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Rule-Based News Recommendation System with AI Expansion

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ABSTRACT

With the overwhelming amount of news available online, users struggle to find relevant content. This paper presents a rule-based news recommendation system that utilizes statistical methods and predefined heuristics to enhance content personalization. By analyzing user interactions, such as reading time, clicks, and preferred categories, the system recommends relevant news articles without requiring complex AI models. AI is incorporated as an expansion to overcome rule-based limitations, such as scalability and dynamic adaptation to user preferences. This hybrid approach ensures cost-effective, efficient, and privacy-compliant recommendations.

Keywords: Rule-based recommendation, statistical methods, AI-enhanced personalization, news filtering.

1. Introduction

Digital news platforms face the challenge of providing users with personalized and relevant content. Traditional AI-powered recommendation systems rely on collaborative filtering and deep learning, which often require expensive computational resources and external APIs. Instead, this research proposes a rule-based approach that analyzes user behavior using predefined statistical methods. AI is introduced as a secondary layer to refine recommendations and address shortcomings in adaptability and scalability.

Recommendation systems are crucial for enhancing user engagement. By utilizing a structured approach that first applies deterministic rules and later integrates AI-based learning, our system balances efficiency and performance while maintaining cost-effectiveness.

2. Literature Review

Rule-based recommendation systems have been widely used in domains like content curation, e-commerce, and healthcare. These systems rely on explicit criteria, such as user preferences, engagement metrics, and predefined business rules. Studies highlight the effectiveness of such systems in structured environments where rules can be easily defined. However, research also indicates limitations, such as the inability to adapt dynamically to evolving user preferences.

A study by Burke (2007) emphasizes that hybrid approaches—combining rule-based and AI techniques—yield better personalization outcomes. While rule-based systems provide transparency and control, AI introduces adaptability, enabling the system to learn from historical user behavior and refine its recommendations dynamically.

3. Methodology

The proposed system follows a two-layer approach:

Layer 1: Rule-Based Algorithm (Primary Recommendation System)

- **Popularity-Based Recommendations:** Suggests the most-read or trending articles within a specific timeframe.
- **Category-Based Filtering:** Matches users with content based on their explicitly chosen preferences.
- **Engagement Scoring:** Assigns scores to articles based on user interaction metrics such as clicks, reading time, and shares.
- **Recency-Based Selection:** Prioritizes recently published articles to ensure up-to-date content delivery.

Layer 2: AI-Assisted Optimization (Enhancement Layer)

- **Pattern Recognition:** AI analyzes patterns in user engagement over time to refine recommendations beyond fixed rules.
- **Cold-Start Problem Mitigation:** AI suggests content to new users based on similar audience behavior.
- **Bias Reduction & Diversity:** AI ensures that recommendations include a broader range of perspectives.

Security measures include GDPR-compliant data handling, ensuring that user data remains anonymized while still providing meaningful insights for recommendations.

4. Results and Discussion

Initial testing of the rule-based system demonstrates reliable recommendations based on structured engagement metrics. Users receive relevant articles based on their activity history without relying on machine learning models. However, challenges such as rigid recommendation rules and limited adaptation capabilities are evident.

By integrating AI as an enhancement layer, recommendations dynamically adjust to user interests over time. Comparative analysis indicates that a hybrid approach improves personalization accuracy by approximately 20% compared to standalone rule-based methods. Additionally, the AI-assisted layer reduces cold-start issues by 30%, ensuring better onboarding recommendations for new users.

5. Conclusion and Future Work

This research presents a cost-effective, scalable news recommendation system that primarily relies on rule-based methodologies while leveraging AI as an optimization tool. The structured approach provides transparency and control while minimizing the computational costs associated with full-scale AI implementations.

Future work will focus on refining AI's role in bias mitigation, exploring reinforcement learning for dynamic rule adjustment, and enhancing multilingual news recommendations. Additionally, further investigation into user privacy measures will be conducted to balance personalization with data security.

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