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# Mental Health Prediction of Children Addicted to Digital Platforms

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**ABSTRACT:** The propagation of digital platforms has transformed communication and connectivity, particularly among younger generations. However, the excessive usage of digital platforms among children has sparked worries about its possible impact on mental health. In response to this growing concern, this research study focuses on the progression of predictive models to identify children at risk of social media addiction and associated mental health issues. Machine learning (ML) algorithms and data-driven approaches can act as a catalyst to study and analyze patterns of social media usage and their correlation with mental health. In this analysis, questionnaires are used to collect data, followed by preprocessing, feature extraction, and model training. Through model interpretation as well as validation, the predictive models seek to give information about the elements impacting social media addiction and mental health outcomes in children. Certain performance indicators like AUC-Score, accuracy and precision were used to train and evaluate the models. The results indicate the Decision Tree algorithm performs superior to other models with high precision and accuracy.

**KEYWORDS:** Logistic Model, Random Forest (RF), Decision Tree (DT), K-Nearest Neighbor, Mental Health Datasets, Prediction.

## I. INTRODUCTION

Conditions relating to children's mental well-being, addiction to digital platforms present a significant and growing concern globally. World Health Organization estimates that millions of children worldwide are affected by psychological issues related to digital platform addiction. Excessive use of digital platforms by children are affecting their mental well- being. This includes depression, anxiety, and low self-esteem. An accurate prediction of this issue becomes difficult for parents' educators, and doctors. Earlier, a manual approach was followed to detect whether children had mental health issues. The arrival of technology has introduced a lot many ways in detecting mental health issues in children specifically addicted to social media. There is an opportunity now to investigate how kids are using digital platforms and their influence on the child's well-being. Therefore, in this manner, numerous works is being done to ensure the welfare of our children. The primary focus of this research is to implement a predictive model to forecast the mental health issues of children addicted to social media. A dataset that includes details about social media usage, demographic information, and psychological issues are employed to study patterns. To develop predictive models, distinct kinds of related data are gathered and analyzed. The algorithm's effectiveness is assessed, and compared to predict mental health outcomes. It identifies the negative effects of digital platform on children's mental health. Insights for early detection and intervention of psychological issues is provided here.

The significance of parental supervision and the requirement to establish a healthy online environment is promoted in this study. This study explores how excessive use of digital platforms lead to negative impacts on mental health of children. It aims to deal with the growing concern of psychological disorders of children who are addicted to digital platforms using ML methods to predict these issues. ML algorithms can identify and provide an accurate prediction of psychological disorders in children. Four ML algorithms namely Logistic Model, RF, DT and K-Nearest Neighbor (KNN) were employed in the study. The aim of this study is to identify the most effective algorithm that can predict mental health outcomes by comparing the performance of Logistic Model, RF, DT and KNN models. These insights aim to reduce the effects of digital platform on children's mental well-being and help to establish a healthy online environment for young users. The article is structured as follows. Section II discusses the related work. Section III looks into the methodology of the research study. Section III focuses on the observations and results. Section IV highlights the conclusions and future work.

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## II. RELATED WORK

Vengalarao Pachava et al. [1] explored the connection between various mental health indicators and other influencing factors among Indian youth. ML techniques were used to analyze the impact of social media and other factors of mental well-being.

Maryam Latifian et al. [2] used a quantitative survey method to gather information from students. This study examines the correlation between internet addiction, academic resilience, and the state of mind of high school students. The outcomes were showcased in the context of correlations and statistical relationships rather than using algorithms to predict outcomes.

Kyungwon Kim et al. [3] used ML algorithms to anticipate and avoid smartphone addiction of children aged 10 to 19 years. This study takes early signs of smartphone addiction so that prevention measures can be taken quickly.

Mehmet Gülü et al. [4] used a cross-sectional analysis that involves adolescents aged between 9 to 14 years to analyze the connection between addiction to digital games, fitness activity and obesity. Binomial Logistic Regression Analysis is used to forecast digital game addiction.

W. Andrew Rothenberg et al. [5] used ML algorithms to predict adolescents problems pertaining to mental health for those between 13 to 17 years. This study shows how to blend theory and data-driven approaches to determine the key preadolescent risk variables that determine adolescent mental health.

Sangeeta R. Kamite and Dr. V. B Kamble [6] used ML models which includes Naïve Bayes algorithm and RF algorithm to predict depression in social media that effectively predicted mental health treatment adherence by analyzing patterns in social media activity.

Vidit Laijawala et al. [7] designed a system to predict mental health conditions and treatment using ML techniques, precisely by using the Decision Tree algorithm. Users were given the provision to enter their knowledge about psychological issues in a form and receive results about their potential and accurate health based on their input.

Rahul Katarya and Saurav Maan [8] created a mental health prediction model utilizing KNN, Support Vector Classifier, Logistic Model, RF and DT. The setup of the system was done as a website to highlight the importance of addressing psychological issues in the workplace.

J.M. Imtinan Uddin et al. [9] predicted early depression risk among tech employees using an Adaboosted Decision Tree so that preventive measures could be taken. The model is designed for Binary Classification as this was able to predict whether a user is experiencing depression (yes or no).

Charith Silva et all. [10] highlighted the potential of data science to transform public mental health by providing a structured approach in order to derive practical insights from complex datasets and involving key stakeholders.

Table 1. Comparative Work

| Paper | Algorithms used | Accuracy |
|---|---|---|
| Vengalaro Pachava et al. [1] | K - Means Clustering algorithm, CatBoost Classifier algorithm. | CatBoost Classifier algorithm has high accuracy 76.5% than K - Means Clustering algorithm |
| Maryam Latifian et al. [2] | This study does not focus on ML algorithms. It focuses on statistical analysis methods. | The results are presented with respect to correlations and statistical relationships. No accuracy information has been given. |
| Kyungwon Kim et al. [3] | Logistic Regression, RF, Gradient Boosting Machine (GBM), Extreme Gradient Boosting (EGB), Convolutional Neural Network | Extreme Gradient Boosting has high accuracy 87% compared to other algorithms. |

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|---|---|---|
| Mehmet Gülü et al. [4] | Binomial Logistic Regression Analysis | 75.3% |
| W. Andrew Rothenberg et al. [5] | Support Vector Classifier and RF. | Support Vector Classifier has better accuracy 78.0% than Random Forest |

Table 1 indicates the relevant work which was done by comparing with the existing study. It is found that several projecting models have been arrived at by using some ML algorithms. Additionally, a study [2] suggests that statistical analysis is suitable and applied as an alternative to ML algorithms in prediction process. Therefore, predictive models are obtained from mental health data through the application of numerous tools and techniques. The study [3] employed different indications of smartphone addiction, such as gaming, e-books, web novels, and the extent of smartphone dependence.

## III. RESEARCH METHODOLOGY

The research methodology, data gathering procedures, and ML strategies employed in this investigation are described here. It serves a structured framework in order to develop a predictive model to address the mental illness issues of children addicted to digital platforms. The process of collecting data is described with the help of behavioral patterns, social media usage, and measures of mental health from a sample population of children. Figure 1 outlines the preprocessing procedures, feature selection and model training procedures for creating predictive models with ML algorithms. The block diagram of the system is displayed in Figure 1. It illustrates various phases and modules of the system and the flow of the project.

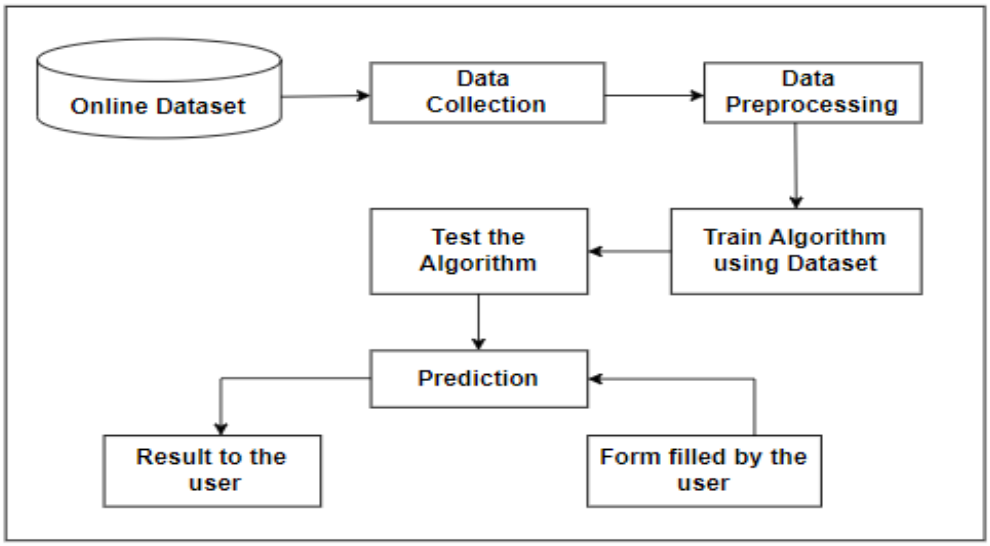


Figure 1: System Block Diagram

### A. Data Collection

Two different kinds of datasets are employed in the data collection process. The first data is an online available dataset. The second data is collected from children, parents and guardians through online survey using questionnaires. These questionnaires include queries concerning their social media usage and habits, emotional health and behavioral changes. A sample of children of age group between 10 to 16 years who regularly use digital platform were identified. By combining these datasets, more precise forecasts were made and its potential impact on their mental health enabled more accurate predictions and interventions.

### B. Data Cleaning and Preprocessing

After data collection, preprocessing was performed to clean, transform, and prepare it for analysis and prediction. The details that were gathered from questionnaires were reviewed to identify missing values or incomplete data.

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### C. Model Selection and Training

Model selection and training to predict mental health issues in children involve the following steps. First the ML models are selected namely Logistic Model, DT, RF and K-Nearest Neighbor. Considering the characteristics of the information as well as the research objectives, the ML algorithms were used to arrive at predictive models. The frameworks are trained and evaluated to determine their effectiveness by using the performance indicators namely accuracy, precision and AUC-Score. After model selection, it is trained on the preprocessed dataset. A model learns the underlying patterns and relationships between the input qualities as well as the intended variable (mental health outcomes).

### D. Machine Learning Algorithms

1. Logistic Model:

Logistic Model is utilized to predict whether an individual is likely to create a mental health disorder or to require certain solutions according to the questionnaires. This algorithm decides by considering the responses in the questionnaires as to whether a child is mentally ill or not, this is done by giving a special value 0 or 1, 0 representing “not mentally ill” and 1 representing “mentally ill”.

2. Decision Tree:

DT algorithm was utilized to identify patterns and relationships between using digital platforms and psychological issues in children. It predicts whether a child is mentally ill based on their digital platform usage. Here the data is being split based on significant features of digital platform usage patterns. In a DT classifier, each leaf is given a class label and the attributes are represented on the internal node of the tree.

3. Random Forest:

RT model incorporates multiple decision trees to create a robust predictive model. Here the performance is enhanced by creating a ‘forest’ of trees where each trees’ decision is employed to provide a final prediction. RF model constructs multiple decision trees in the course of training and provides the most typical classification for prediction from those individual trees. Many DT were built in this study using random subsets within the training set. Each DT was individually trained on a replacement-based random sample taken from the training data. The prediction from each and every DT was combined and the majority vote was taken as the final prediction.

4. K-Nearest Neighbor (KNN):

The KNN algorithm was also employed in this study as a part of the methodology to classify and predict mental health. To categorize the data, the readings of the nearest data points were taken. This algorithm classifies a new observation by comparing it, that is most typical among its k- nearest neighbors.

## IV. RESULTS AND OBSERVATIONS

In this research, the information is gathered from online available dataset to predict psychological issues in children aged 10 to 16 years who are addicted to digital platform. The dataset consists of various parameters to predict mental illness of children. Few parameters are age, gender, screen time, type of digital platform usage, quality of sleep, social interactions, self-esteem level, anxiety level, depression level, mental health consequence, physical health consequences etc... The findings of this study shows that certain demographic factors and patterns of digital platform usage contribute as a forecast for psychological state issues.

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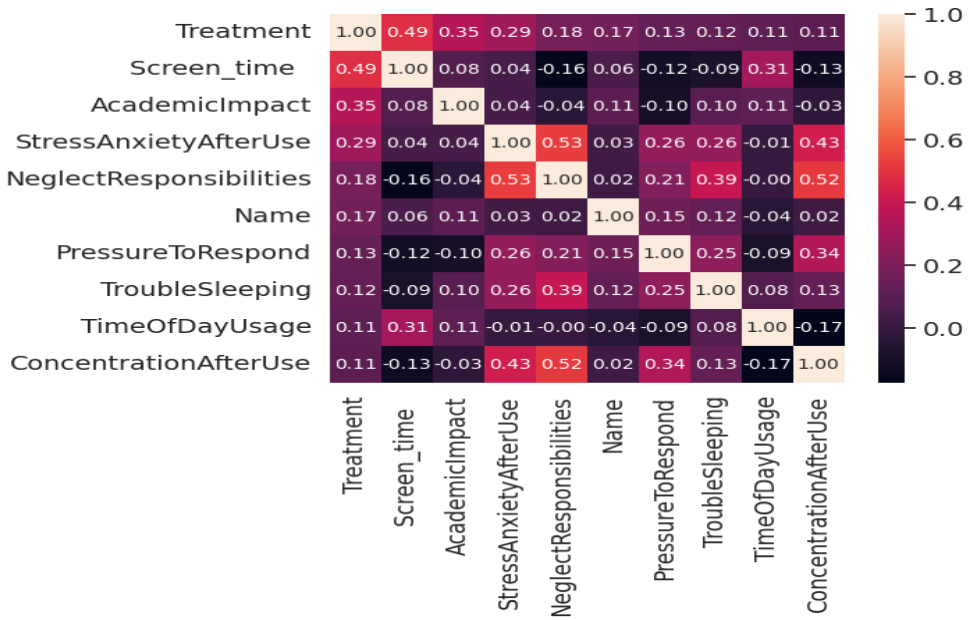


Figure 2: Attributes Relationship Matrix

Figure 2 represents the attributes relationship matrix of various variables, here both axes list the same set of characteristics like demographics, behavioral metrics, and other measurable factors. The color spectrum ranges from dark purple (strong negative correlation) to light yellow (strong positive correlation), with white indicating no correlation. Each cell shows the correlation coefficient between the intersecting variables, with the diagonal line being white as it represents each variable's perfect correlation with itself. This visual tool helps to identify which variables move together positively or negatively, aiding in understanding relationships within the dataset. To predict mental health outcomes, four ML models are applied. The execution of each model is assessed according to accuracy, precision and AUC-Score. The result of the applied system is outlined in Table 2.

Table 2. Performance of ML Algorithms

| Algorithms | Accuracy | Precision | AUC-Score |
|---|---|---|---|
| Logistic Regression | 0.6667 | 0.6364 | 0.6643 |
| KNN | 0.7500 | 0.7778 | 0.7413 |
| Decision Tree | 0.875 | 0.7142 | 0.9090 |
| Random Forest | 0.7917 | 0.8000 | 0.7867 |

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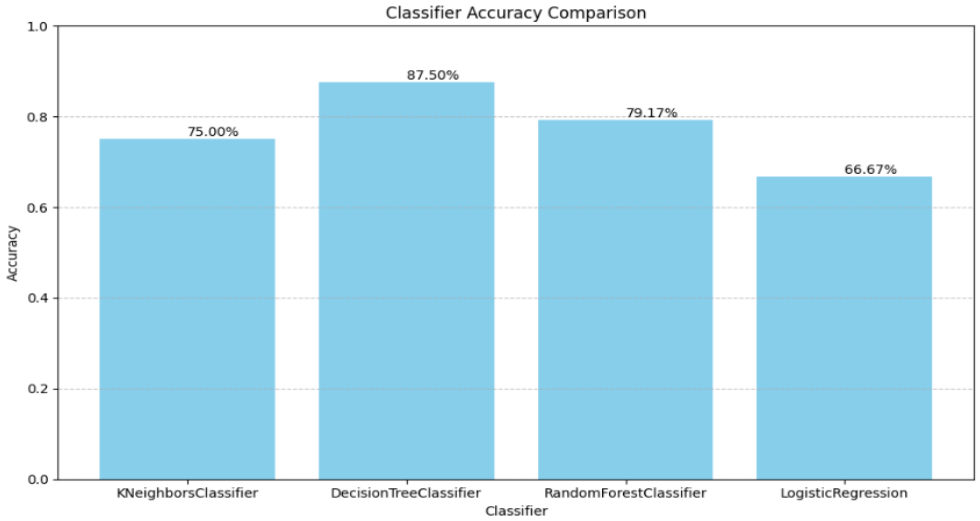


Figure 3: Classifier Accuracy Comparision

Figure 3 indicates that DT model has the highest outcome among all classifiers. Each classifier's performance is measured by its accuracy, which represents the ratio of accurate predictions out of all predictions it makes. Thus, the model is more effective in predicting psychological issues related to social media addiction among children. The DT model is qualified to predict whether a child has psychological issues or no issues. The tree starts with the root node as well as branches considering the conditions of various features. Each node represents a decision point, where the data is split as per the feature's threshold value. This gives an illustration of the rules used to classify the data, illustrating how different features contribute to the forecasting of psychological issues in children.

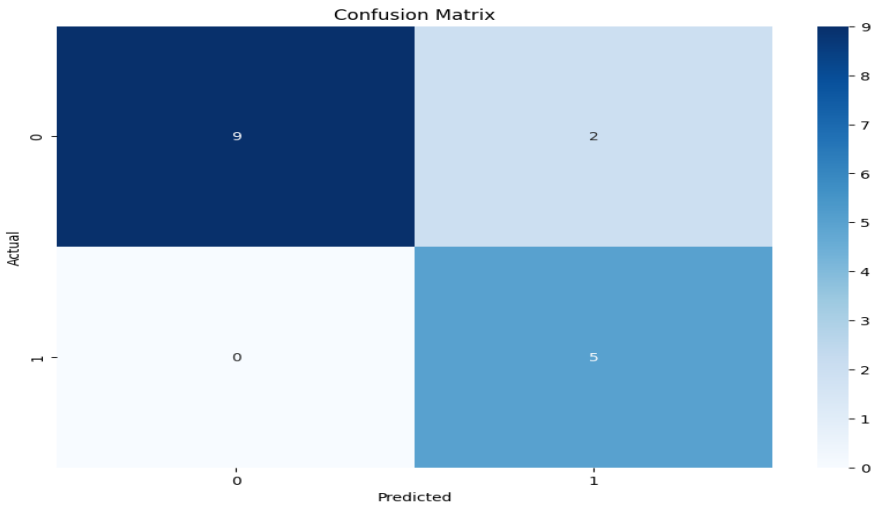


Figure 4: Confusion Matrix

Figure 4 shows the confusion matrix that compares the actual and expected classification to visualize the effictiveness of the classification model. The present study indicates that the selected machine learning model is effective in predicting the state of psychological health children addicted to social media. This indicates that the model is reliable and also can be utilized for early detection and intervention. The significant features correspond with the existing literature, it shows that excessive use of digital platform is connected to problems with mental health issues in children. The study [1] is employed with different machine techniques such as K - Means Clustering algorithm and CatBoost Classifier algorithm. The previous study [3] used GBM, EGB and Convolutional Neural Network. It included data factors like internet addiction, academic resilience, patterns of smart phone usage and also digital platform activity.

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This research work is implemented by four ML models namely Logistic Model, RF, DT and KNN models. Decision Tree algorithm is discovered to be more successful in predicting whether children are prone to psychological illness or not. The age, gender, screen time, sleep quality, social interactions, self-esteem level, depression level, mental and physical health consequences were taken as data factors. This enabled to arrive at an enhanced robust predictive model.

## V. CONCLUSIONS

Through a thorough examination and comparison of algorithms this investigation indicates the efficacy of ML model as a valuable tool in the domain of psychological health prediction. Implementation of these models in healthcare and educational institutions can facilitate early detection of children at risk. Appropriate interventions can be implemented to prevent quick rise of psychological issues. This highlights the importance of parent's supervision to monitor their children on their digital platform usage. A healthy online environment can be created for young users by improving their mental well-being and the adverse consequences effects of digital platform addiction can be reduced.
Future studies can have a better understanding on consequences of digital platform and can improve the psychological health strategies. This can involve dataset expansion that includes more diverse population and also can be done by integrating advanced technology with traditional approaches.

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