Exploration of Approaches for Applying Artificial Intelligence Technology to Radio and Television Program Supervision: Postprint

Authors: Bai Yuewen

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Abstract

Contemporary society has fully entered the 5G era of rapid information technology development, wherein public demand for programs and information is exhibiting a trend toward diversification. The radio and television industry has begun actively accommodating shifts in audience demand, leading to increasingly rich program content and formats, which in turn has further escalated the workload and difficulty of radio and television program supervision. Against this backdrop, radio and television program supervision urgently requires technological innovation, and artificial intelligence can undoubtedly effectively meet these supervision needs, enabling intelligent supervision of radio and television programs and comprehensively enhancing supervision efficiency and quality. Accordingly, this article provides an overview of artificial intelligence technology, analyzes relevant technologies for applying artificial intelligence in radio and television program supervision, and finally proposes several practical measures for such applications, for readers' reference and consideration.

Full Text

1. Overview of Artificial Intelligence and Its Role in Broadcast Television Program Supervision

1.1 Overview of Artificial Intelligence

Artificial intelligence is primarily a discipline that integrates various intelligent science and technologies, including integrated intelligence, artificial intelligence, and natural intelligence, with AI technology at its core. To define AI, we must first understand "intelligence," which encompasses learning and adaptation capabilities, thinking and memory abilities, and perceptual capacities. The definition of AI can be discussed from two perspectives: capability and discipline. From a capability standpoint, AI refers to achieving intelligence in machines through

artificial methods, also known as machine intelligence [2]. From a disciplinary perspective, AI is the field of study concerned with building intelligent systems and intelligent machines that simulate and extend human intelligence.

1.2 The Role of AI in Broadcast Television Program Supervision

1.2.1 Driving Innovation and Development in the Broadcast Television Industry The application of AI technology to broadcast television program supervision is not confined to the supervision domain alone. As AI technology matures and its application in the broadcast television industry deepens, it can be adapted to more areas within the industry, thereby effectively driving technological innovation and development [3]. On one hand, the in-depth application of AI technology enables model construction based on content algorithms, gradually promoting technological innovation in broadcast television program production. The industry can advance toward model-based program production and value judgment, further improving production efficiency through technological reform and innovation. On the other hand, with the support of AI technology, broadcast television can accelerate the processing efficiency of various information data, including audio and video, achieving frame-based retrieval, analysis, mining, and application of information materials. This drives program production toward systematization, intelligence, and integration, ultimately establishing a comprehensive technical application system that enhances broadcast communication efficiency [4]. Looking at future development trends, broadcast television programs are no longer limited to television and network terminals but can integrate software and hardware to create more diverse formats and more realistic experiences based on smart glasses, VR devices, and AR devices.

1.2.2 Promoting Collaborative Resource Building and Sharing in Broadcast Television The in-depth application of AI technology can further break down internal barriers within the broadcast television industry and promote collaborative resource building and sharing. Firsthand information resources and cutting-edge content resources are undoubtedly fundamental to broadcast television program quality, especially in the 5G era of rapid information technology development, where data has become a crucial foundation for broadcast media to produce programs, compete in the market, and gain competitive advantages [5]. Essentially, with the application of AI technology, competition among broadcast media focuses on information data acquisition, content processing, platform construction, and program generation. Whether a broadcast media organization can obtain high-quality information data directly affects final program quality. However, in the vast sea of information resources, a single broadcast media organization' s resources are clearly limited, and these resources often suffer from an "information cocoon" effect. To enhance the overall competitiveness of the broadcast television industry, promoting collaborative information resource building and sharing becomes paramount. Yet, how to share these resources, which ones should be prioritized, and how

to use them after sharing have become urgent issues to address. Obviously, in modern society with information explosion, such resource exchange cannot be fully realized through manual means, and manual implementation is highly inefficient. AI technology must be relied upon to achieve efficient information exchange and utilization, which has given rise to AI editing rooms. Based on current AI technology applications, future AI editing rooms (or "AI editing units") will replace humans in handling many primary and basic news information positions, while broadcast media organizations can use AI technology to accomplish collaborative resource building and sharing, with the entire process achieving automation and intelligence.

2. Analysis of AI Technologies Applicable to Broadcast Television Program Supervision

2.1 Intelligent Recognition Technology

Intelligent recognition technology primarily uses AI patterns to identify and judge required information content from data, especially when facing current massive amounts of knowledge or information, where identification and judgment cannot be accomplished without technical support. Current intelligent recognition technology development mainly includes intelligent recognition in speech content and image content domains. From the perspective of research trends, current focuses are concentrated on deep learning and content recognition technologies, which have been widely applied in various models for video, speech, and image processing, such as Long Short-Term Memory networks (LSTM), Recurrent Neural Networks (RNN), Convolutional Neural Networks (CNN), and Hidden Markov Models (HMM) [6]. For broadcast television program supervision, intelligent recognition technology can be effectively applied to intelligent auditing, intelligent retrieval, advertising monitoring, and intelligent cataloging.

2.2 Intelligent Systems

Intelligent systems refer to software and hardware systems equipped with intelligent functions and characteristics. Much of the research content involved in AI is basically demonstrated through intelligent systems, such as intelligent retrieval systems, intelligent control systems, and intelligent manufacturing systems [7]. Currently, typical intelligent systems mainly include expert systems and intelligent decision support systems. Expert systems are intelligent systems that integrate various knowledge domains, presenting experts' experiences from different fields through knowledge-based methods, incorporating them into knowledge bases, and then conducting analysis. Intelligent decision support systems are developed based on traditional decision support systems, with additional intelligent components added to construct decision support systems that also encompass expert system technology and decision support system functionality.

2.3 Machine Learning

As the core technology of AI, machine learning refers to machines automatically acquiring new knowledge and continuously improving their functions based on the ongoing refinement of knowledge structures. Machine learning itself includes various classification methods; for instance, based on methods that simulate human learning, it can be divided into neural learning, symbolic learning, etc. From the perspective of broadcast television program supervision, machine vision and deep learning are both central components. Deep learning, as the most widely applied technique in the machine learning field, includes Bayesian algorithms, clustering algorithms, artificial neural network algorithms, etc. The application of machine vision enables computers to possess comprehensive capabilities similar to humans in proposing, analyzing, processing, and understanding information. In recent years, with the further development of deep learning technology and the continuous application of diverse methods such as algorithmic processing, preprocessing, and feature extraction, increasingly sophisticated AI algorithms have gradually taken shape.

3. Practical Exploration of AI Application in Broadcast Television Program Supervision

3.1 Architecture of Broadcast Television Program Supervision System

With the continuous development of the broadcast television industry, the types and content of programs have become increasingly diverse, leading to substantial growth in both the workload and difficulty of program supervision. Therefore, the primary task in applying AI technology is to construct a broadcast television program supervision system. Based on current AI technology development trends, a supervision system architecture as shown in Figure 1 [Figure 1: see original paper] can be established. The system is built on a cloud computing platform that comprehensively provides standardized network resources, computing resources, and storage resources, with supervision content divided into zones including audit management, storage, news program analysis, and advertising monitoring. By comprehensively utilizing AI technologies such as intelligent retrieval and intelligent recognition, the system can conduct full-scale supervision of covered broadcast television programs. It can intelligently retrieve information related to illegal advertisements, public service advertisements, and commercial advertisements, dynamically monitor broadcast television programs, and promptly issue warnings or take action when abnormalities are detected [8]. Simultaneously, the system can also conduct dynamic supervision of specific program content, immediately identifying sensitive content and key sensitive figures in television programs, achieving the goal of comprehensive supervision coverage throughout the entire broadcast television program process.

3.2 Processing Flow of Broadcast Television Program Supervision

Based on streaming media, broadcast television programs can be directly distributed, enabling management, auditing, discovery, and recognition of these programs during the process. The specific supervision workflow is shown in Figure 2 [Figure 2: see original paper]. The system front-end regularly collects EPG data from various broadcast television programs. If new EPG data is added, the system can automatically save it; if changes occur, the system can also automatically update them. Based on streaming media, audio program streams can be retrieved in real-time and sent to the supervision system, which can directly support the configuration of channel recognition tasks and violation events, including parameters such as violation levels, sensitive figures, and sensitive keywords. Corresponding recognition tasks are then dispatched to the recognition engine for analysis. The recognition engine can adjust the time to preset points according to task requirements, conduct video recognition, and automatically upload recognition results. If violation information is detected, the system can also upload corresponding warning messages during this process. Upon obtaining recognition results, the system directly displays them and incorporates them into the database, providing diverse functions for later retrieval, including video retrieval, audio retrieval, text retrieval, and image retrieval.

3.3 AI Deep Learning Analysis Database Solution

To further enhance the efficiency of broadcast television program supervision, it is necessary to integrate an AI deep learning analysis database into the system to conduct comprehensive analysis of various reported alarm messages. Through continuous supervision and analysis, the analytical capabilities of the AI deep learning analysis database can be comprehensively improved. At present, broadcast television program supervision requires massive information data capture, which must undergo processes such as data cleaning, sorting, and consistency verification before being integrated into the cloud computing platform [9]. Meanwhile, the information content involved in broadcast television program supervision is extremely complex, encompassing not only traditional broadcast television programs but also diversified program information. Various types of information, images, audio, and video all require supervision, though their usable value density is relatively low. In the future, efforts can be made to effectively integrate big data technology, cloud computing, and AI to improve the efficiency of information data screening.

3.4 AI Deep Learning Inference Solution

The AI deep learning inference engine is also a crucial technology for applying AI to broadcast television program supervision. It primarily analyzes basic alarms by referencing information organized in the monitoring and supervision knowledge base, ultimately deriving comprehensive alarm results. The AI deep learning inference engine can process multi-level monitoring and supervision alarm information from the system, including alarms related to audio-video,

channels, and code streams. It can correlate the above alarm information and simultaneously aggregate relational data in real-time to understand the causes of alarms, laying the foundation for intelligent system processing [10]. In this way, the AI deep learning inference solution can seamlessly integrate with the broadcast television supervision system, improving not only the efficiency of broadcast television program supervision but also its overall effectiveness.

In summary, with the full arrival of the 5G era, the difficulty of broadcast television program supervision has further increased, and traditional supervision technologies are clearly no longer adequate to meet current massive information supervision demands. This necessitates intensified research and development of emerging technologies. By combining the needs of broadcast television program supervision and actively introducing AI technology to construct an AI-based broadcast television program supervision system, dynamic and intelligent supervision of broadcast television programs can be achieved, effectively improving supervision quality and laying a solid foundation for the development of the broadcast television industry.

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About the Author: Bai Yuewen (1985-), female, from Hefei, Anhui, engineer, research direction: Television AI-based broadcast control technology.

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