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Research on the Innovation of Statistical Analysis Methods at the Grassroots Level with the Aid of AI Technology

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Abstract: Against the backdrop of the booming digital economy, the working environment of grassroots statistics has undergone significant changes. Faced with challenges such as the explosive growth of massive statistical data and diversified analytical demands, improving the efficiency of grassroots statistical data processing and the depth of analysis has become the primary goal of current reforms. The innovative development of artificial intelligence (AI) technology has brought more possibilities for the innovation of grassroots statistical analysis methods in the new era. This paper focuses on the application of AI technology in the innovation of grassroots statistical analysis methods. Based on an analysis of the main pain points in current grassroots statistical analysis methods, it proposes effective paths to promote the innovation of grassroots statistical analysis methods, aiming to provide a reference for relevant work.

Keywords: AI technology; Grassroots statistics; Analysis methods; Innovation

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1. Introduction

Statistical data serves as an important basis for the modernization of national governance capacity. Through the analysis and processing of statistical data, the economic and social development can be objectively reflected. With the expansion of the statistical scale, grassroots statistics directly face the majority of community residents and enterprises, undertaking important responsibilities such as the collection, collation, and analysis of basic data. The quality of data processing and analytical efficiency directly determine the scientificity of overall decision-making. Under the background of the new economic normal, the process of social and economic transformation is accelerating, and grassroots statistical work is facing severe challenges. Vigorously promoting the integrated application of AI technology in the field of grassroots statistics helps to drive the innovation and optimization of statistical analysis methods. With the powerful pattern recognition and data prediction and analysis capabilities of AI technology, it brings more possibilities for in-depth transformation in the field.

2. Main pain points in grassroots statistical analysis methods

2.1. Low efficiency and accuracy in data collection

In the implementation of grassroots statistical work, the efficiency and accuracy of data collection largely affect the reliability of subsequent analytical results. From the perspective of the actual work of macro data collection, traditional data collection methods mostly rely on manual reporting and layer-by-layer aggregation, which are cumbersome in process, long in cycle, and easily disturbed by subjective and objective factors, leading to data loss or reduced accuracy. Faced with the increasing number of statistical indicators, grassroots statisticians often need to spend a lot of time and energy on follow-up and verification, resulting in low work efficiency. Moreover, they are easily affected by subjective factors, leading to data deviations that affect the depth and breadth of subsequent data analysis [1]. For key surveys or periodic censuses, it is difficult to effectively respond only by traditional paper records or manual visits. Even though some regions have vigorously promoted the electronic collection of data, problems such as repeated data entry and inconvenient sharing still exist due to system barriers. Some survey respondents, due to insufficient statistical knowledge reserves or lack of sufficient attention, perfunctorily fill in data, greatly reducing the accuracy of source data. In addition, the standards and calibers of multi-source heterogeneous data are not the same, which may lead to deviations in the data integration process and increase the difficulty of later data verification and cleaning [2].

2.2. Single dimension of data analysis

Traditional grassroots statistical analysis is mostly limited to the calculation of simple indicators such as total volume, percentage, and mean value, with little involvement in the integrated analysis of historical data, and the problem of single analysis dimension is quite obvious. Constrained by their mastery of tools and knowledge structure, some grassroots statisticians rarely use more reliable quantitative analysis methods such as time series analysis and multivariate statistical analysis. The mining of potential data correlations is superficial, making it naturally difficult to explore and master the potential laws and driving mechanisms of data. At the same time, the perspective of data analysis is limited to the isolated analysis of single or simple indicators, lacking comprehensive correlation analysis. For example, when analyzing the level of regional economic development, the focus is on the GDP growth rate of the region, with little attention paid to indicators such as local employment and industrial structure, resulting in insufficiently objective and comprehensive analysis results [3].

2.3. Insufficient professional literacy of grassroots statisticians

The professional literacy of grassroots statisticians largely determines the overall work efficiency and quality. In practice, some grassroots statisticians have little knowledge of econometric models and emerging AI information technologies, and fail to consciously introduce them into actual work, habitually using manual retrieval and entry modes. Some personnel have resistance and fear of difficulties in the application of AI or big data technologies. Coupled with the lack of systematic professional training, it is difficult for them to independently use advanced analysis tools for data mining and analysis, or their cognition of AI technology is limited to the conventional conceptual level, failing to objectively view the application value of AI technology in statistical work [4].

3. Paths for AI technology to drive innovation in grassroots statistical analysis methods

3.1. Innovate data collection and preprocessing methods

Integrating AI technology into the data collection link focuses on the innovation and optimization of data

collection and preprocessing methods, aiming to improve the efficiency and accuracy of data acquisition from the source. Based on advanced AI technologies such as Web Crawling and NLP, grassroots statistical data can be automatically obtained from channels such as government public information platforms, social media, or news media to enrich the content of data reports [5]. Based on RPA and API interface technologies, AI technology can realize the automatic collection and synchronous update of data in different business systems such as social security, taxation, and market supervision, reducing manual repeated entry and work intensity, and improving the consistency of data collection. Integrating the Internet of Things and AI technology, edge computing can be performed on massive data collected by various sensors, or data can be uploaded to a cloud platform for intelligent analysis, thereby realizing the continuous collection of indicators in various fields and dimensions, especially suitable for statistical scenarios such as floating population statistics and agricultural yield estimation [6]. In addition, based on speech recognition and NLP technologies, AI can assist statisticians in designing more scientific questionnaires, or automatically collect data with the help of Chatbots to guide respondents to answer effectively, enhancing the authenticity and integrity of interview data from the source [7].

After data collection, preprocessing and cleaning are carried out through AI technology. AI algorithms such as rule engines or machine learning algorithms can automatically identify duplicate values, outliers, or missing values from massive multi-source heterogeneous data. For example, using the Isolation Forest algorithm to detect data outliers can deeply mine potential data correlations and inconsistencies, realize intelligent repair under the guidance of preset rules, reduce the intensity of later manual verification, and improve data accuracy [8]. Concurrently, AI technology can provide great convenience for statisticians in mechanized work such as data format conversion and unit unification. For example, it can quickly locate the problem of expression differences of the same enterprise or industry, correct them in a timely manner, and improve the accuracy of data matching [9].

3.2. Strengthen in-depth data mining and analysis

The integrated application of AI technology in the data mining and analysis link can break through the limitations of conventional descriptive statistics, conduct in-depth data mining and analysis, explore potential data laws, thereby accurately predicting abnormal problems and issuing early warnings in a timely manner [10]. Supported by clustering and classification algorithms, AI technology can automatically mine group feature correlations from complex variable data, explore potential logical relationships of data, and provide a data basis for precise services and decision-making. By building a hybrid model integrating ARIMA, LSTM, and deep learning technologies, and collecting economic indicators such as grassroots economic fixed asset investment and fiscal revenue, as well as social indicators such as employment rate and population mobility, accurate trend prediction and analysis can be realized on this basis [11].

AI models can integrate historical data and real-time updated data streams to build risk early warning models, thereby realizing intelligent prediction and early warning of risks [12]. For example, a risk prediction model built based on data such as enterprise income, cost, and benefit can accurately predict the debt risk of regional small and medium-sized enterprises. By collecting data from production site sensors and monitoring videos, potential safety accidents can be intelligently analyzed and warned. Grassroots statisticians use anomaly detection algorithms to accurately analyze abnormal data in economic operation, thereby providing a basis for the precise intervention of subsequent risks [13].

3.3. Innovate methods for result presentation and transformation

Innovating methods for result presentation and transformation based on AI technology aims to fully demonstrate the value of statistical analysis and provide support for relevant decision-making and deployment [14]. According to user needs and data characteristics, AI technology can automatically generate visualizations such as line charts, bar charts, or heat maps, and transmit data information in a more vivid and intuitive form by adjusting the structural layout and color matching. With the financial support of higher-level departments, grassroots statistical departments can develop targeted intelligent statistical question-and-answer and visual interactive platforms, integrating NLP technology to provide users with all-weather information consulting services. For example, when a user input "Show the development trend of emerging industries in our city in the past 5 years in the form of a line chart", AI parses the semantics, extracts relevant data, and generates a visual chart for reference after intelligent analysis and judgment, greatly reducing the difficulty for users to obtain data. While improving the efficiency and quality of grassroots statistics, it optimizes the user operation experience.

3.4. Innovate error correction and supervision methods

To ensure the authenticity and accuracy of grassroots statistical data, AI technology can innovate error correction and supervision methods to guarantee data quality in an all-round way. Embedding AI technology into the data collection and entry stage, the standardized storage and verification of statistical data can be realized with the help of a real-time verification rule engine, and intelligent audit can be carried out according to business logic, data distribution and other conditions. For example, if the system finds that there is an obvious mismatch between the output value data and power consumption data of a certain enterprise, it will automatically send an early warning message to urge relevant manual review [15]. In addition to accurately detecting abnormal data, it can also trace the source, accurately locate the link of data deviation, and clarify the relevant responsible person. In the process of data cause analysis, AI technology can be used to identify the common or individual causes leading to data deviation, supporting the subsequent system improvement and upgrading.

4. Conclusion

In summary, against the background of the digital era, the scale of statistical data continues to expand, and grassroots statistical analysis methods need to be innovated accordingly. By integrating AI technology into all links such as data collection, analysis, processing, and presentation, it is convenient to deeply mine the potential value and correlation of data, reduce manual intensity and data deviation, and improve the efficiency, quality, and analytical efficiency of data statistics, laying a solid foundation for the construction of socialist modernization.

Disclosure statement

The author declares no conflict of interest.

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