**Project Progress Report**

Project Title : MindCare

Members

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**Introduction**

In recent years, mental health has emerged as a critical component of overall well-being, with the World Health Organization (WHO) emphasizing its importance for individuals and society at large. Mental health disorders, particularly depression, have become one of the leading causes of disability and health burden worldwide. Despite its prevalence, mental health often remains stigmatized, leading to under-diagnosis and inadequate treatment. Timely intervention is crucial to mitigate the long-term effects of mental health issues, especially for vulnerable groups such as students and working professionals, who often face intense academic and professional pressures.

With advancements in technology, artificial intelligence (AI) and machine learning (ML) have shown promising potential in addressing mental health concerns. These technologies enable early detection and prediction of mental health disorders by analyzing various behavioral, psychological, and environmental factors. By leveraging machine learning models, especially decision-based algorithms like Random Forest, it is possible to predict mental health risks such as depression, offering a proactive approach to mental health care.

This project, MindCare, focuses on developing a machine learning-based web application to predict depression risk in individuals based on their personal and environmental factors. The application utilizes Random Forest Classifier, a robust ensemble learning algorithm, to estimate the risk of depression and provide detailed insights into the factors contributing to the risk score. The model uses user data such as age, sleep patterns, dietary habits, academic/professional pressure, family history, and suicidal thoughts to assess mental health risk on a scale from 1 to 10. By providing individualized risk predictions and detailed explanations, MindCare aims to assist users in understanding their mental health better and seeking professional help if necessary.

The primary goal of this project is not just to predict whether an individual is at risk of depression but also to provide a breakdown of how each feature contributes to their risk score. This unique approach aims to empower users with detailed insights, encouraging self-awareness and preventive action. By integrating machine learning with mental health prediction, this project hopes to provide an accessible tool for mental health management that can be used in academic institutions, workplaces, and broader healthcare settings.

**Literature Review**

**Machine Learning in Mental Health Prediction**

Over the last decade, there has been significant research into the application of machine learning (ML) in healthcare, particularly in mental health prediction. Studies such as Kessler et al. (2002) have highlighted the complexity of mental health disorders like depression, which are influenced by a range of psychological, social, and biological factors. Traditional diagnostic methods rely on subjective assessments by healthcare professionals, which can be time-consuming and prone to human error. Machine learning models, on the other hand, can process large amounts of data quickly and objectively, providing more consistent predictions.

A number of machine learning algorithms have been used for mental health predictions, including Support Vector Machines (SVM), Decision Trees, Neural Networks, and Random Forests. In the mental health domain, supervised learning methods like Random Forest have become particularly popular due to their ability to handle both structured and unstructured data, manage missing values, and provide accurate results without overfitting (Breiman, 2001). For instance, Zhang et al. (2019) used Random Forest models to predict depression in a large sample of college students based on a range of demographic and lifestyle variables, demonstrating high predictive accuracy.

Several studies have also examined the use of ensemble methods like Random Forests to predict depression. Random Forest is a highly versatile and robust algorithm that works by constructing multiple decision trees during training and outputting the mode or average of their predictions. It excels at handling complex relationships between input variables and provides feature importance scores, which can be used to interpret how various factors contribute to a prediction (Hastie, Tibshirani, & Friedman, 2009).

**Factors Contributing to Depression**

Depression is a multifaceted disorder that can be influenced by a variety of personal, social, and environmental factors. Studies have identified several key predictors of depression, including academic pressure, work stress, sleep quality, dietary habits, financial stress, and family history of mental illness (Kendler et al., 2006; Drapeau et al., 2012).

1. **Academic and Work-Related Stress**: Multiple studies have shown a strong link between stress and mental health disorders. For students, academic pressure, including grades and performance anxiety, plays a major role in mental well-being (Tian, 2017). Among working professionals, job satisfaction and work-related stress are important predictors of depression (Wang et al., 2014).
2. **Sleep Patterns**: Poor sleep quality and insufficient sleep duration have been consistently linked to an increased risk of depression. According to Baglioni et al. (2011), individuals who sleep less than six hours per night are significantly more likely to develop depression than those who sleep seven to eight hours.
3. **Dietary Habits**: A growing body of evidence suggests that diet plays a critical role in mental health. Studies have found that individuals with unhealthy diets, characterized by high sugar and processed food intake, are at higher risk of developing depression compared to those with a balanced diet rich in fruits and vegetables (O’Neil et al., 2014).
4. **Suicidal Thoughts**: Suicidal ideation is one of the most severe indicators of depression. Individuals who express suicidal thoughts are at high risk for depression and other mental health disorders (Nock et al., 2008).
5. **Family History of Mental Illness**: Genetics play a crucial role in determining the likelihood of developing depression. Studies such as Kendler et al. (2006) have found that individuals with a family history of depression are significantly more likely to experience the disorder themselves.

**Random Forest and Mental Health**

Random Forest, as an ensemble learning method, has proven effective in handling both regression and classification tasks, particularly in healthcare. It is widely used due to its ability to handle diverse datasets, manage missing values, and output interpretable models. One of the key advantages of Random Forest in mental health prediction is its ability to provide feature importance scores, which can help explain how different variables contribute to an individual’s depression risk (Breiman, 2001). This feature of Random Forest aligns with the goals of MindCare, which aims to provide personalized insights into mental health risk.

Random Forest models have been successfully applied in previous research to predict depression using variables such as demographic data, lifestyle factors, and psychological assessments. For example, a study by Chen et al. (2020) used Random Forests to predict mental health outcomes based on social media behavior, achieving an accuracy rate of over 80%. These findings demonstrate the feasibility of using machine learning algorithms to predict mental health outcomes.

In summary, the literature supports the use of Random Forest models for mental health predictions, particularly in cases where the dataset includes a range of demographic and lifestyle variables. The flexibility and interpretability of the Random Forest algorithm make it an ideal choice for the MindCare project, where the goal is not only to predict depression risk but also to provide detailed insights into how different factors contribute to the risk score.