Chapter 4

A Decision Support System Approach for Early Diagnosis of Digital Addiction Observed in Generation Z

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Abstract

This study presents a decision support system for the early diagnosis of digital addiction observed in Generation Z individuals. Born in the digital age, Generation Z actively uses the internet and social media as a means of social interaction, which leads to digital addiction. At this stage, when identity formation has just begun, digital addiction causes negative consequences such as social isolation, academic failure, anxiety, and depression. The aim of the study is to model the levels of digital addiction using machine learning methods by observing the effects of smartphone usage habits among students aged 12 to 21 in this context. This model has been created by observing daily phone usage statistics. The publicly available data set used in the study has been collected through structured surveys. The dataset shows that screen time is 4.5 hours across all age groups. A relationship between screen time exceeding eight hours and addiction has also been observed. Four different classification algorithms (Logistic Regression, Gradient Boosting, Neural Net (MLP), XGBoost) have been used in the study. Among the models, the Logistic Regression model showed the highest accuracy in classification performance. Compared to similar studies in literature, the machine learning approach has higher prediction success in classifying the level of digital addiction. This study, which applies a data-driven analytical approach to the problem of digital addiction in early ages when identity formation is just beginning, emphasizes the significance of developing early diagnosis and intervention strategies.

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1. Introduction

Information and communication technologies play an integral role in our daily lives in this digital age. Individuals born after 1995 are referred to as Generation Z. Social media platforms provided by the internet infrastructure play a significant role in their identity formation process (Li et al., 2023; Ricoy et al., 2022). This is because they use these platforms for social interaction. The internet is not only used as a means of communication by this generation, but it is also considered a fundamental part of life, including social interaction, education, and entertainment (Akhtar et al., 2023; Herawati et al., 2022; Li et al., 2023). The development of communication and internet technology has enabled instant connectivity and artificial intelligence technologies to provide personalized and rich content tailored to the user, making life easier and faster. The pursuit of social approval in digital spaces often results in unregulated use, excessive content consumption, and digital dependency. Negative effects on social relationships, academic life, and work life have also been experienced because of this situation (Hamida et al., 2021; Huang, 2024; Jun, 2015).

Digital addiction arises when individuals are unable to control their use of technological devices, which can lead to adverse results like social isolation, poor physical health, and diminished mental well-being. The emergence of negative emotional states, such as restlessness and anxiety, is associated with the absence of individuals from technological devices or the internet. People define digital addiction not only as high screen time but also as a type of psychological addiction. This psychological condition, known as nomophobia, is characterized in literature as the state of being without a smartphone. There are important factors in the emergence of this psychological problem in Generation Z, and it is essential to understand these factors to develop effective solutions. The existence of factors such as competence, belonging, feelings of loneliness, and the search for excitement can serve as triggers for digital addiction. Additionally, family and friends' attitudes towards young individuals are also among the causes that trigger this condition. Significant negative consequences result from digital addiction, including decreased empathy skills, anxiety disorders, sleep disorders, and depression. Another common result is a decrease in academic achievement (Hamida et al., 2021; Huang, 2024; Khan et al., 2021; Vaghefi & Lapointe, 2014; Yang & Gao, 2022).

Table 1. A Review of Literature: Analytical methods and findings

Authors and Year	Topic	Analytical Method	Data	Findings
(Dhanalakshmi et al., 2025)	The present study aims to assess the prevalence of internet and mobile addiction across all age demographics through the utilization of artificial intelligence methodologies.	Machine Learning Classification Models (Random Forest, SVM, KNN, Logistic Regression)	Internet Addiction Test (IAT) Survey (n=1763)	Artificial intelligence models can classify addiction levels (low, medium, high) from survey data with up to 71% accuracy.
(Parhi et al., 2025)	The utilization of digital data and soft computing techniques has emerged as a novel approach for the analysis and tracking of behavioral addiction.	Machine Learning (Logistic Regression), feature selection with Particle Swarm Optimization (PSO)	Application-Based Real-Time Usage Data (UsageStats, Activity Tracker) and Survey	Instantaneous usage data collected via applications assesses addiction more accurately than traditional surveys. A survey optimized with real-time data achieved 98.61% success in predicting nomophobia.
(Singh et al., 2023)	The objective of the present study is to utilize an unobtrusive method for the detection of smartphone addiction.	Rule-Based System Development, Behavioral Analysis	Passive User Data Collected via an Android Application (device unlocks, number of screen-ons, application usage time)	Addiction detection through behavioral rules derived from various methods (e.g., turning on the screen more than 110 times a day).
(Wu & Zhang, 2023)	A statistical model has been developed to analyze the impact of middle school students' engagement with mobile phones on their addictive tendencies.	Regression Analysis, Moderation (Interaction) Analysis	Survey Data (n=312)	Parent-child communication problems and poor peer relationships statistically strengthen this effect.

(Yang & Gao, 2022)	This investigation utilizes longitudinal analysis to examine the correlation between smartphone addiction and basic psychological needs in a sample of middle school students.	Advanced Statistical Modeling	Survey (n=337)	The inability to meet the need for competence significantly predicts future smartphone addiction.
(Hamida et al., 2021)	The present study aims to explore the relationships between loneliness, smartphone addiction, and empathy among Generation Z.	Structural Equation Modeling (SEM)	Survey Data (n=253)	SEM analysis showed that smartphone addiction fully mediates the relationship between loneliness and empathy.
(Davazdahemami et al., 2016)	The phenomenon of device addiction is distinct from the more specific case of application addiction (referred as "app addiction").	Structural Equation Modeling (SEM)	Survey Data (n=333)	Application addiction explains approximately 38% of the total variance in mobile device addiction.

Table 1 presents a compendium of studies in the extant literature that employ various methodologies for the assessment of digital addiction in young individuals. A significant source of data regarding user behavior can be derived from examining smartphone usage habits. The extant literature also indicates that variables such as the time spent using applications, the total screen time, and the responses to phone notifications are significant in determining digital addiction (Dhanalakshmi et al., 2025; Parhi et al., 2025; Singh et al., 2023). In this study, the data are analyzed using machine learning methods to measure digital addiction among Generation Z. The objective of the study is to classify addiction levels, thereby identifying individuals at risk and establishing the foundation for a decision support process to develop intervention systems.

2. Material and Method

The study utilized a publicly available dataset, entitled the 'Teen Phone Addiction Dataset' (Yadav, 2025). The objective of the present study is to examine the effects of smartphone usage habits among students aged 12-21 across a range of dimensions and to utilize machine learning methodologies to model the correlation between digital addiction and its impact on various domains of functioning, including behavioral, psychological, and academic performance. The total sample size of the data is 3000, comprising

25 attributes. The data has been obtained through the administration of structured surveys over a three-month period in educational institutions located within urban areas. Following the removal of identifying information such as ID and Name from the dataset, the variable named 'Addiction_Level', consisting of 24 attributes, has been determined as the target variable, and all data fields are shown in Table 2.

Table 2. Field names and types of the dataset

Column Name	Data Type	Column Name	Data Type
ID	int64	Depression_Level	int64
Name	object	Self_Esteem	int64
Age	int64	Parental_Control	int64
Gender	object	Screen_Time_Before_Bed	float64
Location	object	Phone_Checks_Per_Day	int64
School_Grade	object	Apps_Used_Daily	int64
Daily_Usage_Hours	float64	Time_on_Social_Media	float64
Sleep_Hours	float64	Time_on_Gaming	float64
Academic_Performance	int64	Time_on_Education	float64
Social_Interactions	int64	Phone_Usage_Purpose	object
Exercise_Hours	float64	Family_Communication	int64
Anxiety_Level	int64	Weekend_Usage_Hours	float64
		Addiction_Level	float64

As demonstrated in Figure 1 the median daily screen time across all age groups was found to be 4.5 hours. The distribution graph demonstrates a positive correlation between screen time and addiction. A significant correlation has been demonstrated between screen time exceeding eight hours and the development of addiction.

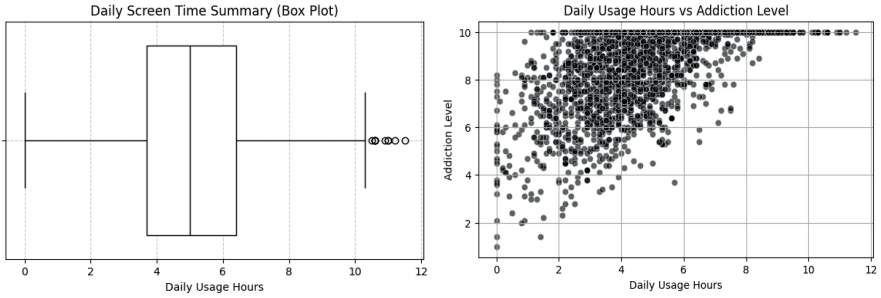

Figure 1. A Correlation Between the Frequency of Daily Usage and the Level of Addiction

A classification model has been developed to predict the digital addiction levels of young individuals in the dataset. The Addiction Level variable has

been categorized into three distinct values: low, medium, and high. In the data preprocessing step, the categorical attributes in the data were converted to numerical values and standardized using StandardScaler. To enhance the generalizability of the data, it has been divided into training and test data at a ratio of 80% and 20%, respectively. In the field of modelling, the success of predictions has been analyzed through the utilization of various metrics, employing four distinct classification algorithms (Logistic Regression, Gradient Boosting, Neural Net (MLP), XGBoost). The outcomes of this analysis have been thoroughly evaluated.

Table 3. Comparative metrics results for the proposed models

Model	Accuracy	Precision	Recall	F1-Score
Logistic Regression	0.99	0.99	0.99	0.99
Gradient Boosting	0.96	0.95	0.96	0.95
Neural Net (MLP)	0.96	0.95	0.96	0.95
XGBoost	0.94	0.94	0.94	0.94

As demonstrated in Table 3, the Logistic Regression model demonstrates superior performance in comparison to alternative models, achieving 99% accuracy and an F1-score. The investigation revealed that the models demonstrated an inability to predict the samples classified as 'Low' in the Addiction Level variable, which contained the smallest number of samples in the dataset. In this instance it has been observed that the Logistic Regression model demonstrated a superior capacity for generalization, despite the presence of an imbalanced dataset.

3. Conclusion

The study demonstrates that four distinct machine learning methodologies can be implemented to model behavioral phenomena in predicting the level of digital addiction among Generation Z. When the modelling prediction results are evaluated alongside similar studies in literature, it is understood that approaches such as machine learning show better prediction performance than other methods. The machine learning models presented in this study demonstrate a high level of success in classifying levels of digital addiction among Generation Z. In particular, the Logistic Regression model demonstrates a significant improvement in similar studies in literature thanks to its high classification accuracy. The findings confirm that data-driven analytical approaches are critical for developing early diagnosis and effective intervention strategies. Considering the prevalence of digital addiction among Generation Z and its associated adverse consequences, data-driven analytical methodologies have emerged as a pivotal instrument

for early diagnosis and the development of effective intervention strategies. These methodologies encompass the interpretation of behavioral data and the creation of decision support systems, such as risk classification, which play a crucial role in identifying and addressing issues promptly. Subsequent studies may concentrate on the practical implementation of the model as mobile applications in real time. However, it is important to acknowledge the limitations of this study. Firstly, participant responses may have been affected by a tendency to seek social acceptance, given that data had been collected through the utilization of structured surveys. Consequently, there is a possibility that the data may not accurately reflect real-world usage habits. Research in relevant literature has shown that real-time usage data collected through smartphone applications measures addiction more accurately than alternative methods based on surveys. Furthermore, it has been observed that the imbalance in the data set has resulted in an insufficient number of sample data points from the "Low Addiction" level for the model to be correctly classified. To surpass the present limitations in future research, it is recommended to apply hybrid datasets that include real-time application data and behavioral indicators. Examples of such indicators include device unlock count and application usage duration, which are also utilized in the literature. Furthermore, rather than focusing only on behavioral metrics, the development of models integrating psychological factors including feelings of social isolation and a need for social acceptance may provide a more comprehensive framework for understanding the fundamental causes of digital addiction. This approach has the advantage of increasing the generalizability of the model, thus creating more effective decision support processes in practical environments, like mobile applications.

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