The Challenges, Strategies, and Roles of Database Technology in the Big Data Era: A Case Study of the Push System in E-Commerce

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Abstract: In the era of big data, live e-commerce has seen explosive growth, putting pressure on instant and tailored advertising. This research aims to refine ad systems, focusing on delivering ads promptly and accurately to improve user experience and increase platform revenue. The study uncovers that processing extensive data can hinder the speed of ad delivery, which can negatively impact user satisfaction and, consequently, sales. To address this, e-commerce platforms are in need of more accurate recommendation systems to facilitate personalized ads, which depend on a thorough analysis of consumer behavior. There exists a challenge where existing algorithms may not fully comprehend or anticipate user needs, leading to a misalignment between the ads served and the actual interests of users. In the context of increasingly stringent data protection laws, it is imperative for ad systems to manage user data with greater care and legality, thereby ensuring compliance with regulations and safeguarding user privacy.

1   INTRODUCTION

Big data is widespread today. Live e-commerce boosts consumer spending. It personalizes shopping. Live e-commerce enhances the buying experience. It makes purchases engaging. It makes purchases immediate. Yet, as the user base and product assortment expand, the advertising mechanisms of these platforms are under pressure to maintain responsiveness and enhance the precision of their recommendations. By establishing a database security guarantee system and optimising the method of user access to the database, the real-time and accuracy of advertisement push can be effectively improved, and the effect of personalised recommendation can be enhanced(Feng, Yang, Li, Y, 2021).

These optimisation measures include the use of technical means, management mechanisms, and audit trails to ensure security and compliance with data collection and processing.Feng Wenlu et al. discussed how traditional media can be transformed through the live e-commerce mode, and proposed the driving forces for the development of media live e-commerce, including the accelerated layout of

Internet platforms, the shift in user demand under the digital survival mode, the promotion of relevant regulations, and the in-depth integration of media.These factors have pushed the growth of the live e-commerce industry, creating new platforms and user bases for ad push(Feng, Yang, and Li, 2021).Feng Qinqun proposed that in the context of big data, a database security protection system should be established to improve the external environment of the database system, apply technical means, implement the management mechanism, strengthen the audit trail and comprehensively back up the data. This is a meaningful way for live e-commerce platforms to ensure data security and user privacy protection when dealing with massive amounts of user data(Feng,2013).Tang Tao proposes a method of optimising the user access database of the live e-commerce platform based on big data, screening the goods frame number images corresponding to the time of the live video through the link of the recommended goods on the user access to the live video, extracting the content features in the enhanced image of the goods frame number, comparing and screening the various content features corresponding to the needs of the user access to the goods, and arranging them in sequence. This method helps

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improve the ad push effect of the live e-commerce platform, and enhances the user experience and conversion rate by optimising how users access the database(Tang, 2020).

In addition, database technology is improving data processing capabilities through distributed processing and real-time analysis in the live e-commerce industry to meet the challenges of massive user interactions and product data. However, how to achieve in-depth access to data while protecting user privacy and improving the accuracy and real-time performance of personalised recommendations remain major problems for researchers. Live e-commerce platforms need to optimise their database systems to support more efficient ad push and user behaviour analysis while observing data security (He, 2024).

Against this background, this study proposes an optimisation strategy for personalised ad push on live e-commerce platforms based on existing theories and patents. Adopting the literature review method, this study thoroughly analyses the optimisation strategy of personalised ad push system for live e-commerce platforms. It explores the key role of database technology in processing massive user data, improving the effect of ad push, and protecting data security. This paper not only aims to improve the real-time and accuracy of ad push, but also devotes itself to achieving more accurate personalised recommendation by deeply accessing user data under the premise of complying with data security regulations. The meaning of this study is that it can not only provide theoretical support for the ad revenue of live e-commerce platforms but also discuss how to provide a more personalised and high-quality user experience under the premise of protecting user privacy, with the development of the live e-commerce industry(He, 2024).

2 THE ROLE OF DATABASES IN AD PUSH

2.1 Database Principles

A database is a computer software system that organises, stores, manages and retrieves massive data. It is not only a simple data storage warehouse, but a complex system that ensures data integrity, security and efficient access. Live online shopping relies on databases. Databases store customer profiles, product catalogs, and transaction histories. They keep the platform running well and help user interactions.

Databases solve data management challenges before computers, filing cabinets and card indexes stored and retrieved information. These methods became inefficient with more data.

Databases use data models and database management systems (DBMS). Data models show data structure and connections with tables. DBMS has tools for creating, querying, changing, and deleting data. It also protects data, ensures security, manages access, and helps recover data. In live e-commerce, databases process consumer behavior data quickly. This helps make personalized recommendations and place ads strategically.

2.2 The Role of Databases in Ad Push

Database technology is very important in live online shopping. Tang Tao says using databases can improve how users interact with products in live streams. This makes ads more personalized and enjoyable. It does this by looking closely at product images and studying how users interact with items.

Feng Qinqun says protecting databases is crucial. This means improving the database environment, using advanced strategies, managing it well, tracking activity, and backing up data. These steps help keep databases secure, stop unauthorized access, and keep data reliable and accessible(Feng, 2013).

At first, in live online commerce, databases store basic data like customer messages, product info, and sales records. They help manage user accounts, handle orders, and offer searches. As live e-commerce grows, databases now work closely with key parts of the business, like live shows, user chats, and product suggestions.For example, by analyzing user interaction data during live broadcasts in real time, the database can support a personalized recommendation system that pushes users with products they may be interested in. By analyzing users' browsing, purchasing and interaction data, a detailed user profile is constructed for personalized recommendation. Intelligent product recommendations are implemented using user profiles and behavioral data to improve user satisfaction and conversion rates. Optimize advertisement placement strategy and improve advertisement effect by analyzing user data in real time. Supported the rapid processing of online transactions, including order creation, payment processing, and logistics tracking. Provide data support for platform operations and help merchants and platforms make smarter business decisions.

According to Min Li, database advertising design plays a role in storing and analyzing the design

elements of advertising language to help build an effective advertising communication strategy. The database can store information such as the title, content, and promissory nature of advertisements, and by analyzing this information, it can help advertisers understand which advertising languages are more likely to stimulate consumers' desire to buy, thus realizing the effective push of advertisements(Li, 2021).

Huang Rui says databases collect data on what users do online, like clicking, browsing, and interacting. This data helps analyze users' habits and likes. Marketers use these analyses to find and group their target audiences. They make ads that fit these groups' needs, making the ads more appealing and effective(Huang, 2023.

Live streaming commerce platforms use big data to understand their users better. They want to target ads more accurately. Tang Tao says by looking at how users watch live streams, ads can be made more relevant. This means finding what products users like and matching ads to those preferences. Tengfei Gao and others say databases are key for personalizing ads. They keep track of users' past actions, like ads they clicked and things they bought. By studying this data, ad platforms learn users' likes and guess what they might want in the future. This leads to personalized and effective ad suggestions(Gao,and Qu 2023).

3 DATABASE OPTIMIZATION TECHNIQUES

3.1 Technology Examples

In live e-commerce, better database technology helps make user experience better and ad delivery more efficient. Feng Qinqun's research shows that making good indexes, like B-trees, hash tables, or full-text indexes, can greatly speed up how fast data is found. This is very important when there's lots of data to handle(Feng, 2013).In addition, Yuan Yuan He in his essay emphasized the importance of query optimization, which can reduce unnecessary data accesses and computations by analyzing and rewriting SQL queries, thus improving the efficiency of database operations(He, 2024).

In live e-commerce, the application of database optimization techniques is not limited to improving query speed and optimizing query statements. Ying Wu discusses the application of real-time data analytics in live e-commerce in her research. With ClickHouse database (which provides high-performance data analytics and supports fast querying and processing of hundreds of millions of data) processing user interaction data, such as likes, comments, and shares, in real time, the database is able to quickly update the user profiles and achieve more accurate ad targeting. At the same time, Yao Ge mentioned in his article that for frequently accessed advertising content, the use of caching technology can reduce the reading pressure on the database and improve the system's response speed, which is especially important for the fast-changing advertising content on live e-commerce platforms (Wu, 2024; Yao, et al., 2023).

3.2 Optimization Recommendations

In the future development of live e-commerce ad push, advances in database technology will be key. First, to meet the challenge of data privacy protection, databases should adopt more stringent security measures and privacy-preserving algorithms, such as differential privacy and homomorphic encryption, to ensure the security of user data during analysis and use. Ad content personalization and compliance need databases to quickly update and adjust ad strategies. They must follow different region and platform rules. This might mean creating better algorithms to find and block non-compliant ads. Databases must also adapt quickly to changing rules, data structure, and search criteria.

Handling data from many platforms requires databases good at combining different data sets. Solutions might include making a standard data model. They might also involve systems for regular data sync and sharing across platforms. This ensures a consistent ad experience for users on any platform. It also means databases need strong data transfer and change tools, moving data smoothly between systems and platforms.

Using cloud-native databases and microservices can improve live e-commerce data management. It makes the ad system handle more traffic, reducing costs. Smart database tools, like auto index tuning and query analysis, improve ad delivery's effectiveness and accuracy.

For this progress, industry cooperation and setting common standards are key.Providers of database solutions, online marketplaces, and regulatory bodies must collaborate to formulate consistent data protocols and interoperability guidelines. This facilitates the seamless exchange and consolidation of data across various platforms.Through these practical measures, live e-commerce ad push systems will be able to better serve users while protecting user

privacy and improving ad compliance and effectiveness.

4 CONCLUSIONS

The research in this paper focuses on the optimization strategy of personalized ad push system for live e-commerce platform. The research adopts the method of literature review, by analyzing the existing theories and patents, and combining with several papers in related fields, it discusses the challenges faced by live e-commerce in the context of big data, and how to improve the real-time, accuracy and user experience of ad push through the application and optimization of database technology.

It was found that the ad push system of live e-commerce platforms faces problems with insufficient real-time performance and poor recommendation accuracy when dealing with massive user data. To solve these problems, the study proposes a series of optimization strategies. First, a database security guarantee system is established by improving the external environment of the database system, applying technical means, implementing management mechanisms, strengthening audit trails and comprehensively backing up data to ensure data security and user privacy protection. Second, an optimization method of user access database for live e-commerce platform based on big data is proposed to improve the personalization level and user experience of ad push by screening and extracting the content features in the images of product frames and users' behavioral data when they access the products.Moreover, the research underscores the pivotal role that database technology plays in the live e-commerce sector, which encompasses not only the preservation and handling of fundamental data like customer details, merchandise descriptions, and sales histories, but also the facilitation of tailored recommendation algorithms and the enhancement of advertising delivery strategies.

Looking ahead, live commerce platforms are expected to refine their database infrastructure to enhance ad delivery efficiency and consumer behavior analysis while adhering to stringent data protection guidelines. This will involve implementing more robust security protocols and privacy-preserving data processing techniques, creating smart algorithms that can identify and filter out inappropriate ad content automatically, and setting up systems that facilitate the synchronization and exchange of data across different platforms. Concurrently, embracing cloud-based databases and

microservices design will offer greater adaptability and scalability in data management for live commerce. As technology continues to evolve, this research is poised to offer innovative approaches and strategies for personalized ad targeting, contributing to the sustainable growth of the live e-commerce sector.

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