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ANALYSING USER BEHAVIOR DATA FOR MOBILE APP OPTIMIZATION

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ABSTRACT:

In today's competitive mobile app landscape, understanding user behavior is essential for improving performance, engagement, and retention. This research focuses on applying machine learning techniques—Random Forest (RF), Decision Trees (DT), and Support Vector Machines (SVM)—to analyze user interaction patterns within mobile applications. Data from user sessions, in-app activities, and engagement metrics are processed to identify factors driving user satisfaction and churn. Random Forest is used for feature selection and ranking, highlighting the most influential variables. Decision Trees offer interpretable insights into user navigation and behavior paths, while SVM is employed to classify user preferences and predict future actions. The insights gained help developers personalize app experiences, refine UI/UX design, and implement data-driven improvements to enhance user retention.

INTRODUCTION:

In today's dynamic digital era, mobile apps play a pivotal role in how users engage with technology, generating valuable data with every interaction—be it a tap, swipe, or click. As the global mobile app market grows, understanding user behavior has become essential for developers striving to remain competitive. Beyond attracting users, successful apps must also engage and retain them by delivering personalized, seamless experiences. Traditional metrics like downloads, session durations, and retention rates provide only surface-level insights and often overlook deeper

behavioral patterns. While these basic stats may suggest initial success, they fail to reveal whether users remain satisfied or quickly abandon the app. To truly enhance user experience and app performance, developers must move beyond basic analytics and explore more advanced, behavior-focused data insights.

PROBLEM STATEMENT:

In the competitive mobile app market, understanding and predicting user behavior is key to enhancing performance, engagement, and retention. Although vast user interaction data is available, many apps fail to extract meaningful insights due to limitations in traditional analytics. Basic optimization methods often overlook complex behavior patterns, leading to poor user experiences and higher churn. To address this, advanced machine learning techniques—such as Random Forest, Decision Trees, and Support Vector Machines—are needed to analyze user behavior, predict future actions, and guide app design improvements. These approaches enable more personalized, efficient, and user-centric mobile applications.

LITERATURE SURVEY:

The integration of data analytics and machine learning in mobile app optimization has attracted considerable interest from both academia and industry. With mobile applications expanding across various sectors, there is an increasing demand for approaches that go beyond basic metrics to deliver deeper insights into user behavior and preferences. This literature survey explores key research contributions that leverage data-driven techniques to enhance user engagement, retention, app performance, and predictive modeling.

Mobile Application Analytics and User Behaviour

Traditional mobile app analytics have primarily relied on basic metrics such as session duration, usage frequency, and retention rates (Xu et al., 2015). While useful, these metrics offer limited insight into the underlying reasons behind user engagement or churn. Recent research has shifted towards more advanced behavioral analysis, emphasizing the importance of data-driven approaches for effective app optimization.

- **User Interaction Tracking:** Modern analytics emphasize tracking detailed user interactions within apps. For instance, Hassan et al. (2018) analyzed session data to identify usage patterns and critical touchpoints that influence satisfaction and retention. Such insights support the development of features that enhance user flow and experience.
- **Engagement Metrics:** Metrics like Daily Active Users (DAU), Monthly Active Users (MAU), and session length remain common indicators of app success (Zhang et al., 2019). However, these alone often fail to pinpoint specific behavior-related issues, highlighting the need for more granular, machine learning-based analysis techniques.

EXISTING METHOD

Traditional approaches to analyzing customer behavior in mobile apps rely heavily on basic metrics such as downloads, session duration, and user ratings, which offer only limited insights. Many businesses still use manual surveys and feedback forms to understand user needs, but these methods are time-consuming and often lack precision. Basic statistical tools used for engagement tracking fail to uncover deeper behavioral patterns. Customer segmentation is typically based on fixed categories rather than adaptive, data-driven analysis, and marketing strategies often target broad demographics rather than individual

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preferences. Without advanced data mining techniques, identifying high-value users and customizing app experiences remains a challenge. Consequently, these conventional methods fall short in harnessing the full potential of big data for personalization and service optimization.

PROPOSED METHOD:

The proposed method employs machine learning algorithms—Random Forest (RF), Decision Trees (DT), and Support Vector Machines (SVM)—to optimize mobile applications by analyzing user behavior data. Interaction data such as session duration, navigation flows, clicks, and in-app activities is collected via analytics tools and logs. This data is preprocessed through cleaning, normalization, and feature selection to improve model accuracy. RF is used to rank the most influential features affecting user engagement and retention. DT provides clear, interpretable insights into user navigation and app usage patterns, while SVM classifies users based on behavioral trends and predicts potential churn or feature preferences. The model is validated using real-time data to refine UI/UX design, offer personalized experiences, and guide feature development. Additionally, anomaly detection is integrated to identify performance bottlenecks. This AI-driven framework enables informed decision-making, resulting in higher user satisfaction, increased engagement, and improved app efficiency.

SOFTWARE REQUIREMENTS

Operating System : Windows

Version : Python 3.9.1

Programming Language: Python

Development IDE : Jupyter Notebook

HARDWARE REQUIREMENTS

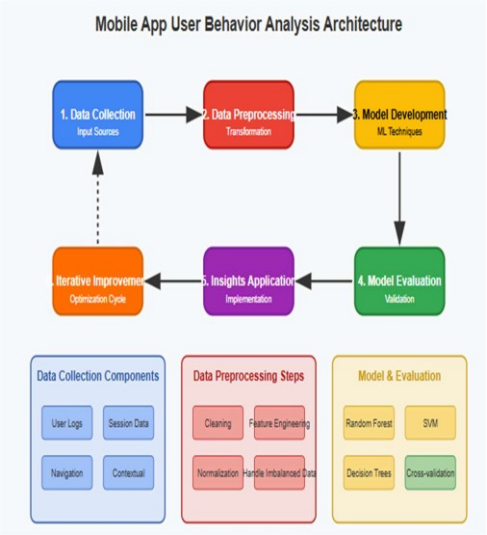
Processor : intel i5

Speed : 1.1 GHz

RAM : 16GB

Hard Disk : 512 GB SSD

SYSTEM ARCHITECTURE



This research follows a structured methodology to analyze user behavior in mobile applications through advanced data analytics and machine learning techniques. The objective is to utilize user interaction data, in-app activities, and engagement metrics to build predictive models that guide app optimization. The process involves key stages: data collection, preprocessing, model development, evaluation, and the application of insights to enhance app performance, user engagement, and retention.

CONCLUSION

In the competitive mobile app ecosystem, understanding user behavior is key to enhancing performance, engagement, and retention. This study applied machine

learning techniques—Random Forest (RF), Decision Trees (DT), and Support Vector Machines (SVM)—to analyze user interaction patterns and identify factors influencing satisfaction and churn. RF effectively ranked the most impactful features on engagement, while DT provided clear insights into user navigation, aiding UI/UX improvements. SVM proved useful in classifying user preferences and predicting future behavior, enabling personalized retention strategies. Additionally, anomaly detection helped uncover and resolve performance issues, contributing to a smoother and more satisfying user experience.

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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 behaviors within mobile applications.
7. **Roy & Saha (2019):** Discussed current challenges in mobile app user behavior analytics and highlighted future research directions.