Analysis of Accelerating the Application of New Technologies in Broadcasting and Television Cable Networks - Postprint

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Abstract

In the context of ongoing supply-side structural reforms, China' s cable television network industry currently places considerable emphasis on informatization construction. Nevertheless, in terms of business processing efficiency, application service innovation, and network operation management, certain deficiencies persist, and user needs have not been adequately met. The effective utilization of various emerging technologies constitutes precisely an effective means to address these shortcomings. Accordingly, this paper analyzes the value of new technologies in cable television networks and explores the specific applications of emerging technologies such as artificial intelligence and big data in this domain, with the aim of promoting the sustained and stable development of the cable television network industry.

Full Text

Accelerating the Application of New Technologies in Radio and Television Cable Networks: An Analysis

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Abstract: Against the backdrop of continuous advancement in supply-side structural reform, China' s radio and television cable network industry, despite its emphasis on information technology development, still exhibits certain deficiencies in operational efficiency, application service innovation, and network operation management, failing to fully satisfy user demands. The effective application of various emerging technologies precisely serves as an effective means

to address these shortcomings. Based on this analysis, this paper examines the value of new technologies in radio and television cable networks and explores the specific applications of emerging technologies such as artificial intelligence and big data in these networks, aiming to promote the sustained and stable development of the radio and television cable network industry.

Keywords: Radio and television cable network; supply-side structural reform; information technology development; artificial intelligence; big data

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1.1 Strengthening Network Operation Management

As the primary transmission channel for radio and television media programs, radio and television cable networks have exhibited new development trends such as bidirectional and broadband capabilities, which can effectively enhance operational capabilities and video/audio dissemination capacity. However, the difficulty of operation and management remains relatively high. The effective application of various emerging technologies can precisely improve the operational management level of radio and television cable networks, providing important support for the effective completion of various operation and management tasks. For instance, in equipment management, the operation of radio and television cable networks relies on various hardware devices such as satellite receivers and video servers. Malfunctions in any of these devices can significantly impact the normal operation of the network. By applying advanced technologies such as big data and sensors, real-time monitoring of hardware devices can be achieved, with collection and analysis of equipment operation data to determine performance indicators. Once abnormal performance indicators are detected, targeted fault prediction and inspection can be immediately conducted, effectively eliminating potential equipment failure risks and ensuring continuous, stable operation of hardware devices.[1] In terms of network security, big data and system vulnerability detection technologies can be utilized for network performance monitoring and security risk screening, with timely warnings issued upon discovering network information security vulnerabilities to prevent leakage of private information such as user authentication data.

1.2 Optimizing User Service Experience

In response to the diverse service demands of radio and television network users, the application of various emerging technologies by radio and television cable network enterprises can also achieve effective improvement in overall service levels, fully satisfying user needs while delivering a better service experience. For example, with the support of big data technology, radio and television media can conduct detailed classification of user groups and clearly identify the preferences and needs of different user segments, enabling the provision of more targeted personalized services. Meanwhile, regarding user churn issues, user behavior and activity levels across different periods can be monitored and analyzed to obtain relevant user churn data, helping to identify the primary causes of user attrition and pinpoint deficiencies and problems in various services, thereby providing support for service improvement and user retention efforts.

2.1 Application of Artificial Intelligence Technology

2.1.1 Intelligent Distribution and Transmission During the operation of radio and television cable networks, the distribution and transmission of digital content often prove challenging due to significant differences in information resource demands among users and the highly diverse video, audio, and other information resources currently available from radio and television media. The flexible application of artificial intelligence technology can precisely enable intelligent distribution and transmission of digital content and network resources, significantly improving the efficiency of radio and television cable networks while avoiding waste of bandwidth and hardware resources. For example, in network resource allocation, since the network resources available to radio and television cable networks are relatively limited, occupying excessive resources for digital content transmission to some users can easily lead to insufficient available resources, directly affecting other users' access to digital content.[2] To address this issue, radio and television cable network enterprises can preprocess network resource-related data through data mining, data cleaning, and other technologies to grasp real-time availability of network resources. Subsequently, based on artificial intelligence technology, network resources can be intelligently allocated according to user demands to improve the alignment between user needs and resource allocation. This approach both satisfies users' digital content acquisition needs by allocating sufficient resources for transmission and avoids waste from excessive resource occupation. Regarding digital content distribution, deep learning AI technology can be utilized to analyze user access data in radio and television networks, enabling the system to establish models for hotspot prediction, regional preferences, and content popularity, thereby gaining deeper understanding of digital content demands across different regions. Based on regional user demands, the system can distribute and transmit corresponding digital content to nodes closer to users, and once users complete relevant operations, directly finalize transmission from node to terminal, achieving effective improvement in overall digital content distribution efficiency and

resolving issues such as network latency and insufficient bandwidth resources.[3]

2.1.2 Intelligent Terminal Interaction As society continues to evolve, many radio and television network users are no longer satisfied with human-computer interaction methods dominated by terminal buttons and remote controls, instead hoping to control television sets and other terminals through more convenient interaction methods such as voice commands and gesture instructions. This innovation in intelligent terminal interaction also relies on the application of artificial intelligence technology. Taking voice recognition-based terminal interaction as an example, radio and television cable network enterprises typically need to utilize AI speech recognition technology to develop intelligent terminal devices with voice recognition capabilities, and then install such devices in television sets and other terminals. This enables terminals to accurately identify voice commands issued by users (such as power on/off) and complete corresponding control operations according to the instructions. This not only provides considerable convenience for users in terminal control but also delivers a better human-computer interaction service experience.[4] Additionally, from the perspective of user viewing experience, radio and television cable network enterprises can also apply AI image recognition technology to video playback. By using intelligent devices on television terminals to accurately assess ambient lighting conditions, video image content, and scenes, video image quality can be intelligently adjusted based on this information. Consequently, even when video image content and lighting conditions vary significantly, optimal image presentation effects can still be achieved, substantially enhancing users' video viewing experience.

2.1.3 Intelligent Application Services During the construction and development of radio and television cable networks, artificial intelligence technology can also be effectively applied in the application services domain, providing support for personalized service innovation and improved viewership data. For example, in business innovation, since user demands in radio and television networks are characterized by diversity, radio and television cable network companies can not only extensively collect user data to understand their needs but also identify potential demanders for various new value-added services from the vast user base based on service innovations targeted at user needs. This enables targeted deployment and promotion of value-added services to enhance marketing effectiveness and achieve effective innovation in profit models.[5] In program production, AI technology can be utilized to intelligently analyze data such as program on-demand volumes, ratings, and live program online viewer numbers to determine program popularity and artist influence. This provides important references for radio and television media in program type selection, production, and guest artist selection, leading to continuous improvement in program viewership data and audience satisfaction.

2.2 Application of Big Data Technology

2.2.1 Production and Operation Analysis Although the application of big data technology in traditional media fields has become quite common, from the perspective of radio and television cable network development, big data technology applications remain primarily concentrated in production and operations, providing support for data sharing, user demand analysis, service innovation, and operational management decision-making. For example, when available resources and data differ across regions, various radio and television cable network companies typically utilize big data technology for omnimedia data operations, establishing unified comprehensive omnimedia data platforms that connect with different companies' operation management systems to conduct cross-terminal, cross-network data operation management.[6] This enables real-time sharing of data resources in daily operations even when data collection, storage, and transmission standards vary among different radio and television cable network companies, thereby providing users with richer and more diverse digital content. Meanwhile, since radio and television network users are primarily household-based, and different families exhibit significant variations in digital content demands, usage time, and usage habits, radio and television cable network companies can also use big data technology to extensively collect and analyze relevant data on user habits, usage time, and viewing content. By creating individual profiles for each user, accurate user classification can be achieved, distinguishing user groups with different needs and habits. For different user categories, companies can employ relevant algorithms in big data technology to predict user interests, digital content demands, and service requirements. Based on relatively accurate prediction results, they can then complete page and button embedding, and reasonably adjust the functions, layout, content recommendations, operation processes, and interaction methods of human-computer interfaces to accommodate users' personalized needs and usage habits. Although current personalized service innovation based on big data technology remains imperfect, and radio and television cable network companies often struggle to determine user habits and interests from limited data, continuous acquisition of user behavior data over time still allows for ongoing optimization and correction of data analysis results, thereby improving analytical accuracy and providing important references for operational management decisions.[7]

2.2.2 User Service Optimization For radio and television cable network companies, big data technology not only supports user demand analysis but also enables accurate assessment of specific user behaviors, providing important references for radio and television program production and broadcasting decisions. Taking television program scheduling as an example, companies can typically collect user behavior data from set-top box logs at television terminals, establishing data on user session duration, usage time slots, geographic regions, and usage habit types. After classifying this data by region and usage time slots, they can identify the primary viewing periods and durations of key audience groups for television programs. Based on these critical viewing periods of tar-

get audiences, broadcast schedules can be reasonably adjusted to accommodate main audience viewing habits, thereby further improving program ratings.[8] Additionally, from the perspective of user service needs, radio and television cable network companies can also apply big data technology to user activity analysis and retention efforts. By analyzing user behavior data, they can assess the activity levels of different users, upgrade services for highly active loyal customers to enhance their satisfaction with the radio and television network, or implement various retention measures for less active users. For instance, when user activity declines to a certain threshold (which should be determined based on actual conditions), companies can examine the user' s payment status, terminal usage information, and other data to determine the reasons for decreased activity. They can then implement targeted retention measures such as payment reminders, overdue notices, on-site installation/removal services, or payment discounts, striving to maximize user activity levels to the greatest extent possible.

2.3 Application of Cloud Computing Technology

2.3.1 Front-end Data Management In the information age, the development of radio and television cable networks inevitably faces network security issues. Particularly with the extensive application of big data technology, various data and information resources such as user behavior data, authorization information, and program information are highly susceptible to leakage and loss. To ensure the security of this data, the application of cloud computing technology can be employed. Generally speaking, since cloud computing data management centers exhibit extremely high reliability and security, radio and television cable network companies only need to develop highly fortified cloud servers based on cloud computing technology and use them as front-end servers to replace traditional hardware servers. This enables secure storage of various highly confidential data and information, while network information security issues such as hacker attacks and computer virus propagation can be effectively controlled.

2.3.2 Front-end Server Upgrading In the early stages of radio and television cable network development, set-top boxes and other terminal devices exhibited significant brand and regional variations with obvious compatibility deficiencies. Consequently, whether expanding set-top box hard drive capacity, updating value-added services, or upgrading key device functions, all had to be accomplished through terminal device replacement. This not only substantially increased the operational management costs of radio and television cable networks but also created additional workload for companies, which was highly detrimental to network development. With the support of cloud computing technology, radio and television cable network companies can fully leverage the advantages of cloud servers in computing and storage capabilities by transferring most terminal device functions to front-end servers. These front-end servers can then handle functional upgrades, value-added service updates, program content

storage, and other business operations, reducing the need for terminal device replacements and supporting cost control and workload reduction in radio and television cable network operational management.

2.3.3 Promoting Triple Network Convergence Through the application of cloud computing technology, radio and television cable network companies can further advance triple network convergence, using cloud servers to provide users with various digital content and making services for end users more diversified. For example, when users are watching television programs via television terminals and need to temporarily go out, they can log into relevant network platforms using smartphones, after which front-end cloud servers can continue providing relevant digital content based on user accounts, enabling them to continue playing previous television programs on their smartphones. In summary, the development of radio and television cable networks cannot be separated from the support of emerging technologies. However, for radio and television cable network companies to effectively apply emerging technologies such as big data, cloud computing, and artificial intelligence, they must still adopt appropriate technology application strategies in areas including terminal interaction innovation, user service optimization, production and operation analysis, and front-end data management.

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Note: Figure translations are in progress. See original paper for figures.