Comprehensive Analysis of Music Streaming Trends and User Engagement Patterns Using Spotify Data for Insights into Listener Behavior

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ABSTRACT

This project studies user interaction patterns such as app usage, screen on time, and in app activities to find out what makes users satisfied. By analyzing large amounts of data, the framework identifies the most important factors that influence user experience and loyalty. The insights gained help developers create personalized experiences, improve app efficiency, and make data driven decisions to keep users engaged for longer. an intelligent system to classify mobile user behaviour into distinct categories like "Light user", "Moderate user", "Heavy users", "Gamer" and "Social Media Addict".

KEYWORDS: ***Mobile App Analytics, User Behaviour Analysis, Machine Learning, Random Forest, Decision Tree, Support Vector Machine (SVM)***

INTRODUCTION

In today's fast growing mobile app world, knowing how users behave is very important to improve performance, engagement, and retention. In this generation, mobile applications have become an essential part of everyday life, shaping how people connect, learn, shop, and entertain themselves. Every tap, swipe, or click generates valuable data that reflects user behavior and preferences. Understanding this behavior is crucial for developers, not only to attract users. While analysis of user actions reveals patterns that explain why users stay loyal or leave an app. By focusing on behavior based insights, this project aims to help developers improve app performance, deliver personalized experiences, and strengthen user retention in a competitive mobile market. The study leverages data analytics to uncover patterns in user interactions, enabling personalized app experiences and predictive insights.

LITERATURE SURVEY

[1] Recent years I have explored some related papers to Analysing Users Behaviour for Mobile App Optimization. In that I got some limitations. To check papers, I studied recent papers. In the first paper is[1]Used Random Forest and Decision Trees to predict user churn in mobile applications based on usage patterns by Liu, Yang & Zhang (2019) and the [2] Utilized deep learning to classify and interpret user behaviours within mobile applications by Xu, Zhu & Li (2020) and third one is [3] Applied ML techniques to optimize mobile app performance through resource usage prediction and management by Guo, Shen & Zhu (2020).

RELATED WORK

Users's behaviour for Mobile app optimization analysis concentrated on using machine learning approaches to forecast and manage resource utilization in order to optimize the performance of mobile apps. Although these studies demonstrate how machine learning can enhance user experience, they are restricted to particular tasks like resource management or churn prediction.

By combining several models to categorize users into more general groups like Light User, Moderate User, Heavy User, Gamer, and Social Media Addict, our technology expands upon these foundations and makes real-time behavioural prediction and customized app optimization possible.

EXISTING SYSTEM

Predictive capabilities and sophisticated classification methods are absent from current systems. It is challenging to classify users according to their behaviour or predict future usage trends without the application of machine learning algorithms. Instead of proactive optimization, the majority of conventional systems concentrate on historical analysis. The utility of analytical findings is further hindered by a lack of real-time interaction and visualization. the system allows for basic monitoring, it is still ineffective, less scalable.

PROPOSED SYSTEM

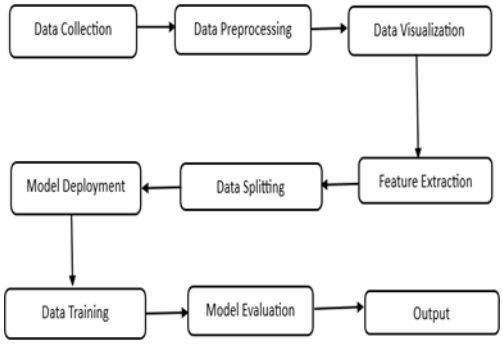

Fig1: Architecture of Analysing users Behaviour for Mobile optimization

using Data Analytics and Machine Learning

By combining data analytics and machine learning approaches to examine mobile user behaviour, the suggested solution seeks to alleviate the shortcomings of the current system. The system uses a Support Vector Machine (SVM) classifier to predict user behaviour categories after processing structured user behaviour data, preprocessing, and feature encoding. It offers a web-based interface that lets users enter behavioural data and get predictions in real time. Developers can better assess user engagement levels and optimize application performance by classifying users into separate behaviour categories. The technology facilitates quicker, more precise, and data-driven decision-making by automating the analysis process.

METHOD DESCRIPTION

Data Collection: Sources include offline datasets (CSV, Excel) and online inputs such as APIs or activity logs. Tools like Pandas and NumPy are used to import, store, and manipulate this raw data.

Data Preprocessing: To create structured datasets of user behaviour, it involves cleaning up missing entries, eliminating duplicates, and standardizing formats. The dataset is guaranteed to be consistent and prepared for analysis by libraries such as Pandas and NumPy.

Data Visualization: To understand user interaction patterns and detect trends. Seaborn and Matplotlib are used to generate plots such as histograms, bar charts, and heatmaps.

Feature Extraction: Label Encoding for categorical variables and One-Hot Encoding for multi-class features.

Data Splitting: Training set is used to train models and Testing set is used to evaluate performance.

Model Training: Load empty ML models. Fit models like Support Vector Machine, Decision Tree, Random Forest using the training dataset only.

Model Serialization: To save trained models for deployment.

Displays prediction: User enters details through the form. Prediction results are displayed like “Light User”, “Heavy User”, “Gamer”, “Social Media Addict”.

RESULTS AND DISCUSSION

Fig2: Web page of Analysing Users Behaviour Data for Mobile app optimization using Data analytics and Machine learning.

It shows the Web page of Analysing Users Behaviour Data for Mobile app optimization using Data analytics and Machine learning. After Click on user Behaviour, it shows the user Behaviour Analysis

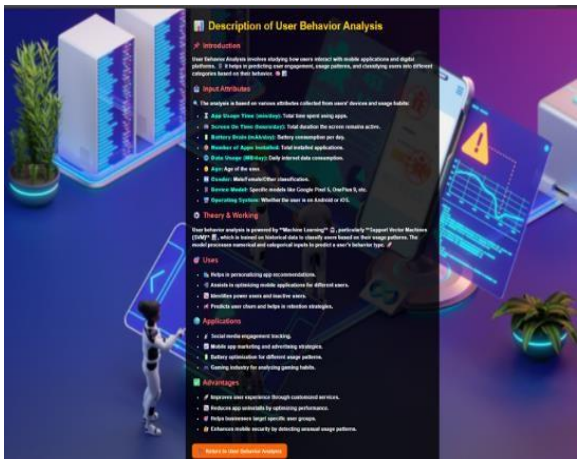

Fig3: Description of the user behaviour Analysis.

Click on the Description of the user behaviour Analysis, it shows the description of this project.

Fig4: Users Behaviour Detection Form

Click on the User Behaviour Detection, it shows a Form which has consist of 5 features like App usage time, Screen on time, Battery Drain, Number of app installs, Data usage, Device Model, Operating System and having the predict button.

Fig5: Users Behaviour Detection Form with user input.

After entering the 5 features from users like App usage time, Screen on time, Battery Drain, Number of app installs, Data usage, Device Model, Operating System then click predict button.

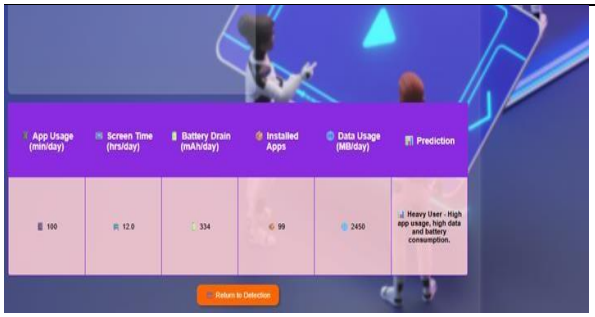

Fig6: Predicts the Users Behaviour Analysis

After Clicking the Predict button it predicts the heavy user and also having light user, social media addict, moderate user and gamer depends on users inputs.

CONCLUSION

A system to categorize mobile user behaviour into different groups, such as "Light User," "Moderate User," "Heavy User," "Gamer," and "Social Media Addict," was successfully built by this project. We obtained high-accuracy results based on crucial digital footprints, like screen time and battery depletion, by training and contrasting SVM, Random Forest, and Decision Tree models. This automated method uses a data-driven framework that analyses 12 essential parameters to find patterns of human usage in place of manual observation. Lastly, these intricate machine learning insights are readily available for real-time behavioural prediction thanks to the integration of a Flask-based web interface.

FUTURE SCOPE

The software may get data straight from the phone by using an automated system, which would speed up the process and reduce typing errors.

The app can act as a helpful coach by providing smart tips and suggestions based on your data to help you balance your day better.

REFERENCE

[1] Harini, D. P. (2013). Two Level Intrusion Detection For Detecting Intruders in Multitier Web Applications. *International Journal of Engineering & Science Research*, *3*, 472-478.

[2] Guo, Shen & Zhu (2020): Applied ML techniques to optimize mobile app performance through resource usage prediction and management.

[3] Liu, Yang & Zhang (2019): Used Random Forest and Decision Trees to predict user churn in mobile applications based on usage patterns.

[4] Kowsari, Meimandi & Brown (2018): Employed Support Vector Machines (SVM) to predict user engagement levels in mobile apps.

[5] Zhao & Wu (2021): Introduced an AI based, data-driven framework for

enhancing mobile app efficiency and user experience.

[6] Xu, Zhu & Li (2020): Utilized deep learning to classify and interpret user behaviours within mobile applications.

[7] Roy & Saha (2019): Discussed current challenges in mobile app user behaviour analytics and highlighted future research directions.

[8] Wang &Sun (2023):ML-driven adaptive UI design for mobile apps.

[9] Patel & Roy (2020): Ensemble learning for mobile app performance optimization.

[10] Gao & Lin (2021): ML models for mobile app crash prediction

[11] Zhang & Chen (2022): Deep learning for mobile health app engagement prediction

[12] Tan & Luo (2020): Context-aware ML models for mobile app recommendation.

[13] Ahmed&Khan (2019): Neural networks for mobile app anomaly detection.

[14] Muthineni (2024): ML-driven mobile AI for UX & security.

[15] Singh & Patel (2020): Hybrid ML models for predicting mobile gaming engagement.

[16] Sharma & Gupta (2021): ML-based sentiment analysis of app reviews to predict churn.