

# Smartphone Addiction Prediction and Intervention System Using AddictNet and CatBoost

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## Abstract:

Addiction to smartphones is one of the growing issues among all other behavioral and psychological disorders since everyone today uses his or her smartphone not only to make calls but also for studying, entertainment, and social communication. In addition, smartphones affect people's psychology, physical condition, studies, and interaction with others. Thus, research is required in order to develop effective strategies for identifying the patterns of addiction to smartphones. The paper suggests developing a Behavioral Data Analysis-Based Smartphone Addiction Prediction and Intervention System using AddictNet and CatBoost algorithms. Using these two algorithms, the developed system will be able to identify users' level of addiction and offer relevant interventions based on analyzing the following indicators: screen time, applications usage, notifications control, and nocturnal phone use. With the help of the CatBoost algorithm, the system will be capable of predicting the level of addiction by dividing users into Low, Moderate, and High-risk groups. Besides, the system will send warnings, notify parents about problematic phone use by their children, and offer users some recommendations regarding their healthy behavior. The combination of behavioral analysis, machine learning, and interventions will allow timely detecting any potential risks of addiction and preventing them. Moreover, the developed system will provide its users with an online platform where they will be able to monitor and change their smartphone behavior.

**Keywords:** Smartphone Addiction, Behavioral Data Analysis, Machine Learning, CatBoost, AddictNet, Addiction Prediction, Intervention System, Digital Well-Being, Behavioral Analytics.

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## I. INTRODUCTION

Today, smartphones are a key aspect of everyday life which has changed the communication, learning, work processes and access to information. Rapid development of technologies and expansion of internet connections has led to higher levels of smartphones usage among all age groups of population. The high level of advantages provided by smartphones also creates a behavioral issue called smartphone addiction which impacts user's physical state, psychological well-being, academic

performance, work efficiency and interpersonal relationships. With smartphones being used more and more extensively by individuals, the necessity arises to build intelligent systems which will be able to identify and solve the problem of addiction through its early prediction and efficient intervention.

The traditional tools of assessing smartphone addiction rely on the results provided by questionnaires and surveys. These techniques may prove to be helpful yet they are quite subjective and

cannot be considered completely reliable. Recent developments in Machine Learning (ML), Artificial Intelligence (AI) and behavioral data analytics create the possibility for objective assessment and prediction based on the usage data. Analyzing the behavior of the smartphone user by looking at their time on screen, the frequency of app usages, notifications interaction and activity during the night period, one can identify the risks and make predictions about the person's addiction risk.

In order to cope with the problem described above, the author proposes building a Smartphone Addiction Prediction and Intervention System which would implement the use of behavioral data analysis and CatBoost-based AddictNet to determine the level of addiction risk. The use of ML, alert generation and recommendations will promote healthy smartphone usage practices among all age groups.

## **II. LITERATURE SURVEY**

Recent research has emphasized the rise of the research trend in predicting smartphone addiction and analyzing behavior-related data because of the prevalence of mobile phones among users of all ages. According to Kwon et al. (2013), the researchers developed the Smartphone Addiction Scale (SAS), which is one of the most widely used methods for assessing the level of addiction of mobile phone users. Their research shows the link between the overuse of mobile devices and certain psychological conditions such as anxiety, stress, and decreased social engagement. Other researchers continued their work by focusing on finding behavioral markers such as screen time, application use, notifications, and night-time activity.

Recently, significant improvements have been made in terms of predicting smartphone addiction using artificial intelligence and machine learning approaches. Several machine learning algorithms including Decision Trees, Random Forest, Support Vector Machines, and Gradient Boost have been used to classify addiction based on the user's smartphone activity. It has been proved that the

analysis of behavioral data is much more reliable and objective than the traditional assessment conducted through questionnaires. Moreover, the combination of AI, behavioral analysis, and monitoring technology made it possible to develop an intelligent system that is capable of sending alerts and recommending actions to the users.

## **III. BEHAVIOURAL DATA ANALYSIS AND ADDICTION PREDICTION USING ADDICTNET**

Machine learning and behavioral data analysis have proved to be effective tools for discovering smartphone addiction patterns. Nowadays, intelligent algorithms are commonly used for analyzing smartphone usage behaviors, screen time, frequency of using applications, interacting with notifications, and night-time smartphone usage. Traditionally, self-reporting questionnaires have been employed to assess the degree of smartphone addiction. However, they fail to provide objective measurements as people do not always behave in accordance with what they say about their habits. Hence, behavioral data analysis offers a new way to predict smartphone addiction more effectively and reliably.

Smartphone addiction prediction models apply machine learning algorithms to uncover patterns and correlations in behavioral data. In the context of our work, the machine learning framework is implemented through using the proposed CatBoost-based AddictNet algorithm designed for classification of users into three categories (Low, Moderate, and High risks). Machine learning algorithms employ advanced data preprocessing and feature extraction strategies in order to boost prediction accuracy.

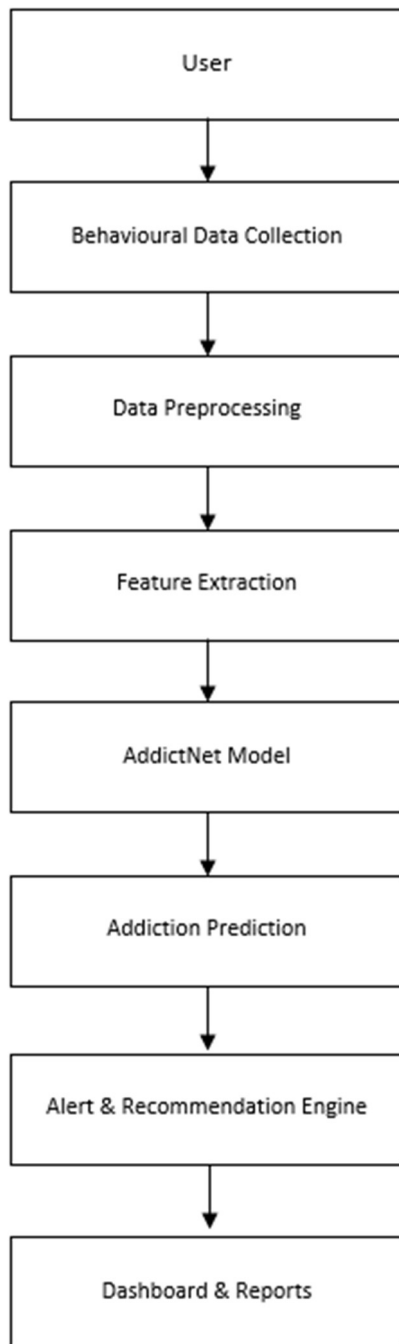


Fig. 1 Architecture diagram

#### IV. TRANSFORMING DIDGITAL WELL-BEING THROUGH SMARTPHONE ADDICTION PREDICTION

Introduction of the Smartphone Addiction Prediction and Intervention System signifies one great milestone in the realm of fostering digital

wellness and technology adoption. Although the utilization of smartphones has enhanced interaction, learning, and entertainment, too much consumption has raised problems concerning health issues, productivity, academic success, and social interactions. The implementation of Behavioral Data Analysis, Machine Learning, and Intelligent Intervention technologies makes it possible to develop a useful means for detecting risks of smartphone addiction and adopting better practices in using these devices.

##### A. Education

The system allows students to track their smartphone activity and recognize addictive behavior early on. Educational organizations can make use of predictions generated from the report to inculcate digital discipline, enhance academic performance, and minimize the impact of mobile phones.

##### B. Healthcare and Mental Well-Being

The healthcare sector is able to employ the findings from addiction predictions to detect people who are prone to suffer from behavioral and mental disorders due to overuse of their smartphones.

##### C. Parental Monitoring

The parents and caregivers can check the level of addiction to the smartphone in their kids and teenagers via alerts, notifications, and reports. Thus, they are able to help them lead a healthy digital life.

##### D. Workplace Productivity

Firms may leverage the power of behavioral analysis to learn about smartphone usage patterns and encourage good digital habits. Lower smartphone addiction levels would lead to improved focus and hence productivity.

##### E. Research and Behavioral Studies

Researchers may use the data generated from behavior and prediction outcomes to analyze the addiction patterns of smart phones, human behavior online, and how technology affects the well-being

of people. This enables the creation of better intervention measures for addiction.

#### ***F. Impact on Society and Digital Lifestyle***

As the use of smartphones increases around the world, intelligent addiction prediction systems will be a helpful way to foster good digital health and promote healthy smartphone use. The early detection of addiction helps users become aware of the potential problems of using smartphones too much.

Furthermore, this system will be useful for helping families, schools, hospitals, etc., understand their patients' or children's behavior. This system is designed to promote good digital behavior, which will ultimately help improve mental well-being, efficiency, interpersonal relationships, and overall well-being.

#### **V. CHALLENGES AND LIMITATIONS**

Despite the effectiveness of the proposed approach, there are various technical, operational, and ethical problems associated with the Smartphone Addiction Prediction and Intervention System. Firstly, the quality and completeness of data on users' behavior can become a significant issue for this application. Unreliable behavioral records can impact the AddictNet model's efficiency, resulting in incorrect predictions of a person's state and potential issues regarding their smartphone usage. Moreover, individual behavior differs depending on people's age, profession, and personal habits; thus, creating a universal prediction algorithm for all users would be difficult.

Secondly, the reliability of prediction results depends largely on machine learning algorithms. While CatBoost allows predicting whether someone has problems with smartphone addiction correctly, it is necessary to retrain the model regularly and update datasets to ensure accurate results. Additionally, the real-time analysis of behavioral information may require more powerful hardware resources than the current system employs.

From an ethical perspective, privacy protection is vital when developing a smartphone addiction

prediction and intervention solution. Behavioral information should be collected and stored safely so that only authorized personnel have access to this information. Users need to feel comfortable using this system and know that their data will not be used maliciously.

#### **VI. FUTURE PERSPECTIVES**

There are many reasons why the predictions regarding future smartphone addiction behavior are looking quite good—developments in Artificial Intelligence, Behavioral Analytics and Mobile Computing technologies are all continuing to improve. As further research continues to be conducted, future intelligent addiction prediction systems should be even more accurate, adaptive, and personalized for those being predicted. Future models may employ behavioral monitoring in real time, use sophisticated deep learning algorithms/models to analyze data against a range of addiction detection metrics, and include context-aware analysis to improve the efficacy of all forms of addiction detection and intervention. There are many other emerging technologies that will enhance the proposed model.

Explainable Artificial Intelligence (XAI) will provide transparent, explainable predictions for users and parents to better understand certain aspects of their potential risk for addiction based on their actual behaviors and corresponding data. Using Federated Learning technologies will further increase security and privacy of users by enabling data modeling to occur without sending user data to centralized locations for model training.

Using wearable devices and a variety of health/environmental monitoring sensors will provide additional behavioral data associated with sleep patterns, levels of stress, and amounts of activity that have been expended through physical exercise. As mobile applications for monitoring addiction behavior, cloud-based analytics, and intelligent recommendation engines will all make monitoring addiction more convenient and effective for users, all future addiction monitoring models may incorporate psychological evaluation data,

social media usage patterns, and personalized intervention strategies into their monitoring systems to provide a comprehensive approach to digital well-being. All of these developments will ultimately lead to a reduction in the number of people who exhibit unhealthy smartphone usage patterns and will provide greater support for those who require addiction prevention services.

## VII. CONCLUSION

The Smartphone Addiction Prediction and Intervention System is a technology designed to solve the growing issue of too much time spent using smartphones. The system uses three technologies to analyze the way people use their smartphones and determine how addicted they are to them: 1) collecting behavioural data about smartphones; 2) utilizing machine learning to create a model of how people use smartphones; and 3) creating a system for assisting in the prevention of smartphone addiction. AddictNet uses the CatBoost machine learning model to conduct the analysis of smartphone behaviours to categorize users into varying levels of risk for becoming addicted to their smartphones. To assist with this process, the system provides real-time alerts, notifications to parents or guardians, and personalized recommendations for responsible smartphone use. By enabling early detection and intervention, this system will improve digital health, create a healthier lifestyle, and help in managing smartphone addiction. These devices demonstrate how artificial intelligence and behavioural analytics can be used together to develop a solution to a real-life problem and support a healthier relationship between people and digital technologies. Over the next several years, future enhancements and developing technologies will allow the Smartphone Addiction and Prevention Prediction and Intervention System to evolve into a complete platform for predicting, monitoring and intervening when a person is becoming addicted to their smartphone.

## ACKNOWLEDGEMENT

The authors express their sincere gratitude to the Department of Master of Computer Applications, Sri Manakula Vinayagar Engineering College, for providing continuous support, guidance, and academic encouragement throughout the development of this research work.

Through valuable conversations with faculty and other experts in the fields of Machine Learning, Artificial Intelligence, Data Analytics, Software Engineering that provided critical information on how to direct the technology portion of this project. The input and recommendations from these experts have helped refine the design of the proposed Smartphone Addiction Prediction and Intervention System and to improve the overall quality and effectiveness of the finished product.

To these experts, the project guide and my faculty mentors (who were invaluable sources of continual motivation, constructive feedback and guidance throughout all parts of this project), I would like to deeply thank each of them for their continued support throughout the course of the development of this research. In addition, I would like to extend my gratitude to the institution and its resources (laboratory, software tools and research environment), as none of this would be possible without the institution's cooperation and support.

Finally, I would like to express my sincere gratitude to my fellow students, friends and colleagues with whom I have worked on this research project for their support, encouragement and many contributions to make this work possible. All of these contributions allowed for the creation of an intelligent system capable of using Behavioral Data Analysis (AddictNet & CatBoost) to predict whether or not someone has a smartphone addiction and, thereby providing timely intervention and personalized recommendations to improve their digital wellness.

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