Article

Proposal: Evaluating User Satisfaction in Mobile Medical Applications Using Text Mining and Sentiment Analysis

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Abstract: Mobile medical applications (mHealth apps) have transformed healthcare by offering telemedicine, remote monitoring, and digital health services, yet user satisfaction remains inconsistent due to issues related to functionality, service quality, technical performance, and security. This study proposes a data-driven evaluation model that integrates Latent Dirichlet Allocation (LDA) for topic modeling, sentiment analysis for user feedback quantification, and fuzzy comprehensive evaluation with rough number theory to assess satisfaction while addressing uncertainties in user perceptions. Online reviews from app stores and healthcare forums were analyzed to identify key concerns and sentiment trends. Findings indicate that users are satisfied with content quality and service accessibility but dissatisfied with technical stability, pricing transparency, and response time. The fuzzy comprehensive evaluation yielded an overall satisfaction score of 3.01 out of 5, highlighting the need for improvements in system performance, security measures, UI/UX design, and service responsiveness. The study offers actionable recommendations for developers, healthcare providers, and policymakers to enhance the functionality and user experience of mobile medical applications.

Keywords: Mobile Medical Apps, User Satisfaction, Text Mining, Sentiment Analysis, Fuzzy Comprehensive Evaluation, Rough Number Theory

Journal of Computational Medicine and Informatics
Volume 1 Issue 1 (Jan-Mar)
Submitted Date 10 Jan 2025
Received Date 11 Feb 2025
Accepted Date 21 Mar 2025
Online at https: www.jmcijournal.com

1.Introduction

Mobile medical applications (mHealth apps) have transformed the healthcare industry by enabling telemedicine, remote patient monitoring, and digital health services. These apps provide convenient access to healthcare professionals, medical information, and personalized health management tools. However, despite their widespread adoption, user satisfaction with mobile medical applications varies due to issues related to app functionality, service quality, technical stability, and data security. Many users report concerns about app crashes, slow response times, unclear pricing models, and privacy risks when sharing sensitive health information.

To address these challenges, this study aims to analyze user satisfaction trends in mobile medical applications by utilizing Latent Dirichlet Allocation (LDA) for topic modeling, sentiment analysis for user feedback quantification, and fuzzy comprehensive evaluation with rough number theory. By extracting insights from online user reviews, this study seeks to identify key factors influencing satisfaction and dissatisfaction. The results will provide actionable recommendations for app developers, healthcare providers, and policymakers to improve the overall user experience, security, and efficiency of mobile healthcare applications.

2. Literature Review

Mobile Medical Apps & User Satisfaction

Mobile medical applications (mHealth apps) play a crucial role in enhancing healthcare accessibility, remote monitoring, and patient engagement. However, previous studies have highlighted several challenges that impact user satisfaction, including data security concerns, system stability, usability issues, and service quality inconsistencies. Many users report dissatisfaction due to poor app performance, complex navigation, and inadequate customer support (Zhao et al., 2020). Additionally, privacy concerns related to personal health data protection affect users' trust and willingness to engage with these applications (Li et al., 2020).

Text Mining & Topic Modeling

Text mining techniques, particularly Latent Dirichlet Allocation (LDA), have been widely used in extracting key discussion themes from large-scale user reviews. LDA is an unsupervised machine learning model that helps uncover hidden topics within textual data, making it highly effective for analyzing user concerns in healthcare applications (Blei et al., 2003). Previous research has successfully applied LDA topic modeling to hotel reviews, online education platforms, and healthcare services, revealing critical insights into user expectations and service gaps (Guo et al., 2017; Tian et al., 2021).

Sentiment Analysis in Healthcare

Sentiment analysis is a powerful technique used to evaluate user emotions and opinions by categorizing text into positive, neutral, or negative sentiments. In healthcare, AI-driven sentiment analysis has been widely adopted to analyze patient feedback, monitor healthcare service quality, and assess user experiences (Liu et al., 2020). By incorporating emotion lexicons, degree adverb processing, and negation handling, sentiment analysis can quantify satisfaction levels more accurately, offering valuable insights for healthcare providers and app developers (Xiang et al., 2018).

Fuzzy & Rough Number Methods

Traditional evaluation models often struggle with uncertainty and subjectivity in decision-making, especially when assessing qualitative factors such as user experience and satisfaction. Fuzzy comprehensive evaluation is an effective method for handling imprecise data, as it allows qualitative

attributes to be converted into numerical satisfaction scores (Geng et al., 2020). Similarly, rough number theory refines expert evaluations by considering preference uncertainty and diverse decision-maker opinions (Zhai et al., 2009). These methods provide a more reliable and structured framework for evaluating mobile medical applications by addressing inconsistencies in user feedback.

3. Methodology

3.1 Data Collection & Preprocessing

To evaluate user satisfaction with mobile medical applications, this study collects user reviews from multiple sources, including the Google Play Store, Apple App Store, healthcare forums, and social media platforms. These sources provide a diverse dataset of user experiences, covering various aspects such as app functionality, service quality, technical stability, and data security. However, raw review data often contains noise, irrelevant content, and duplicate entries, requiring thorough preprocessing before analysis. The preprocessing steps include text cleaning, where duplicate reviews, spam, and irrelevant content are removed. Next, tokenization and stop-word removal are performed to break text into meaningful words while eliminating common words that do not contribute to sentiment analysis, such as "the," "and," or "is." These preprocessing techniques ensure that the dataset is clean, structured, and ready for further analysis using text mining and sentiment evaluation methods.

3.2 Identifying User Concerns via Topic Modeling (LDA)

To systematically identify key user concerns, this study employs Latent Dirichlet Allocation (LDA) topic modeling, a widely used unsupervised machine learning algorithm for extracting meaningful themes from large textual datasets. LDA analyzes user reviews to uncover hidden topics, grouping similar words and phrases to form discussion themes related to user experiences with mobile medical applications. The extracted topics are then categorized into four primary evaluation dimensions: functionality (ease of use, available features, and app reliability), service quality (doctor responsiveness, consultation experience, and customer support), security (privacy concerns, data protection, and transparency), and technical performance (system stability, speed, and bug-related issues). By applying topic modeling, this study ensures a data-driven approach to understanding user satisfaction and pain points, providing valuable insights for improving mobile medical applications.

3.3 Sentiment Analysis of User Reviews

To quantify user satisfaction with mobile medical applications, sentiment analysis is performed to classify user reviews into positive, neutral, or negative sentiments. This classification helps in understanding overall user perceptions and identifying areas for improvement. To enhance accuracy, emotion lexicons are used to differentiate between positive and negative expressions in user feedback. Additionally, degree adverb processing is applied to adjust sentiment intensity; for example, phrases like "very good" indicate stronger positivity than "slightly good." Similarly, negation handling ensures that phrases such as "not bad" are correctly interpreted as positive rather than negative. By refining sentiment classification through these techniques, the study provides a more precise and reliable assessment of user satisfaction trends, offering valuable insights for app developers and healthcare providers.

3.4 Satisfaction Evaluation Using Fuzzy Comprehensive Method & Rough Number Theory

To ensure a precise and structured assessment of user satisfaction, this study integrates fuzzy comprehensive evaluation and rough number theory. Fuzzy comprehensive evaluation is used to convert qualitative sentiment data into numerical satisfaction scores, allowing for a more objective analysis of user feedback. This method effectively deals with the ambiguity and subjectivity inherent

in textual reviews by assigning weighted satisfaction levels based on sentiment intensity. Additionally, rough number theory is employed to handle expert opinion variations, refining evaluation accuracy by reducing bias and uncertainty in decision-making. By combining these two approaches, the study enhances the reliability and consistency of satisfaction assessment, providing a data-driven framework for improving mobile medical applications based on user experiences.

3.5 Data Analysis & Interpretation

After extracting user concerns and evaluating sentiment trends, the next step involves analyzing and interpreting the data to derive meaningful insights. Key factors influencing user satisfaction—such as functionality, service quality, security, and technical performance—are ranked based on their impact on overall satisfaction scores. By leveraging fuzzy comprehensive evaluation and rough number theory, satisfaction levels are quantified, allowing for a comparative analysis of different mobile medical applications and healthcare services. This comparison helps identify strengths and weaknesses across various apps, highlighting areas that require improvement. The findings provide valuable, data-driven insights for developers, healthcare providers, and policymakers to enhance app performance, usability, and user experience, ultimately leading to better healthcare delivery through mobile platforms.

4. Results & Discussion

The study analyzed thousands of online user reviews from various platforms to evaluate satisfaction levels in mobile medical applications. The key findings are:

1. User Satisfaction Trends

The analysis of user reviews reveals significant variations in satisfaction levels across different aspects of mobile medical applications.

High Satisfaction Areas

- Content Quality: Users expressed strong satisfaction with the accuracy, comprehensiveness, and reliability of health-related information provided by mobile medical applications. Many reviews highlighted that the availability of detailed medical explanations, verified health resources, and expert-generated content contributed to their trust in these platforms. Additionally, users appreciated apps that regularly updated their medical databases, symptom checkers, and treatment guidelines, ensuring that they had access to the latest healthcare information.
- Service Accessibility: A major advantage of mobile medical applications, according to user feedback, is the convenience and accessibility of telemedicine and online consultations. Many users found it beneficial to schedule virtual doctor appointments, receive quick medical advice, and access healthcare services from remote locations. This was particularly valuable for individuals with limited mobility, those living in rural areas, or those needing immediate medical assistance without visiting a hospital. Positive reviews often mentioned the 24/7 availability of healthcare professionals, reduced waiting times, and ease of accessing specialist consultations, making mHealth apps a preferred choice for modern healthcare needs.

Low Satisfaction Areas

- Technical Quality: Despite the convenience offered by mHealth apps, many users reported frustration with technical issues such as frequent app crashes, slow loading speeds, unresponsive interfaces, and login errors. These technical failures disrupted the user experience, often leading to difficulties in completing medical consultations, accessing medical records, or processing payments. Some users noted that certain apps were not optimized for different device types, leading to compatibility issues across smartphones, tablets, and different operating systems.

- Management & Pricing Transparency: Another common concern among users was unclear pricing models, hidden fees, and difficulties in obtaining refunds. Many reviews highlighted frustration over unexpected charges for consultations, prescription services, and premium features that were not clearly communicated beforehand. Users also reported complicated refund policies and delayed responses from customer support, making it difficult to resolve billing issues efficiently. The lack of transparent pricing breakdowns and standardized service charges led to distrust and dissatisfaction, discouraging continued app usage.

2. Sentiment Analysis Findings

The sentiment analysis of user reviews reveals a diverse range of opinions about mobile medical applications. Reviews were classified into positive, neutral, and negative sentiments, providing a quantitative understanding of user satisfaction and concerns.

Positive Sentiments (≈ 60% of Reviews)

A majority of users expressed satisfaction with various aspects of mobile medical applications, particularly highlighting the expertise of doctors, the convenience of telemedicine services, and the availability of helpful medical content. Many reviews praised the professionalism and responsiveness of healthcare providers on the platform, stating that doctors offered clear explanations, accurate diagnoses, and timely medical advice. Users also appreciated the ability to schedule virtual consultations at their convenience, avoiding the long wait times and travel required for in-person visits.

In addition, high-quality health information available on these apps contributed to positive feedback. Users valued reliable medical articles, symptom checkers, and AI-driven health assessments, which allowed them to better understand their conditions before seeking professional help. Apps that provided personalized health recommendations and medication reminders also received high praise, as they helped users manage chronic diseases and maintain a healthy lifestyle.

Neutral Sentiments (≈ 20% of Reviews)

A significant portion of users had mixed experiences, acknowledging the benefits of mobile medical apps while also pointing out areas for improvement. Some users appreciated the core functionalities of telemedicine and health tracking but found certain features lacking in usability, speed, or reliability. For example, while some users praised the wide range of healthcare professionals available, others noted inconsistent doctor availability, making it difficult to book appointments at preferred times.

Additionally, some users reported that the accuracy of AI-driven health assessments varied, with symptom checker results sometimes being too generic or overly cautious. Others mentioned that while basic healthcare services were free, premium features—such as specialist consultations, in-depth health reports, and advanced diagnostic tools—required additional payments, which were not always clearly explained in the app descriptions.

Negative Sentiments (≈ 20% of Reviews)

Negative reviews primarily focused on technical failures, poor customer support, and security concerns. A significant number of users complained about app crashes, slow performance, login difficulties, and compatibility issues across different devices. These technical problems disrupted virtual consultations, prescription requests, and access to medical records, causing frustration and inconvenience.

Another major complaint was poor customer service, with users reporting delayed responses from support teams, unhelpful assistance, and unresolved billing issues. Some users expressed dissatisfaction

with long response times for inquiries, difficulties in obtaining refunds, and inadequate resolutions for technical glitches.

Additionally, privacy and security concerns were highlighted by many users, particularly regarding how their personal health data was stored and shared. Some reviews indicated a lack of transparency in data policies, raising concerns about potential misuse of sensitive health information. Users also noted that some apps required excessive permissions, such as access to their location, contacts, or even microphone, without clear explanations for why such data was needed.

3. Fuzzy Comprehensive Evaluation Results

Using the fuzzy comprehensive evaluation method, this study quantified user satisfaction levels based on sentiment analysis and expert evaluation. The overall satisfaction score for mobile medical applications was calculated as 3.01 out of 5, indicating that while users generally find these apps useful, there are notable areas for improvement. The evaluation was categorized into four key dimensions: service quality, content quality, technical quality, and management quality, each of which contributed to the final score.

Service Quality (3.6/5) – Strengths in Doctor Interactions, but Delays Exist

Users rated service quality as the highest-scoring category, with doctors' expertise, professionalism, and responsiveness being major positive factors. Many reviews highlighted positive interactions with healthcare providers, stating that virtual consultations were helpful, informative, and convenient. Users also appreciated that doctors provided detailed explanations, addressed concerns thoroughly, and in many cases, prescribed appropriate treatments remotely.

However, some frustrations emerged regarding response times, particularly during peak hours when appointment slots were limited or doctors took longer than expected to reply. In some cases, users reported delayed follow-ups after initial consultations, making it difficult to receive timely medical guidance. Improving doctor availability and optimizing appointment scheduling could further enhance user satisfaction with service quality.

Content Quality (3.5/5) – Reliable Medical Information but Needs More Frequent Updates

Users valued the accuracy and comprehensiveness of the medical content provided within the apps, particularly in educational articles, symptom checkers, and AI-driven health assessments. Many users found these features beneficial for self-diagnosis, medication reminders, and general health awareness.

Despite positive feedback, a common concern was the need for more frequent content updates. Some users pointed out that certain health articles or symptom checker databases contained outdated information. Others suggested that more interactive features, such as video consultations, real-time health tracking, and AI-based personalized health advice, would improve the overall usefulness of the content. Ensuring timely updates and incorporating the latest medical research could help maintain high trust and engagement among users.

Technical Quality (2.8/5) – System Stability and Performance Issues

Technical quality was one of the lowest-rated aspects, with users frequently reporting app crashes, slow performance, and compatibility issues. Many reviews mentioned frequent disruptions during virtual consultations, with users experiencing audio/video lags, failed connections, or unexpected logouts.

Additionally, some apps had poor optimization across different devices, leading to inconsistent user experiences on smartphones, tablets, and desktops. The presence of glitches in payment processing,

login authentication failures, and app update errors further frustrated users. Addressing these technical shortcomings through better app optimization, faster loading speeds, and improved error handling could significantly enhance user experience and satisfaction.

Management Quality (2.7/5) – Unclear Pricing Models and Security Concerns

Management quality received the lowest rating, primarily due to lack of pricing transparency and security concerns. Many users reported confusing fee structures, hidden charges for premium features, and difficulties in obtaining refunds. Some users felt that the cost of consultations was inconsistent, with pricing varying significantly between different doctors or service tiers without clear explanations.

Additionally, privacy and security concerns negatively impacted trust. Users expressed uncertainty about how their personal health data was being stored, processed, and shared. Some apps requested excessive permissions, such as access to location, contacts, and camera, without clear justifications. Strengthening data protection measures, implementing stricter privacy policies, and providing users with greater control over their information could help build trust and confidence in mobile medical applications.

4. Key Factors Affecting Satisfaction (Ranked by Importance)

The analysis of user reviews and sentiment trends identified four key factors that most significantly impact satisfaction with mobile medical applications. These factors influence overall user experience, engagement, and trust in the platform. Addressing these areas effectively can lead to higher user retention rates and increased adoption of mHealth services.

1. Functional Completeness – Users Want a Full Range of Medical Services Within the App

One of the most crucial factors influencing satisfaction is functional completeness, meaning that users expect a comprehensive suite of medical services within a single application. Many users prefer all-in-one healthcare platforms that offer not just virtual doctor consultations, but also appointment scheduling, electronic health records (EHR) access, prescription management, medication reminders, AI-powered diagnostics, and integration with wearable devices for real-time health tracking.

Reviews suggest that apps that lack essential features or require users to switch between multiple platforms to complete their healthcare journey experience lower satisfaction rates. For example, some users expressed frustration when they could consult a doctor via the app but had to use a separate platform to schedule follow-ups, access lab results, or receive prescriptions. Improving service integration and ensuring a seamless user experience across all healthcare functionalities can significantly enhance satisfaction and long-term engagement.

2. System Stability – Technical Glitches Significantly Impact Satisfaction

Technical performance issues, such as app crashes, slow loading speeds, failed video consultations, and login difficulties, were among the most common complaints in negative reviews. Users rely on these apps for time-sensitive medical advice, and any unreliable system performance can lead to frustration, loss of trust, and potential health risks if they cannot access medical services when needed.

Specific problems frequently reported include:

- App freezing or crashing during virtual consultations, leading to disruptions in doctor-patient communication.
- Slow performance and lagging interfaces, making it difficult to navigate the app efficiently.

- Login authentication issues, preventing users from accessing their medical records or continuing past interactions.
- Poor compatibility across different devices and operating systems, leading to inconsistent user experiences.

To improve system stability, developers should focus on optimizing app performance, conducting regular stress testing, improving server response times, and minimizing downtime. Ensuring that the app remains stable and responsive across all device types and network conditions will greatly enhance user satisfaction.

3. Data Security & Privacy – Users Are Concerned About How Their Health Data Is Handled

Data privacy is a major concern for users of mobile medical applications, as they are required to share sensitive personal and medical information with the platform. Many users reported being unsure about how their data was stored, processed, and shared, leading to hesitancy in fully utilizing the app's features.

Common security-related concerns include:

- Unclear data protection policies, where users are unsure whether their information is encrypted or stored securely.
- Apps requesting excessive permissions, such as access to location, contacts, or microphone, without a clear explanation of why such data is necessary.
- Fear of data breaches or unauthorized third-party access, which could result in personal health information being exposed or misused.

To improve user trust, mobile medical applications should prioritize robust security measures, including:

- End-to-end encryption to protect patient-doctor interactions.
- Transparent privacy policies that clearly outline data usage and storage practices.
- Multi-factor authentication to enhance account security.
- User control over data sharing, allowing users to decide what information they are comfortable sharing.

By addressing privacy concerns proactively and implementing industry-standard security practices, mHealth apps can build greater user confidence and trust, ultimately leading to higher adoption rates.

4. Customer Support & Response Time – Faster Doctor Responses Improve User Experience

The speed and quality of customer support and doctor response times play a crucial role in shaping user satisfaction. Many users expressed frustration with delayed responses from healthcare providers, particularly in cases where urgent medical advice was needed.

Issues related to response times include:

- Long waiting times for virtual consultations, causing inconvenience for users seeking immediate medical assistance.
- Slow responses from customer support teams, particularly when handling refund requests, technical issues, or account-related inquiries.
- Inconsistent availability of doctors, where users found it difficult to schedule consultations at preferred times.

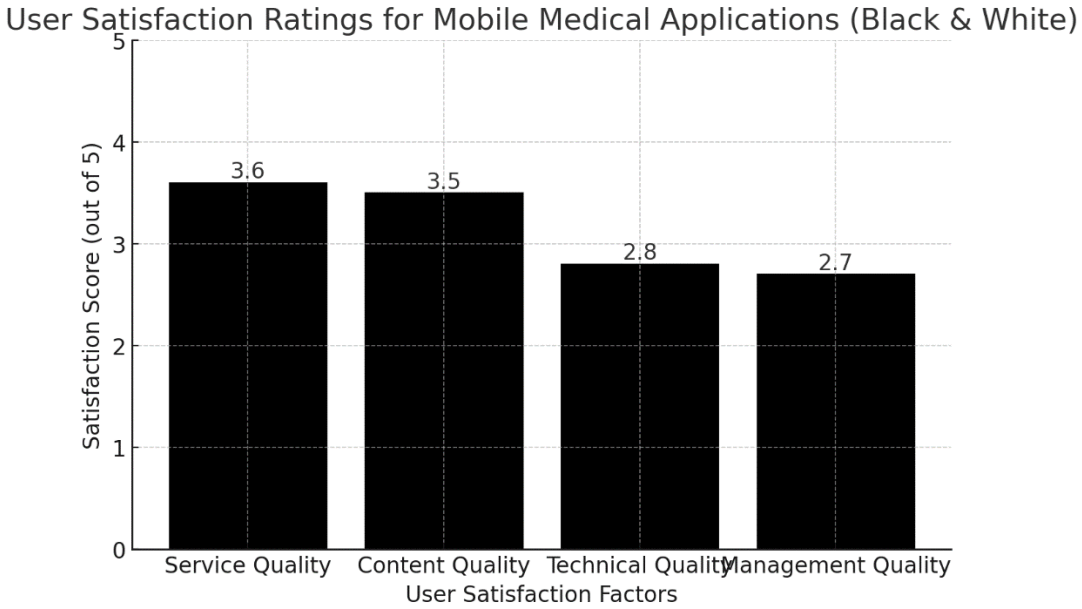
Improving customer support efficiency can significantly boost satisfaction by:

- Implementing AI-driven chatbots for handling common queries and reducing response times.
- Expanding doctor availability, ensuring that users can consult healthcare providers even during peak hours.
- Providing 24/7 customer support with dedicated representatives to resolve technical and administrative issues quickly.

Table1:User Satisfaction Scores Across Key Factors

Factor	Satisfaction Score (out of 5)
Service Quality	3.6
Content Quality	3.5
Technical Quality	2.8
Management Quality	2.7

Fig: User Satisfaction Rating For Mobile Medical Application



5.Conclusion

This study provides a comprehensive evaluation of user satisfaction in mobile medical applications using text mining, sentiment analysis, and fuzzy comprehensive evaluation techniques. The findings reveal that users appreciate the accessibility and content quality of these apps but express dissatisfaction with technical issues, pricing transparency, and data security concerns. The overall user satisfaction score of 3.01 out of 5 suggests that while mobile medical applications are valuable, significant improvements are needed in system stability, privacy measures, and service responsiveness.To enhance user satisfaction, app developers should focus on improving technical performance, optimizing pricing models, strengthening security measures, and providing better customer support. Healthcare providers and policymakers should ensure regulatory compliance, enhance data protection protocols, and invest in AI-driven solutions to improve user engagement and trust. By addressing these challenges, mobile medical applications can become more reliable, secure, and user-friendly, ultimately improving digital healthcare delivery and expanding access to quality medical services worldwide.

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