Big data technology provides technical support for the considerable development of broadcasting postprint

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Abstract

This paper presents the concept and characteristics of big data technology and its significant importance to broadcasting media, introduces the construction methods of big data technology management platforms and the key technologies employed, and explores the principles of big data technology and the security issues encountered by big data. Combining the practical work of radio stations, it elaborates in detail on the role of big data technology in improving the quality of broadcast program production, conducting precise audience rating surveys, expanding information acquisition channels, and fulfilling the functions of mainstream media.

Full Text

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1.1 Characteristics of Big Data

Big data is characterized by the five V's: massive volume, high velocity, diverse variety, low value density, and questionable veracity. These characteristics present significant challenges for data storage, processing, analysis, and visualization. In the broadcasting industry, the application scenarios for big data are extensive, ranging from audience behavior analysis and content recommendation to advertising placement and market forecasting. To address these challenges, technologies such as Hadoop and Spark have emerged for distributed storage and computing, while data mining and machine learning algorithms enable deep analysis and knowledge extraction from vast datasets. The complexity

and real-time requirements of broadcasting data necessitate robust technical architectures capable of handling high concurrency and low-latency processing. Furthermore, the value of big data lies not merely in its scale but in the actionable insights that can be derived through proper analysis, ultimately driving informed decision-making and business innovation in broadcast media.

1.3 Building a Big Data Technology Management Platform

Constructing a comprehensive big data technology management platform requires a layered architecture encompassing data collection, storage, processing, analysis, and application tiers. The platform must support real-time data ingestion from multiple sources, including broadcast signals, online streaming, social media, and user interactions. Distributed storage systems provide scalable repositories for both structured and unstructured data, while parallel processing frameworks enable efficient computation across massive datasets. The analysis layer integrates statistical modeling, machine learning, and artificial intelligence to uncover patterns and trends, and the application layer delivers these insights through visualization tools and decision-support systems. For broadcasters, such a platform serves as the technical foundation for transforming raw data into strategic assets, facilitating everything from content production optimization to audience engagement enhancement.

1.2 Key Big Data Technologies

The big data technology stack comprises several critical components: data collection and integration tools that aggregate information from disparate sources; preprocessing and cleaning modules that ensure data quality; distributed file systems like HDFS that provide reliable storage; parallel computing frameworks such as MapReduce and Spark that enable large-scale processing; data mining and machine learning libraries that support predictive analytics; and visualization platforms that make complex data accessible to decision-makers. Additionally, security technologies including encryption, access control, and audit mechanisms are essential for protecting sensitive information. In broadcasting, these technologies work in concert to process viewer data, analyze program performance, optimize scheduling, and personalize content delivery, thereby creating a data-driven ecosystem that enhances both operational efficiency and audience satisfaction.

1.4 Principles of Big Data Technology

The fundamental principle of big data technology is to extract maximum value from data assets through distributed processing and intelligent analysis. This involves moving beyond traditional sampling methods to analyze entire populations, embracing data heterogeneity, and prioritizing correlation over causation in certain contexts. The technology stack must be designed for horizontal scalability, fault tolerance, and flexibility to accommodate evolving business requirements.

2.2 Big Data Enables Broadcast Media to Obtain More Precise Information

Big data analytics revolutionizes how broadcast media understand their audiences by enabling granular, real-time measurement of viewer behavior and preferences. Traditional ratings systems relied on small sample panels, but big data captures actual consumption patterns across entire populations through set-top boxes, streaming platforms, and mobile applications. This precision allows broadcasters to create detailed user profiles, segment audiences with high accuracy, and tailor content to specific demographic and psychographic groups. Moreover, real-time feedback mechanisms enable dynamic programming adjustments, while predictive models forecast audience response to new content. Advertising becomes more targeted and effective when based on comprehensive viewer data, and content creators can optimize programs based on empirical evidence rather than intuition alone.

2.3 Big Data Helps Broadcast Media Play Their Role and Increases Media Asset Value

Big data technologies empower broadcast media to maximize the value of their content assets through intelligent management and multi-platform distribution. By analyzing usage patterns and performance metrics across channels, broadcasters can optimize content libraries, identify underutilized assets, and develop strategies for repurposing and syndication. Data-driven insights facilitate the creation of derivative products and value-added services, extending the revenue lifecycle of media assets. Furthermore, big data supports the integration of broadcast, online, and mobile platforms, creating seamless cross-media experiences that enhance audience engagement. This convergence enables innovative business models, such as programmatic advertising and subscription-based personalization, while ensuring that content reaches the right audience through the most effective channels at optimal times.

1.5 Big Data Security Issues

The proliferation of big data in broadcasting raises critical security and privacy concerns that require comprehensive safeguards. Broadcasters must implement robust encryption protocols for data in transit and at rest, establish strict access control mechanisms based on role-based permissions, and deploy intrusion detection systems to monitor for unauthorized access. Privacy protection is paramount when handling viewer data, necessitating compliance with data protection regulations and the adoption of anonymization techniques where appropriate. Security management frameworks should encompass risk assessment, incident response planning, and regular audits to ensure continuous protection of valuable data assets. As broadcasters increasingly rely on cloud services and third-party analytics platforms, vendor security assessments and data governance policies become essential components of a holistic security strategy.

3. Conclusion

In conclusion, big data technology has become an indispensable driver of transformation in the broadcasting industry, enabling unprecedented levels of audience insight, operational efficiency, and business innovation. The integration of advanced analytics, machine learning, and real-time processing capabilities allows broadcasters to navigate the complexities of modern media consumption and compete effectively in a digital-first landscape. While challenges related to data security, privacy, and technical implementation remain, the strategic adoption of big data solutions positions broadcast media to unlock new value propositions and sustain long-term growth. Future development should focus on enhancing data quality, fostering cross-platform integration, and cultivating data-centric organizational cultures that embrace evidence-based decision-making.

2.1 Big Data Provides Data Support for Accurate Ratings Survey

Big data fundamentally enhances the accuracy and granularity of audience measurement by replacing traditional sample-based surveys with comprehensive, real-time data collection from multiple touchpoints. Modern broadcast ecosystems generate vast amounts of viewership data through digital set-top boxes, OTT platforms, and mobile applications, capturing actual consumption behavior rather than recalled responses. This multi-source integration enables precise measurement of audience size, composition, and engagement levels, while also revealing viewing patterns, content preferences, and drop-off points. Broadcasters can leverage these insights to make informed programming decisions, optimize scheduling strategies, and demonstrate value to advertisers with concrete metrics. The shift from periodic ratings to continuous measurement represents a paradigm shift that empowers broadcasters to respond swiftly to audience needs and market dynamics.

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