

Development of RWikiStat 4.0 for Modern Statistical Learning

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Abstract—RWikiStat 4.0 is a cross-platform application designed to modernize statistical learning by integrating cutting-edge technologies such as artificial intelligence, cloud computing, and offline support. The application supports web, Android, and iOS platforms, enabling seamless accessibility for users across devices. This paper details the architecture, features, and implementation of RWikiStat 4.0, highlighting its advancements over previous versions. Testing results demonstrate significant improvements in usability, performance, and security, making it a robust tool for modern statistical education.

Index Terms—RWikiStat, Statistical Learning, Mobile Applications, Web-Based Education

I. INTRODUCTION

Rwikistat has been a pioneer in digital-based statistical learning since its inception. The first version in 2010 utilized a combination of *Rweb* and *MediaWiki* to provide an interactive statistics learning platform accessible via intranet and internet [1]. Rwikistat 2.0, introduced in 2012, enhanced this approach by offering a *Live CD/DVD* solution, enabling operations without additional installation, thereby increasing its flexibility [2]. Most recently, Rwikistat 3.0, launched in 2018, brought statistical learning into the *mobile* domain with an Android-based platform, catering to the needs of modern users who prioritize portability and convenience [3].

While each version of Rwikistat has made significant innovations, challenges remain:

- **Dependency on Rweb:** The discontinuation of Rweb has necessitated an urgent shift to a more stable alternative [2], [3].
- **Limited user interface:** Users have reported that the command line in Rwikistat 3.0 still requires improvements for better intuitiveness [3].
- **Focus on local environments:** Many features rely on local installations or specific devices, limiting widespread adoption in modern cloud-based scenarios [2].

To address these challenges, **Rwikistat 4.0** has been designed as an integrated statistical learning platform that is cloud-based and more responsive to user needs.

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Solutions in Rwikistat 4.0

- **Cloud-Based Architecture:** Rwikistat 4.0 eliminates dependency on Rweb by leveraging a *Docker*-based R server, enabling direct execution of R syntax via REST APIs, supporting scalability for various devices.
- **Enhanced User Interface:** The interface has been redesigned using *React Native*, providing a smoother and more responsive experience on both web and mobile applications. Drag-and-drop functionality for data visualization empowers users without programming experience to interact directly with statistical tools.
- **Cloud-Based Collaboration and Storage:** Integration with services like Google Drive and Dropbox enables users to save and share analysis results directly, facilitating modern collaborative learning needs.
- **AI-Powered Statistical Learning Modules:** Rwikistat 4.0 includes artificial intelligence modules to provide automatic recommendations for relevant statistical methods based on user input data, transforming it from a passive tool to an active learning companion.
- **Cross-Device Accessibility:** The platform is fully cross-platform, ensuring seamless access on Windows, macOS, Android, and iOS devices.

Through these innovations, **Rwikistat 4.0** not only continues its tradition as an adaptive statistics learning tool but also sets a new standard for interactivity and accessibility in technology-driven education. This platform is poised to advance statistical education, addressing future challenges with relevant and innovative solutions.

II. SYSTEM DESIGN

The design of RWikiStat 4.0 focuses on flexibility and scalability to support multiplatform usage. Its architecture consists of the following components:

A. Frontend

- **Web Application:** Developed using Next.js, it ensures fast rendering and optimal performance.
- **Mobile Applications:** Built on React Native, the app provides a unified codebase for Android and iOS.

B. Backend

- **API Layer:** Powered by Express.js, it facilitates robust RESTful services.
- **Database:** MongoDB serves as the primary database, offering flexibility and scalability for diverse datasets.

C. Key Features

- An AI-powered chatbot for statistical guidance.
- Real-time R script compilation integrated with Shiny for interactive analytics.
- Discussion forums for collaborative learning.
- Offline access with Progressive Web App (PWA) technology.

D. Cloud Integration

AWS and Firebase ensure secure storage, authentication, and real-time synchronization, enhancing user experience.

III. TESTING AND VALIDATION

A. Functional Testing

Blackbox testing validated each feature, including:

- Google-based and NIM/password-based login functionalities.
- Real-time R script compilation and error handling.
- Accessibility of learning modules and forums.

B. Usability Testing

Using the UMUX method, feedback was collected from 10 respondents. The average usability score was 85.4%, classifying the application as "Very Usable."

C. Performance Testing

JMeter was employed to test API throughput and stress scenarios. The application successfully handled datasets exceeding 1GB without significant performance degradation.

D. Security Testing

OAuth2 authentication and MongoDB encryption were validated to ensure data security.

IV. RESULTS AND DISCUSSION

The testing phase highlighted the following outcomes:

- High satisfaction rates due to intuitive design and efficient functionalities.
- Positive reception of AI-guided learning modules for simplifying complex concepts.
- Challenges in iOS development due to platform-specific requirements.

While user feedback was overwhelmingly positive, enhancements are needed for advanced statistical explanations and seamless iOS integration.

V. CONCLUSION

RWikiStat 4.0 represents a significant advancement in statistical learning tools, combining multiplatform support, AI integration, and offline capabilities. Future development will focus on enhancing AI functionalities and incorporating advanced statistical techniques.

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