevention strategies.

Accessible Support: In an era of digital healthcare, a mental health prediction system can be integrated into online platforms, providing accessible support to a wider population. Individuals can receive predictions and recommendations remotely, breaking down geographical barriers to mental health care.

Continuous Improvement: A well-designed mental health prediction system can learn and improve over time. As it gathers more data and incorporates feedback from users and healthcare professionals, the system can refine its predictions and enhance its accuracy.

Ethical Considerations: Ensuring ethical use of data and maintaining privacy and confidentiality are critical objectives. The system should adhere to strict data protection standards and obtain informed consent from users.

In essence, the overarching objective of a mental health prediction system is to bridge the gap between traditional mental health practices and innovative technological solutions. By offering early detection, personalized care, and valuable insights, such systems have the potential to significantly improve mental health outcomes and contribute to a more informed and empathetic approach to mental well-being.

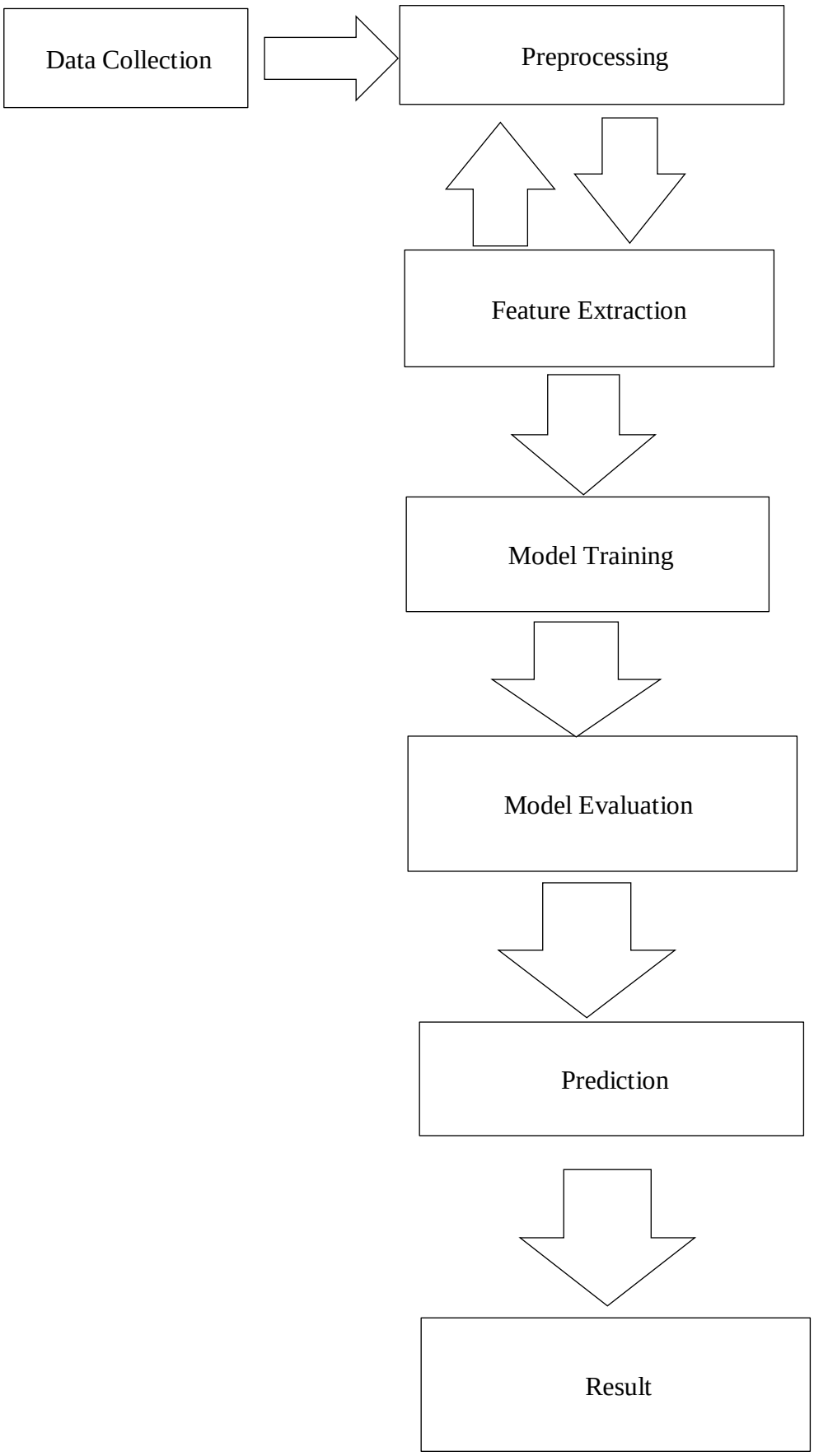
METHEDOLOGY

Search strategy: A searches were conducted to identify relevant literature using the keywords "big data", "machine learning", and "mental health". First, a literature search was conducted through health-related research databases, including PsycInfo, the Cochrane Library, and PubMed. Next, Information Technology databases IEEE Xplore and the ACM Digital Library were searched. Lastly, databases that index both fields including Springer, Scopus and ScienceDirect were searched for relevant literature.

Study selection: Articles were included in the review if the following criteria were met: (i) the article reported on a method or application of ML to address mental health; (ii) the article evaluated the performance of the ML or big data technique used; (iii) the article was published in a peer reviewed publication;(iv) the article was available in English. Articles were excluded if the following criteria were met: (i) the article did not report an original contribution to ML applications in mental health (e.g., the paper commented on the future use of big data only, or reviewed other articles without contributing original research); (ii) the article did not focus on a mental health application; and, (iii) the full text of the article was not available (e.g. conference abstracts).

Data extraction and analysis plan: For each article, data was extracted regarding: (i) the aim of research; (ii) area of mental health focus; (iii) data type; (iv) sample size; (v) ML methods used; (vi) results; (vii) the country of the author group; and, (viii) the discipline area of authors (e.g., health fields, data science fields, or both). To analyse the data, a narrative review synthesis method was selected to capture the large range of research investigating ML and big data for mental health. It should be noted that a meta-analysis was not appropriate for this review given the broad range of mental health conditions, ML techniques, and types of data used in the studies identified.

Data Flow Diagram



TOOL OF DATA COLEECTION

NEURAL NETWORKS: Neural networks (NNs) are popular machine learning models that use nonlinear computation to make inferences from large datasets. Thus, they have started being deployed in the smart healthcare domain [4, 23, 25, 36, 60, 61]. The two main data sources for deep-learning-based analysis of mental health have been clinical data and social media usage data. The former includes studies that use neuro image data for detecting various mental health disorder.

DEEP NEURAL NETWORK: The deep neural networks (DNNs) to directly extract the mental health condition from the physiological signals. These inferences can be communicated to a health server that is accessible to the physician. This has the potential to enhance the ability of the physician to intervene quickly when mental health conditions deteriorate.

LITERATURE REVIEW

The study assessed the performance of eight different machine learning algorithms which classify the dataset into various issues of mental health. Their results show that the three classifiers tested, namely the Multiclass Classifier, Multilayer Perceptron, and the LAD Tree, generate results that are more accurate than the others. It explains that mental health analysis in terms that are intuitive to different target groups. They have created a system for determining an individual's mental health status and prediction models were built using this framework. Clustering methods were also been used to determine the number of clusters before developing models. MOS was used to validate the class labels produced, which were then used to train the classifier. The trials showed that KNN, SVM, and Random Forest performed nearly equally well. The usage of ensemble classifiers was also discovered to considerably increase the performance of mental health prediction with a 90% accuracy rate. In this, the research has concentrated on the benefits of machine learning in improving mental health identification and diagnosis of Alzheimer's disease, depression, and other mental illnesses schizophrenia. Overall, machine learning has the potential to increase clinical and research efficiency while also providing fresh insight into mental health and wellbeing. The key contribution of this paper is that the ILIOU preprocessing method can be utilized to significantly improve the performance of classification algorithms in similar datasets and it can also be used to forecast different types of depression. Depression prediction is critical for patients to receive the most appropriate treatment as soon as feasible. Artificial intelligence is becoming a bigger aspect of medicine, and it will help with mental health research and practice. To realize the full promise of AI, a varied community of specialists involved in mental health research and care, including scientists, clinicians, patients, and regulators, must communicate and interact. They have analyzed by using discourse analysis in this study to better understand the practices of representation in human-centered machine learning (HCML). From this, case prediction of mental health status on social media data, they have found a dataset of 55 interdisciplinary studies. Their findings show that opposing the discourses of interaction throughout the dataset to construct and grant agency for the humans. Their findings demonstrate how the five discourses produce a paradoxical object and subject views of the human, potentially dehumanizing it accidentally.

REFERENCE

1. Sau, A., Bhakta, I. (2017)"Predicting anxiety and depression in elderly patients using machine learning technology. “Healthcare Technology Letters 4 (6): 238-43.

2. Tyshchenko, Y. (2018)"Depression and anxiety detection from blog posts data."Nature Precis. Sci., Inst. Comput. Sci., Univ. Tartu, Tartu, Estonia.

3. R.A.Calvo and S. D’Mello. Affect detection: An interdisciplinary review of models, methods, and their applications. IEEE Trans. Affective. Comput., 1(1):18-37, 2010.

4. Shayan Hassantabar, Joe Zhang, Hongxu Yin, and Niraj K. Jha. 2022. MHDeep: Mental Health Disorder Detection System Based on Wearable Sensors and Artificial Neural Networks. ACM Trans. Embedded Computer. Syst. 21, 6, Article 81 (December 2022).

5. Sau, A., Bhakta, I. (2017)"Predicting anxiety and depression in elderly patients using machine learning technology. “Healthcare Technology Letters 4 (6): 238-43.