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Article

AI policy in action: the Chinese experience in global perspective

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Abstract

This study aims to trace the development of China's artificial intelligence (AI) policies using text analysis, focusing on analyzing the similarities and differences in AI policies being implemented by China's central and local governments. To achieve this, we utilized data from the "China Legal Retrieval System (北大法宝)" to conduct text mining and topic modeling analysis on AI policy documents from both the central and local governments. The analysis revealed that the central government's AI policy documents primarily focus on AI technology-based disaster response, product production, and talent development. In contrast, local governments' policy discourse and objectives showed a trend of decreasing diversity from the eastern to the central to the western regions. The east region targets core technologies across the board, the central region focuses on healthcare and heavy industry, and the region of the west aims at economic development and social stability.

Keywords: China, central-local relations, artificial intelligence policy, text mining, topic modeling

Introduction

The rapid development of artificial intelligence (AI) is impacting politics, economics, and society at large. Beyond being a mere new technology, AI technology is considered an innovative force driving extensive changes in industry and social structures, serving as a key driver that can enhance national competitiveness. According to the "WIPO Patent Landscape Report on Generative AI," released by the United Nations World Intellectual Property Organization (WIPO) on July 3, 2024, China has filed the most patents related to generative AI over the past decade (WIPO, 2024). This number surpasses the combined patent filings of the top five countries: the United States, South Korea, Japan, and India. The research level of China's advanced technology academia has already surpassed that of the United States. In the "2024 Nature Index" released by the scientific journal Nature, which comprehensively evaluates the impact of top-tier papers, China overtook the United States to become the leader, earning recognition as a "true scientific powerhouse." (Nature, 2024).

China's leap forward in the field of AI can be attributed to the government's large-scale investment and expansion of research and development following the 2017 launch of the "New Generation AI Development Plan" (State Council of the People's Republic of China, 2017). This plan fostered collaboration between the government and enterprises to expand the AI-related industrial ecosystem. In 2021, China released the "White Paper on Trustworthy AI" to guide the development of AI systems, aiming to improve their reliability (Baidu, 2021). Moreover, during the opening session of the National People's Congress on March 5, 2024, Premier Li Qiang hinted at the cultivation of an independent AI ecosystem through the "AI Plus Initiative" (人工智能+) as one of the ten major government tasks (China Government Network, 2024). As of June 2024, approximately 1,000 AI-related policies have been announced by China's central and local governments. The proactive support from the Chinese government and its robust policy framework have played a significant role in the development of China's AI industry.

Despite the rapid advancements, research on China's AI policies remains limited (Yang & Huang, 2022). Existing studies often focus on analyzing policies through the lens of specific AI applications or conducting qualitative analyses of individual AI policies set by the central government. This narrow scope fails to comprehensively examine the extensive range of China's AI policies, preventing the identification of accurate policy discourses and hindering the discovery of patterns related to policy diffusion and variation based on local government autonomy. Since Xi Jinping's rise to power in 2013, there has been an increased centralization of authority, with local powers and discretion being curtailed and greater pressure and control imposed on local governments (Chen, 2016; Tsai, 2022). However, the issue of role allocation between central and local governments remains a significant challenge, particularly in addressing the diverse welfare demands of society. In this context, there is ongoing exploration of governance institutionalization to ensure appropriate role distribution between central and local governments, even as centralization trends continue to unfold (Xuan, 2018).

This study aims to analyze the patterns of AI policy diffusion in China within the framework of central-local relations using text analysis. To accomplish this, we utilized data from the "China Legal Retrieval System (北大法宝)" and performed text mining and topic modeling analyses on AI-related policy documents issued from May 2016, when AI policies began to be formally published, through 2024. [1]Additionally, for a more detailed analysis, the study divides local governments into three regions: eastern, central, and western China. Since 1978, China has experienced rapid economic growth, resulting in economic disparities between the eastern and non-eastern regions (Zha, 1996). According to the evolutionary modernization theory, the context of growth can influence the values and perspectives of policymakers, and the differing interests and views of policy actors can lead to distinct policy designs (Bao et al., 2020; Triandafyllidou & Fotiou, 1998). This study is significant in that it uses differentiated textual data from various regions as policy actors or units to identify divergent policy discourses and objectives.

The structure of this study is as follows. Chapter 2 reviews the theories concerning central-local relations in China and the existing literature on AI policies. Chapter 3 introduces the methodologies

[1] China Legal Retrieval System (https://pkulaw.com): The "China Legal Retrieval System" is a legal information database operated by Peking University in China. It serves as a legal information provision system.

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of text mining and topic modeling analysis, which are employed to analyze AI policies of the Chinese central and local governments. The study aims to identify AI policy discourses and objectives by policy actors and regions through these methods. Chapter 4 analyzes the results derived from the text analysis and discusses their implications. Finally, Chapter 5 concludes by summarizing the AI policy discourses and objectives of the Chinese central and local governments and presents the limitations of the study.

Theoretical Discussion and Review of Previous Research

China's central-local relations

Theoretical discussion

The relationship between central and local governments is a crucial issue for development theorists, as it determines the linkage system between the decision and execution of national and local policies. In particular, federal countries like the United States, being large nations, have developed intergovernmental relations (IGR) from the perspective of vertical and horizontal multiple relationships (Agranoff, 2004; Swenden, 2006). However, IGRs generally refer to the "relationships formed between the central government and various levels of local governments with a certain degree of autonomy within a country." This concept may have limitations when applied to countries with authoritarian regimes like China (Kim, 2015). With its strong central control tendency in China, additional mechanisms operate beyond general IGRs to manage the alignment and misalignment between central policy decisions and local execution (Kostka & Nahm, 2017; Li, 2010; Shao & Li, 2024).

The central-local relationship in China has been characterized by a cycle of centralization and decentralization since the establishment of the People's Republic of China. After ending the chaos and fragmentation in the Chinese mainland since the 19th century and achieving complete unification, Mao Zedong established a "centralized-decentralization (集中分权型)" model of government administration based on appropriate decentralization between the central and local governments following the founding of the People's Republic of China (Kim, 2013; Zhang, 2005). However, this "centralized-decentralization" model had a fundamental flaw in that it rejected the institutional establishment of market mechanisms. Until the reform and opening-up period, government reforms consistently failed to break free from the cycle of decentralization → centralization, redecentralization → recentralization, simplification → expansion → resimplification → reexpansion (Liang, 2008; Shue, 1988). In practice, this was the Sinicization of the highly centralized and comprehensive control-oriented omnipotent government model of the former Soviet Union, and fundamentally, it did not escape the shadow of the Soviet government model (Lee & Jeong, 2011; Nee, 1989).

Since China's reform and opening up until the early 2000s, there has been a significant transformation in the relationship between the central and local governments as China transitioned from a socialist planned economy to a market economy. The most substantial changes occurred in the fiscal sector from 1978 to the early 2000s. After four reforms, the State Council issued the

"Decision on Implementing the Fiscal Decentralization Management System" in 1993, and from 1994 onwards, the fiscal decentralization system was implemented nationwide (Lin & Liu, 2000; Pang, 2004; Shen et al., 2012).

After establishing a relatively stable market economy foundation, the Chinese government under Hu Jintao declared that the government's role would be limited to providing public goods and regulating the market. This shifted the focus of discussions on central-local relations to the issue of distributing responsibilities for public services (Li, 2010). However, since the 21st century, China's central-local relations have faced a significant dilemma. While aiming to establish a reasonably differentiated governance structure, it has been challenging to avoid recentralization trends in addressing various issues that arose during industrialization, such as education, healthcare, welfare, and the environment (Lee, 2020). In particular, the leadership under Xi Jinping has shifted towards recentralization to resolve the broader societal issues that emerged during rapid industrialization (Chen, 2019; Verma, 2022; Yoo, 2023).

Regional overview of China

As of 2022, the socioeconomic indicators by region in China are shown in Table 1. This data is compiled based on the "China Statistical Yearbook 2023" published by the National Bureau of Statistics of China (National Bureau of Statistics of the People's Republic of China, 2023). In most categories, the eastern region exhibits significantly higher values, indicating severe regional disparities. The eastern region of China includes Beijing, Fujian, Guangdong, Guangxi, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang. It has the highest population concentration in the country, with per capita income 20% higher than the national average and information and communication technology (ICT) penetration 15.5% above the national average. The education level in this region is also the highest in the country.

Anhui, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangxi, Jilin, and Shanxi are classified as part of the central region. This region is home to about 30% of the population. While its ICT penetration rate is similar to that of the eastern region, other indicators resemble those of the western region. The western region includes Chongqing, Gansu, Guizhou, Ningxia, Qinghai, Shaanxi, Sichuan, Xinjiang, Yunnan, and Tibet. This study aims to analyze the patterns of AI policy diffusion under the assumption that such regional socioeconomic disparities will influence local governments' policy discourses and objectives.

Table 1. Socioeconomic indicators by region in China (compared to national average)

Category	National (%)	Eastern region (%)	Central region (%)	Western region (%)
Population	100	46.8	31.3	21.9
Per capita income	100	120.0	84.4	77.8
Transportation infrastructure	100	42.4	26.1	51.3
Information and communication technology (ICT)	100	115.5	97.6	53.8
Education level (educational expenditure)	100	54.8	20.7	24.5

Based on the National Bureau of Statistics of the People's Republic of China (2023), restructured by the author.

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Literature review

Research on China's AI policies can be categorized into two main areas based on research perspectives and content analysis. Studies on China's AI policies can be classified into national, regional, and nationwide perspectives, with nationwide policies encompassing both national and regional policies. First, from a national perspective, qualitative and comparative analyses have been conducted to understand the macro perspectives of the state on key AI policies such as the "New Generation Artificial Intelligence Development Plan" and the "Three-Year Action Plan to Promote the Development of the Next Generation Artificial Intelligence Industry" (Bareis & Katzenbach, 2022; Roberts et al., 2021; Wu et al., 2020). Second, from a regional perspective, comparative analyses and policy-type analyses have been conducted using regional policies as samples (Song & Xia, 2019; Tang et al., 2019a, 2019b). Third, from a nationwide perspective, research has been divided into analyses of the characteristics of representative policies and comprehensive analyses of policy distribution (Yang & Huang, 2022; Zhang & Li, 2019). These studies have focused on exploring the external attributes and semantic content of policy characteristics, investigating policy themes and instruments. However, they have limitations in that they do not capture the interactions among policies at various levels, including nationwide policies in China.

Second, some scholars have focused on China's AI innovation ecosystem. Arenal et al. (2020) developed a Triple Helix framework to assess the current status and prospects of China's AI innovation ecosystem, discovering general principles for policy formulation and implementation through qualitative research. Third, studies have been conducted on the interaction between academic research and policy formulation. Gao et al. (2019) performed a comparative analysis of China's AI-related international research hotspots and national policy keywords from 2009 to 2018. Fourth, research has focused on the AI policy-making process and IGRs. Yang & Huang (2022) used an analytical framework integrating bibliometric methods, semantic analysis, and network analysis to examine AI-related policies issued by the Chinese central government up to 2019. They found that China's AI development focuses on application areas based on fundamental theories and core technologies. Wang et al. (2022) analyzed the AI policies of the central and local governments, revealing that while China's AI development remains in its early stages, cooperation between central and local governments is smooth, with local governments facilitating the top-down diffusion of central policies.

This study presents the following distinctive contributions based on the previous studies summarized above. Although many existing studies on China's AI policies have conducted qualitative analyses, they often fail to account for regional contexts, limiting their ability to understand interregional characteristics. This study is significant in that it comprehensively examines the content and distribution of AI policies by both the central and local governments in China up to the present time. Second, existing research has not thoroughly explored the attributes and content of policy documents, resulting in limited studies on overall policy issuance trends, policy distribution, and the evolution of policy objectives. In this regard, this study has academic significance by employing text mining and topic modeling methods to differentiate and examine AI policy discourses and objectives by policy actors.

Research Methodology

This study utilized Google Colab (Google Collaboratory), a cloud-based platform that allows writing and executing Python code in a Jupyter notebook environment, to analyze AI policies of China's central and local governments. Google Colab offers free access to high-performance GPUs and TPUs, significantly increasing the computational speed for machine learning and deep learning tasks. It comes pre-installed with modules and libraries used for text mining and topic modeling analysis, such as pandas, numpy, sklearn, matplotlib, and pyLDAvis, and additional libraries can be easily installed using the pip command. In this study, we used jieba and sklearn for data preprocessing and term frequency-inverse document frequency (TF-IDF) analysis, and we employed gensim and pprint for topic modeling analysis. The analysis results were visualized using matplotlib and WordCloud.

Policy text sources

The subjects of this study's analysis are the AI policy documents of China's central and local governments. To identify policy discourses and objectives by policy actors, data was collected by dividing local governments into three regions: eastern, central, and western. The "China Legal Retrieval System" from Peking University was used as the channel for collecting analysis subjects. The keyword 'artificial intelligence (人工知能)' was specified, and the analysis period was set from May 2016 to June 2024. Policy documents relevant to the research objectives were manually saved in txt format.

Data preprocessing using text mining

Text mining is a big data analysis method that applies natural language processing (NLP) techniques to convert unstructured text data into structured data, extracting useful information in the process (Kao & Poteet, 2007). It is widely used due to its ability to extract characteristics, patterns, and useful knowledge from text, as well as analyze contextual issues and the interconnectivity of text. In text network analysis, it plays a role in content analysis. This study employed word frequency analysis and topic modeling, which are representative text mining techniques (Griffiths & Steyvers, 2004; Seo et al., 2023).

Specifically, using Python and the Chinese text analysis package "Jieba," we performed text preprocessing on 66 central government documents and 123 local government documents. This process involved removing unnecessary elements such as tags and punctuation and handling synonyms and stopwords to extract morphemes for analysis. "Jieba" is widely used as a library for Chinese text segmentation in NLP. It employs a Trie structure and Maximum Probability method and offers the ability to discover new words based on a Hidden Markov Model (HMM), making it effective for Chinese word segmentation (Hu et al., 2024; Yang & Huang, 2022; Yang et al., 2013). The analysis included nouns and technical terms, and the process of morphological analysis and preprocessing was repeated to enhance data quality. Words shorter than two characters were generally treated as stopwords since they often hold little significance in the analysis. Additionally, six compound and derivative words were processed further, considering the context of the specific

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policy domain. For instance, documents appended as "Appendix" in the original text were treated as separate documents for analysis, while "Appendix (附件)" was treated as a stopword.

To compare and analyze the AI policies of China's central and local governments, TF-IDF was conducted. TF-IDF is one of the most effective and straightforward methods for calculating the relative importance of each word. It computes the importance of a word by multiplying its frequency within a document (TF: $f_{t,d} / N_d$) by the inverse of the frequency with which the word appears across the entire data set (IDF"log ($N / /d \in D : t \in dvert$)) (Park, 2018; Park et al., 2016). In this study, we used the TfidfVectorizer function from Python's sklearn module to calculate the TF-IDF matrix for each document and then measured the average TF-IDF value for each word. TF-IDF can be expressed using the following equation (1).

$$TF - IDF(t, d, D) = \left(\frac{f_{t,d}}{N_d}\right) \times \log\left(\frac{N}{|\, d \in D : t \in d \,|}\right) \quad (1)$$

Latent dirichlet allocation (LDA)-based topic modeling

Topic modeling is a technique to uncover latent topics within large-scale texts by identifying patterns among words and documents (Blei et al., 2003). Algorithms such as Latent Semantic Analysis (LSA), latent dirichlet allocation (LDA), and Probabilistic Latent Semantic Analysis are used to group documents with similar themes. Among these, the LDA algorithm is the most widely used (Jin & Kim, 2022).

The basic principle of LDA is that documents are considered a mixture of latent topics, with each topic represented by a distribution of words, allowing the determination of the topics that describe the documents (Blei et al., 2003). LDA generates a document-term matrix from a corpus and calculates the correlated probability distributions between documents and words to extract topics (Blei & Lafferty, 2009). The specific process is as follows.

According to the structure of the LDA model proposed by Blei (2012), K represents the number of topics, α is a parameter that determines the value of θ,n is a parameter that determines the value of β. θ is the topic proportions per document, β is the per-corpus topic distribution, representing the generation probability of word W. $Z_{d,n}$ refers to the topic of the ^{n}th word in document d, $W_{d,n}$ refers to the ^{n}th word in document ^{d}, meaning the observed variable in the document (Blei, 2012). θ follows a Dirichlet distribution as the topic proportion value for each document set, the topic Z of the words present in the document set is determined by the value of θ. Additionally, the word W is determined by the value Z, which represents the topic of each word, and the value β, which is the word generation probability for each topic (Blei, 2012).

Topic modeling classifies data based on a predefined number of topics, hence researchers typically determine the number of topics based on subjectivity or prior knowledge. However, in this study, to minimize researcher bias, the topic consistency score was employed to select the optimal number of topics. The topic consistency score indicates whether the words with high probabilities corresponding to each topic are semantically consistent, with higher values suggesting a better model. This score has the advantage of providing a better assessment of the model's strengths and weaknesses. Therefore, this paper chose the topic consistency score to determine the optimal number of topics, set the range of topic numbers from 2 to 10, and utilized the get_Coherence

method in the LDA topic clustering model to compute the consistency value, subsequently selecting the number of topics that corresponded to the highest consistency as the optimal number.

Results

Results of data collection

Using the keyword 'artificial intelligence (人工知能)' in the "China Legal Retrieval System," the analysis period was set from May 2016 to June 2024. A total of 135 central government policies and 1,034 local government policies were identified. The extraction process excluded policies that are no longer in effect, such as the "Notice on the Printing of 'Administrative Norms for Artificial Intelligence-Assisted Treatment Technology (Trial)' by (卫生部办公厅关于印发《人工智能辅助治疗技术管理规范(试行)》的通知)." Local government documents labeled as "local work documents (地方工作文件)," which lack legally binding power and serve as internal management documents, were also excluded from the collection process. Ultimately, 66 central government documents and 123 local government documents were manually saved in txt format, and morphological analysis and artificial language transformation were conducted using text mining. Table 2 summarizes information about the texts used in this study below.

As demonstrated in the above graph, the frequency of AI-related policy issuance in China is generally showing a declining trend. The central government of China issued the most AI policies in 2018 and 2019, while the local governments issued the most in 2017. Notably, the local governments in the eastern region, following the central government, have been particularly active in formulating AI policies. This suggests that the AI industry in the economically more developed eastern region is more vibrant compared to the less developed non-eastern areas (Fig. 1).

Term frequency-inverse document frequency (TF-IDF) result

Before conducting the topic modeling analysis, a TF-IDF frequency analysis was performed on the policy documents included in the final analysis set to identify key keywords. As a result, a total of 11,327 words were extracted, and the top 10 keywords based on TF-IDF values for each policy actor are presented in Table 3.

The TF-IDF analysis reveals that keywords such as 'earthquake,' 'situation,' 'school,' 'headquarters,' 'fund,' 'experimental zone,' and 'teacher' are considered significant in the AI-related policies of the Chinese central government. This indicates that disaster response using AI technologies and

Table 2. Information on Chinese AI policy documents

Category		Data source	Number of documents used	Number of morphemes used	Number of co-occurrence relationships
Central government		China legal retrieval system	66	3,150	17,708
Local government	Eastern region		61	4,422	27,560
	Central region		29	2,032	9,373
	Western region		25	1,723	6,729
Total			189 (66/123)	11,327	144,955

AI, artificial intelligence.

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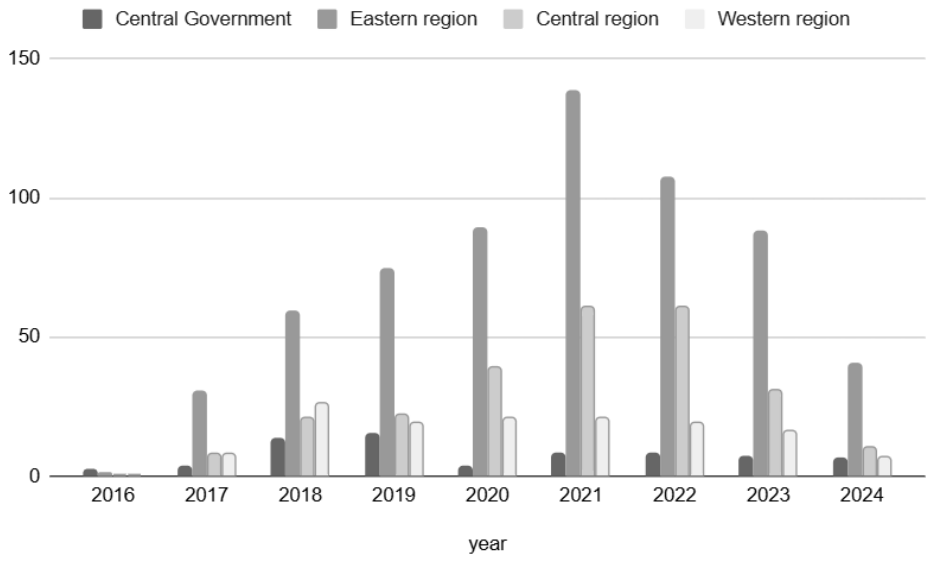

Fig. 1. **Number of policies issued by actors annually.**

Table 3. **Frequency analysis of AI policies by government type**

Ranking	Central government		Eastern local government	
	Keyword	TF-IDF	Keyword	TF-IDF
1	Earthquake	0.931	Region	0.839
2	Situation	0.902	Limited_Company	0.797
3	School	0.886	Smart	0.747
4	Headquarters	0.865	This_City	0.736
5	Fund	0.859	Industry	0.711
6	Member	0.825	Curriculum	0.679
7	Experimental_Zone	0.745	Academic_Society	0.678
8	Teacher	0.744	Major	0.660
9	Provision	0.720	Medical_Institution	0.656
10	Medical_Equipment	0.719	Model	0.643
Ranking	Central local government		Western local government	
	Keyword	TF-IDF	Keyword	TF-IDF
1	Scientific_Technology	1.000	Pandemic	0.722
2	Norm	0.811	Project	0.656
3	Smart	0.776	Data	0.649
4	Professional	0.755	Expert	0.632
5	Enterprise	0.642	Entire_City	0.621
6	Pandemic	0.614	Norm	0.618
7	Email	0.581	Autonomous_District	0.572
8	Voice	0.491	Smart	0.554
9	Standard	0.484	Industry	0.549
10	Committee	0.454	Consultation_Hotline	0.532

AI, artificial intelligence; TF-IDF, term frequency-inverse document frequency.

AI education for talent development are prominent policy goals. Notably, earthquake prevention has emerged as a major discourse. The "Special Plan for AI Development Research in the Field of

Earthquake Prevention and Disaster Reduction (防震减灾领域人工智能发展研究专项规划) (2023–2035)," issued by the China Earthquake Administration in 2023, aims to enhance the efficiency of earthquake prediction and monitoring systems using AI technology by 2035. The plan also seeks to establish intelligent systems for automating data processing and analysis, positioning China as an international leader in this technological field.

The top keywords for the local governments in the eastern region include 'region,' 'limited company,' 'smart,' 'industry,' 'curriculum,' 'academic society,' and 'medical institution.' For the central local governments, the top keywords are 'science and technology,' 'norms,' 'smart,' 'enterprise,' 'infectious disease spread situation,' and 'voice.' In the western local governments, 'infectious disease spread situation,' 'project,' and 'data' emerged as the top keywords, indicating the primary development focus in each region. These findings suggest that the eastern region is actively developing AI in medical and industrial sectors, the central region is focusing on infectious disease response and voice technologies, and the western region is concentrating on preventing the spread of infectious diseases through AI development.

Artificial intelligence (AI) policy topic modeling

Central government

The LDA topic modeling analysis conducted on 66 AI policy documents from the Chinese central government indicated that the highest consistency score was observed in the range with four topics, as shown in Fig. 2. Therefore, four was selected as the optimal number of topics, and a total of four topics were identified, as presented in Table 4.

First, Topic 1 is titled "AI Projects and Technology Development" and includes keywords such as AI, project, application, institution, and smart. Policies within this topic mainly focus on project development related to AI technology, application procedures, smart technology applications, funding, data management, product development, and various technology and industrial sectors.

Second, Topic 2 is titled "State-Led AI Technology and Smart Medical Device Development" and includes keywords such as artificial intelligence, technology, smart, state, medical device, and software. Policies under this topic primarily promote data management using AI and smart

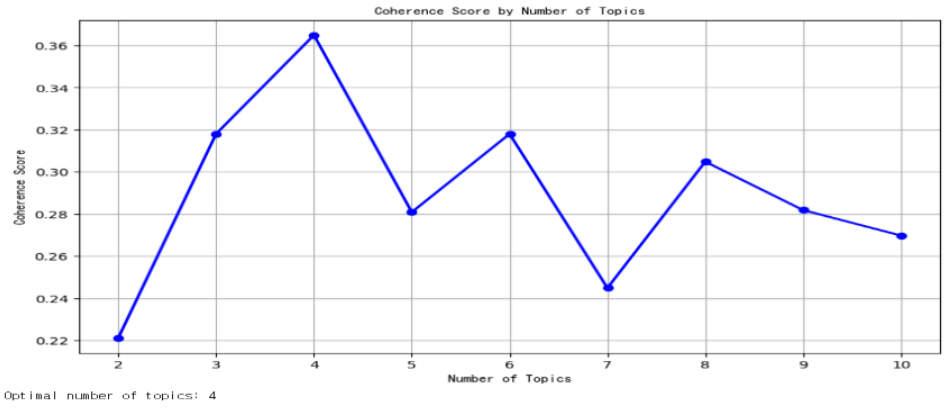

Fig. 2. Results of consistency scores for central government AI policies. AI, artificial intelligence.

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Table 4. Topic modeling analysis results of central government AI policies

Topic no.	Topic name	Term
Topic 1	AI projects and technology development (22%)	Artificial_Intelligence, Project, Application, Institution, Smart, Fund, Data, Technology, Product, Field
Topic 2	State-Led AI technology and smart medical device development (32.6%)	Artificial_Intelligence, Technology, Smart, Data, Scene, Nation, Product, Medical_Device, Field, Software
Topic 3	Data and software development in secondary education using AI and smart technology (8.1%)	Artificial_Intelligence, Smart, Technology, Data, Algorithm, Product, Field, Method, Software, Secondary_Education
Topic 4	Smart product manufacturing using algorithm-based AI technology (37.3%)	Artificial_Intelligence, Product, Technology, Smart, Data, Medical_Device, Algorithm, Software, Function, Image

AI, artificial intelligence.

technologies, the development of medical devices and software, national-level policies and strategies, and the advancement of various technological and industrial sectors.

Third, Topic 3 is titled "Data and Software Development in Secondary Education Using AI and Smart Technology" and includes keywords such as artificial intelligence, smart, algorithm, and secondary education. This topic encompasses policies that emphasize the development of data and software, the application of algorithms, and the development of educational products and methodologies in the secondary education sector using AI and smart technologies.

Finally, Topic 4 is titled "Smart Product Manufacturing Using Algorithm-Based AI Technology" and includes keywords such as artificial intelligence, medical device, algorithm, and image. Policies in this topic focus on developing smart medical devices and software, radiological diagnostic technologies, identity recognition systems within images, and the development of products and functionalities applying these technologies. Compared to Topic 2, this topic places a greater emphasis on visual image processing technology and data management, indicating a slightly different focus.

The results of the topic modeling analysis can be visualized as shown in Fig. 3. Examining the proportion of the four topics, "Smart Product Manufacturing Using Algorithm-Based AI Technology" accounts for 37.3%, "State-Led AI Technology and Smart Medical Device Development" for 32.6%, "AI Projects and Technology Development" for 22%, and "Data and Software Development in Secondary Education Using AI and Smart Technology" for 8.1%. This indicates that "Smart Product Manufacturing Using Algorithm-Based AI Technology" is the most frequently addressed topic in the AI policy documents of the Chinese central government, highlighting a focus on developing radiological diagnostic technologies and image recognition technologies.

AI radiological diagnostic technology in Chinese radiology departments refers to an auxiliary diagnostic technique in which computers analyze radiology data to classify and diagnose imaging materials, complete data classification and search tasks, and assist physicians in their diagnoses (Zhao et al., 2018). This technology has improved diagnostic efficiency by significantly reducing examination times through the extensive use of big data and cloud computing. However, China's AI radiological diagnostics fall under typical cases of multiple rights infringements, with insufficient regulations regarding compensation for damages (Kim, 2022). While advanced countries like the United States have been hesitant to adopt facial recognition technology due to concerns about

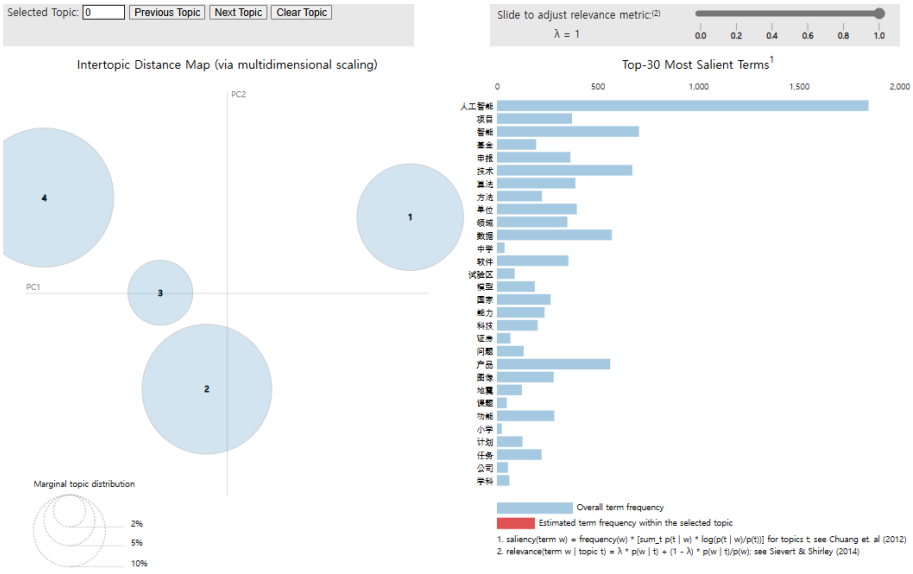

Fig. 3. Topic modeling analysis results of central government AI policies. AI, artificial intelligence.

privacy infringement and bias, China has led the global facial recognition technology industry, showcasing various applications supported by policy and its domestic market (Choi, 2020). Nonetheless, disputes and social issues related to privacy protection continue, highlighting the need for China's ongoing legislative efforts to balance the protection and use of facial recognition information (Lee, 2022).

Local government

Eastern region

An LDA topic modeling analysis of 61 AI policy documents from local governments in the eastern region of China showed that the highest consistency score was observed in the range with eight topics, as depicted in Fig. 4. Consequently, eight was selected as the optimal number of topics, and a total of eight topics were identified, as presented in Table 5.

First, Topic 1 is titled "Industrial Innovation and Economic Development through AI" and includes keywords such as artificial intelligence, smart, enterprise, data, and industry. This topic encompasses policies related to industrial innovation and economic development through AI, focusing on related companies and technologies, data management, various technology projects and fields, smart technology applications, robotics, talent development, and collaboration.

Second, Topic 2 is titled "Advanced Industrial Innovation and Corporate Responsibility Using AI and Robotics" and includes keywords such as smart, artificial intelligence, limited company, enterprise, responsibility, and robot. Policies under this topic focus on using AI and robotics to innovate advanced industries, emphasizing the roles and responsibilities of related companies and organizations, industry changes, developing advanced technology products, applications in the industrial sector, and collaboration with relevant communities.

Third, Topic 3 is titled "State-Led AI Talent Development and Policy Formulation" and includes

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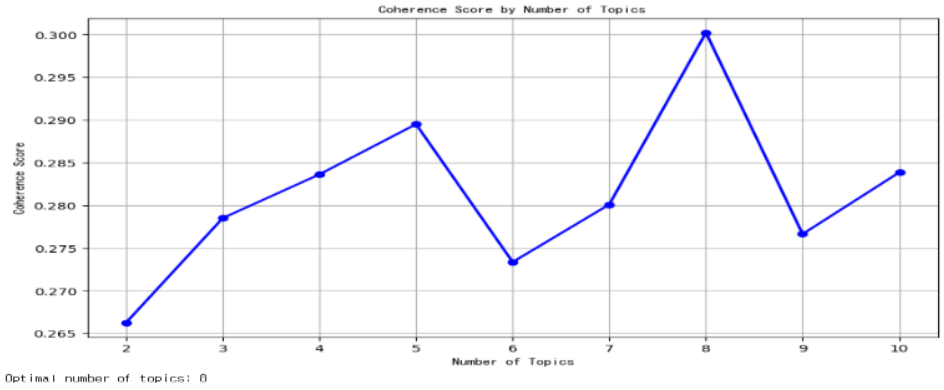

Fig. 4. Topic modeling analysis results of central government AI policies in regional local goverment. AI, artificial intelligence.

Table 5. Topic modeling analysis results of AI policies in eastern regional local government

Topic no.	Topic name	Term
Topic 1	Industrial innovation and economic development through AI (10.5%)	Artificial_Intelligence, Smart, Enterprise, Data, Technology, Industry, Manufacturing, Project, Field, Platform
Topic 2	Advanced industrial innovation and corporate responsibility using AI and robotics (16.8%)	Smart, Artificial_Intelligence, Limited_Company, Enterprise, Responsibility, Sector, Group, Robot, Advanced, Manufacturing
Topic 3	State-led AI talent development and policy formulation (28%)	Talent, Nation, Policy, Artificial_Intelligence, Technology, Expertise, Application, Product, Project, Data
Topic 4	Corporate responsibility through AI and smart technology (1.3%)	Artificial_Intelligence, Smart, Industry, Enterprise, Responsibility, Technology, Platform, Sector, Policy, Requirements
Topic 5	Economic and engineering applications of AI and the internet (27.6%)	Project, Application, Economy, Artificial_Inteligence, Situation, Industry, Process, Institution, Internet
Topic 6	State-led ai technology development application and evaluation policies (1.4%)	Application, Evaluation, Conditions, Nation, Policy, Artificial_ Intelligence, Industry, Technology, Digitalization, Model
Topic 7	AI enterprise project application and funding support policies (11.8%)	Artificial_Intelligence, Corporation, Project, Funding, Limited_ Company, Sector, Policy, Application, Nation
Topic 8	Regional AI industry development and the role of national institutions (2.6%)	This_City, Nation, Institution, Artificial_Intelligence, Smart, Industry, Responsibility, Corporation, Policy, System

AI, artificial intelligence.

keywords such as talent, state, policy, artificial intelligence, and application. Policies within this topic focus on the state-led cultivation of talent in the AI field, the development of supporting policies and strategies, and the promotion of AI technology and product development, project management, and data utilization through these talents and policies.

Fourth, Topic 4 is titled "Corporate Responsibility through AI and Smart Technology" and includes keywords such as artificial intelligence, industry, enterprise, responsibility, and policy. This topic encompasses policies related to the ethical responsibilities of corporations and policy conditions during the process of industrial innovation using AI technology.

Fifth, Topic 5 is titled "Economic and Engineering Applications of AI and the Internet" and includes keywords such as project, application, economy, engineering, and Internet. Policies under this topic focus on developing innovative industries using AI and internet technologies, addressing the roles of related companies and organizations, the development of technological equipment and products, and key tasks for economic development.

Sixth, Topic 6 is titled "State-Led AI Technology Development Application and Evaluation Policies" and includes keywords such as application, evaluation, conditions, and state. Policies within this topic focus on establishing application procedures, evaluation criteria, and necessary conditions for AI technology development projects and research led by the state, with an emphasis on supporting national policies and strategies.

Seventh, Topic 7 is titled "AI Enterprise Project Application and Funding Support Policies" and includes keywords such as artificial intelligence, enterprise, project, funding, policy, and application. This topic encompasses policies related to the application and funding support for projects by AI technology companies, the roles of related industries and companies, supporting national policies and strategies, and application procedures.

Finally, Topic 8 is titled "Regional AI Industry Development and the Role of National Institutions" and includes keywords such as city, state, institution, artificial intelligence, responsibility, and policy. Policies in this topic focus on strategies and policies for developing the AI industry at regional and national levels, emphasizing the roles of related institutions and organizations, and promoting regional and national economic revitalization through these efforts.

The results of the topic modeling analysis can be visualized, as shown in Fig. 5. Examining the proportion of the eight topics, "State-Led AI Talent Development and Policy Formulation" accounts for 28%, "Economic and Engineering Applications of AI and the Internet" for 27.6%, "Advanced Industrial Innovation and Corporate Responsibility Using AI and Robotics" for 16.8%, "AI Enterprise Project Application and Funding Support Policies" for 11.8%, "Industrial Innovation and Economic Development through AI" for 10.5%, "Regional AI Industry Development and the Role of National Institutions" for 2.6%, "State-Led AI Technology Development Application and Evaluation Policies" for 1.4%, and "Corporate Responsibility through AI and Smart Technology" for 1.3%. This indicates that in the AI policy documents of local governments in the eastern region,

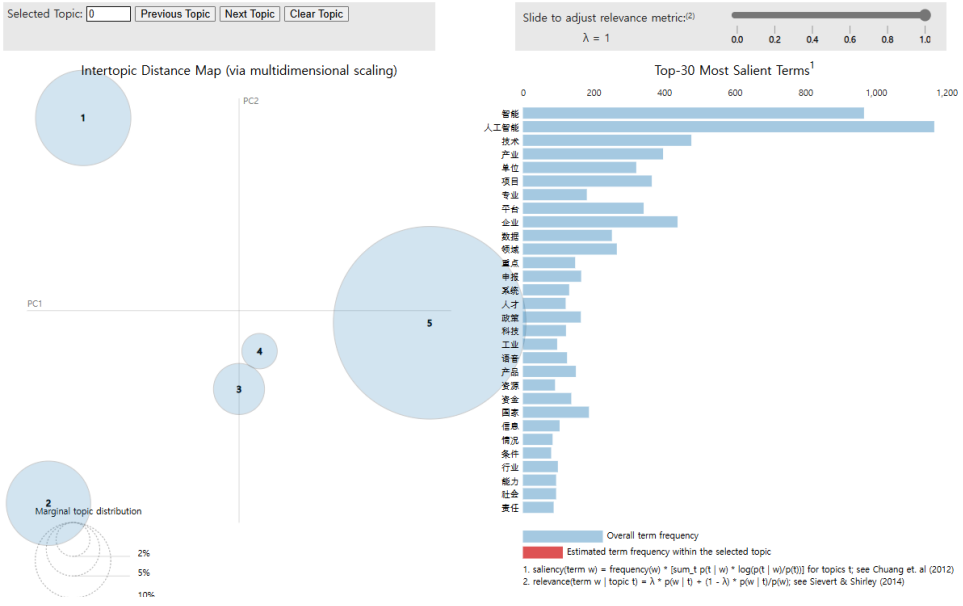

Fig. 5. Topic modeling analysis results of artificial intelligence policies by local governments in the eastern region.

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"State-Led AI Talent Development and Policy Formulation" and "Economic and Engineering Applications of AI and the Internet" are the most frequently addressed topics, highlighting a focus on AI talent cultivation, core advanced technology development, and state policy formulation.

Central region

An LDA topic modeling analysis of 29 AI policy documents from local governments in the central region of China showed that the highest consistency score was observed in the range with five topics, as depicted in Fig. 6. Consequently, five was selected as the optimal number of topics, and a total of five topics were identified, as presented in Table 6.

First, Topic 1 is titled "Policies and Data Utilization for AI Projects and Industrial Development" and includes keywords such as artificial intelligence, project, institution, and industry. This topic primarily encompasses policies related to projects and industrial development using AI technology, the roles of related companies and entities, data management and technology platforms, and supporting national policies and strategies.

Second, Topic 2 is titled "AI-Based Quantum Technology and Voice Recognition Development with National Support" and includes keywords such as quantum, integrated circuit, voice, and artificial intelligence. This topic encompasses policies focused on developing integrated circuits and voice recognition technology using AI and quantum technology, along with national-level policies and strategies supporting these efforts, including technology certification and the cultivation of specialized talent.

Third, Topic 3 is titled "State-Led AI Resource Management and Policy by the Department of Science and Technology" and includes keywords such as Department of Science and Technology, state, resources, policy, and artificial intelligence. This topic comprises policies in which the state, through the Department of Science and Technology, promotes innovation via AI resource management and policies, supporting related projects and research application procedures.

Fourth, Topic 4 is titled "Social Cooperation and Industrial Development through AI and Smart Technology" and includes keywords such as artificial intelligence, society, and cooperation. Policies in this topic focus on enhancing social cooperation using AI and smart technology, advancing various industrial sectors, promoting technological projects through funding, managing and

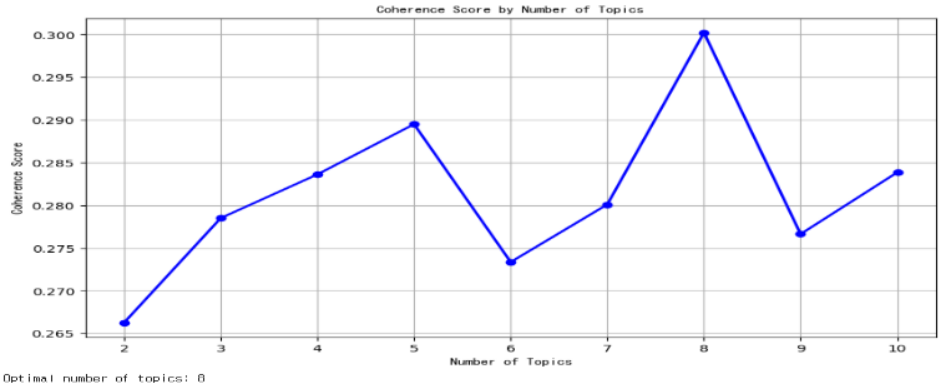

Fig. 6. Consistency score results of artificial intelligence policies by local governments in the central region.

Table 6. Topic modeling analysis results of artificial intelligence policies by local governments in the central region

Topic no.	Topic name	Term
Topic 1	Policies and data utilization for AI projects and industrial development (15.9%)	Artificial_Intelligence, Project, Institution, Industry, Platform, Corporation, Application, Policy, Data, Technology
Topic 2	AI-based quantum technology and voice recognition development with national support (12.4%)	Technology, Expertise, Artificial_Intelligence, Quantum, Integrated_Circuit, Technical_Qualification, Nation, Speech, Engineer, Conditions
Topic 3	State-led AI resource management and policy by the department of science and technology (4.6%)	Artificial_Intelligence, Smart, Technology, Ministry_of_Science_and_Technology, Nation, Resource, Policy, Focus, Application, Talent
Topic 4	Social cooperation and industrial development through AI and smart technology (2.2%)	Artificial_Intelligence, Smart, Collaboration, Society, Sector, Funding, Project, Corporation, Data, Platform
Topic 5	State-led development of the healthcare industry using AI and smart technology (64.9%)	Artificial_Intelligence, Smart, Corporation, Technology, Industry, Nation, Funding, Medical, System, Equipment

AI, artificial intelligence.

utilizing data, and building technology platforms.

Finally, Topic 5 is titled "State-Led Development of the Healthcare Industry Using AI and Smart Technology" and includes keywords such as healthcare, smart, state, and industry. This topic focuses on state-led efforts to advance the healthcare industry using AI and smart technology, emphasizing the roles of related companies and organizations, technology development and funding support, the establishment of medical systems and equipment, and the management of healthcare and technology-related data.

The results of the topic modeling analysis can be visualized as shown in Fig. 7. Examining the proportion of the five topics, "State-Led Development of the Healthcare Industry Using AI and Smart Technology" accounts for 64.9%, "Policies and Data Utilization for AI Projects and Industrial Development" for 15.9%, "AI-Based Quantum Technology and Voice Recognition Development with National Support" for 12.4%, "State-Led AI Resource Management and Policy by the Department of Science and Technology" for 4.6%, and "Social Cooperation and Industrial

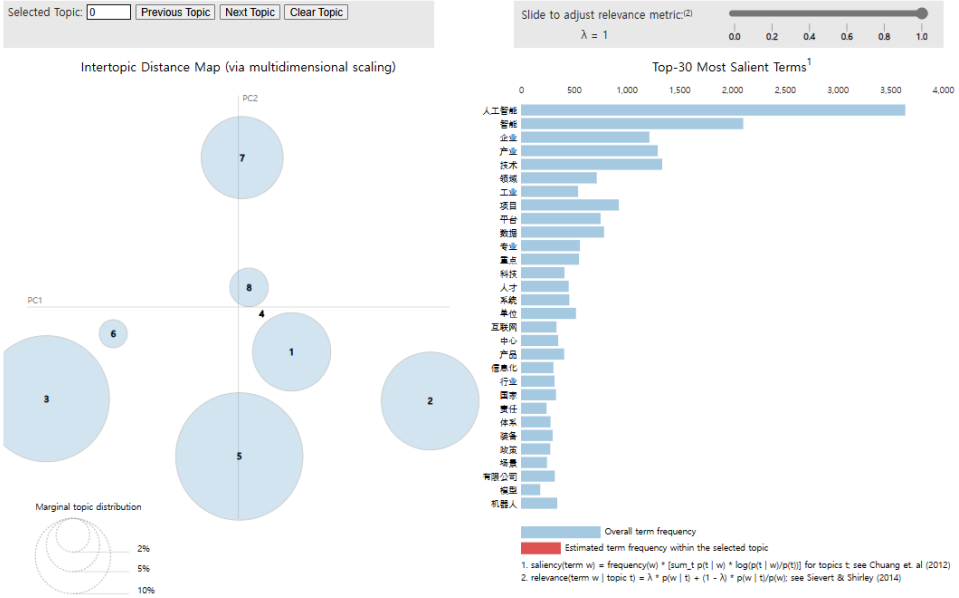

Fig. 7. Topic modeling analysis results of artificial intelligence policies by local governments in the central region.

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Development through AI and Smart Technology" for 2.2%. This indicates that in the AI policy documents of local governments in the central region, "State-Led Development of the Healthcare Industry Using AI and Smart Technology" is the most frequently addressed topic, highlighting a focus on developing smart healthcare services and exploring medical resources.

Western region

An LDA topic modeling analysis of 25 AI policy documents from local governments in the western region of China showed that the highest consistency score was observed in the range with three topics, as depicted in Fig. 8. Consequently, three were selected as the optimal number of topics, and a total of three topics was identified, as presented in Table 7.

First, Topic 1 is titled "State-Led AI Data Projects and Digital Government Policies" and includes keywords such as artificial intelligence, data, project, application, government, institution, and policy. This topic consists of policies that promote various projects using AI and data technology under state leadership, supporting technological development and application through related policies and digital government services.

Second, Topic 2 is titled "Economic and Social Development through AI: Utilization of Data and Resources" and includes keywords such as artificial intelligence, economy, society, data, and resources. This topic encompasses policies related to economic and social development using AI and data technology, applications in the industrial sector, resource management, epidemic response, and talent development.

Finally, Topic 3 is titled "National Policies and Funding Support for the Use of Artificial

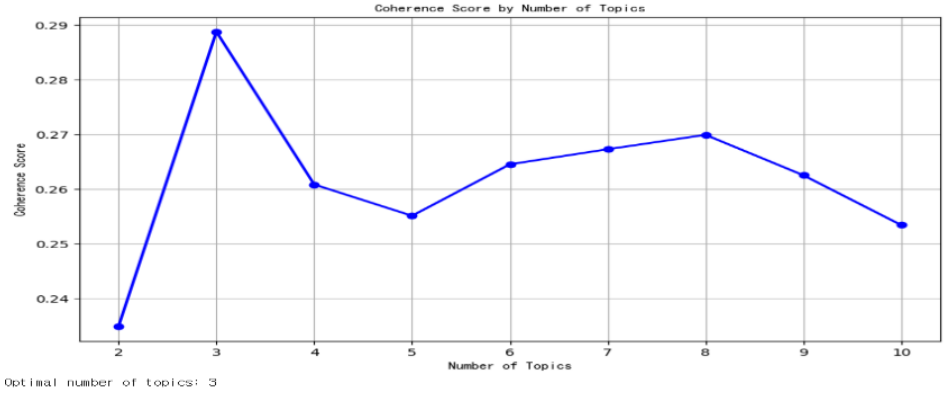

Fig. 8. Consistency score results of artificial intelligence policies by local governments in the western region.

Table 7. Topic modeling analysis results of artificial intelligence policies by local governments in the western region

Topic no.	Topic name	Term
Topic 1	State-led AI data projects and digital government policies (11.7%)	Artificial_Intelligence, Data, Project, Application, Government, Institution, Policy, Government Services, Digital, Policy
Topic 2	Economic and social development through AI: utilization of data and resources (50.4%)	Artificial_Intelligence, Data, Economy, Industry, Society, Resources, Pandemic, Informatization, Internet, Talent
Topic 3	National Policies and funding support for the use of AI and data in autonomous regions (37.9%)	Artificial Intelligence, Data, Corporation, Autonomous Region, Responsibility, Government, Funding, Policy, Part, Nation

AI, artificial intelligence.

Intelligence and Data in Autonomous Regions" and includes keywords such as artificial intelligence, data, autonomous regions, government, responsibility, and policy. The policies on this topic emphasize the responsibility and role of corporations in utilizing artificial intelligence and data technologies. They also highlight the policies and funding support at the national and autonomous region levels, as well as the role of relevant government departments.

The topic modeling analysis results can be visualized, as shown in Fig. 9. The examination of the proportions of the three topics revealed the following order of importance: "Economic and Social Development through Artificial Intelligence: Utilization of Data and Resources" (50.4%), "National Policies and Funding Support for the Use of AI and Data in Autonomous Regions" (37.9%), and "State-Led AI Data Projects and Digital Government Policies" (11.7%). This indicates that in the AI policy documents of the Western regional local governments, the topic "Economic and Social Development through AI: Utilization of Data and Resources" appears most frequently, highlighting a focus on social stability and economic development through AI technology.

The results of the topic modeling analysis of local government AI policies can be summarized as follows. First, the AI policy discourses and objectives in China's eastern region, where the AI industry is most developed, are the most diverse. According to the "2018–2019 China Artificial Intelligence Computing Power Development Assessment Report" published by the global IT analytics firm International Data Corporation (IDC), four of the top five cities leading in China's computing power—Hangzhou, Beijing, Shenzhen, Shanghai, and Hefei—are located in the eastern region. Both Shanghai and Zhejiang have announced investment plans of $3 million and $130 million, respectively, demonstrating their commitment to AI technology development. The economically affluent eastern region actively pursues technology support policies and investment attraction, with a particular focus on developing core technologies across the board.

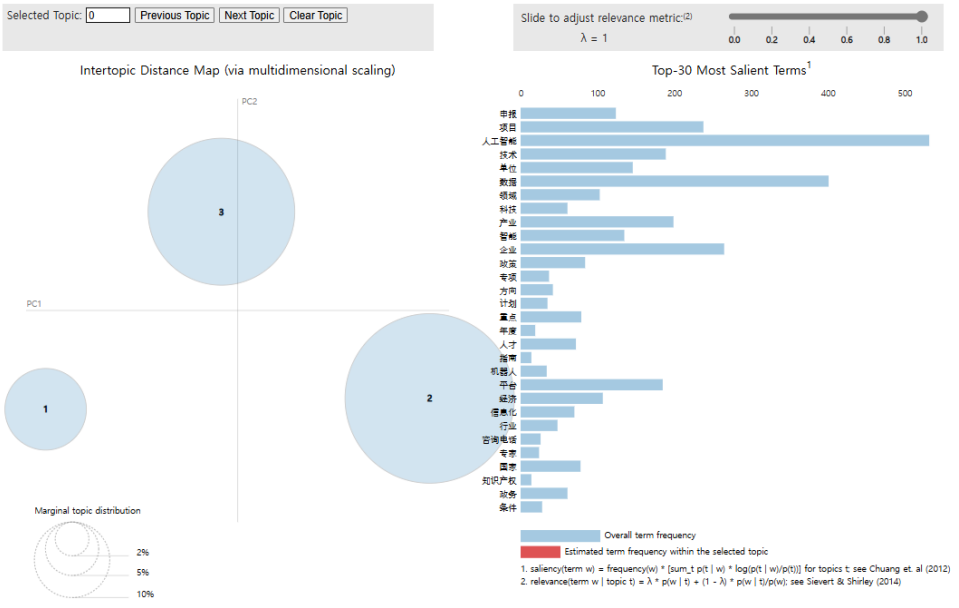

Fig. 9. Topic modeling analysis results of artificial intelligence policies by local governments in the western region.

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Second, China's central region is focusing on technology development in the healthcare and heavy industry sectors. In recent years, the establishment of medical security systems and the distribution of medical resources have been actively pursued in the central region. With the enactment of the "Basic Healthcare and Health Promotion Law" (基本医疗卫生与健康促进法) in 2019, efforts have been made to optimize the allocation of medical resources, such as mobile healthcare platforms, and improve the efficiency of medical services (APICloud, 2020). Additionally, AI technology is being integrated into the industrial environment, primarily focused on heavy industry, to accelerate the development of quantum technology and electronic circuits.

Finally, the AI policy discourses and objectives in the Western region are the most limited, primarily focusing on economic and social stability. Due to the region's weak industrial base and low level of healthcare economic development, AI technology is primarily integrated into the installation and use of industrial robots and management systems for preventing the spread of infectious diseases.

Discussion

Artificial intelligence (AI) has become a major factor in shifting global power dynamics in the era of the Fourth Industrial Revolution. In the international arena, China is competing with the United States for dominance in AI and has already surpassed the U.S. in many technological fields. This advancement is supported by the proactive backing of the Chinese government and a solid policy foundation.

Since Xi Jinping's rise to power, there has been a move towards centralization; however, efforts to institutionalize governance for an appropriate distribution of roles between the central and local governments are ongoing. This study analyzes AI policies from both the central and local governments in China to examine the patterns of policy diffusion and the central-local relationship. Additionally, to explore the impact of socioeconomic disparities between the eastern and non-eastern regions on policy design by policy actors, the study categorizes local governments into eastern, central, and western regions and derives AI policy discourses and objectives for each region. To achieve this, the study utilized data from the "China Legal Retrieval System" to conduct text mining and keyword topic modeling analysis on AI-related policy documents from May 2016 to 2024. The analysis results can be summarized as follows.

First, the Chinese central government's AI policy documents included major keywords on disaster response using AI technology and AI education for talent development. "Smart product manufacturing using algorithm-based AI technology" was identified as a major policy objective, indicating a focus on developing radiological diagnostic technologies and image recognition technologies.

Second, the diversity of policy discourses and objectives in local governments decreases from the eastern to the central to the western regions. The AI policy discourses and objectives in the eastern region, where the AI industry is most developed, are the most diverse, with a strong focus on developing core technologies across various fields. The central region emphasizes technology development in healthcare and heavy industry, particularly in building medical security systems,

distributing medical resources, and developing quantum technology and electronic circuits. In contrast, the AI policy discourses and objectives in the western region are the most limited, primarily focusing on economic development and social stability.

This study offers two key insights. First, from an academic perspective, the study identifies the AI policy discourses and objectives of China's central and local governments, thereby exploring the patterns of policy diffusion according to policy actors. Furthermore, it demonstrates the existence of a division of labor and cooperation between the central and local governments in the AI sector. Second, from a methodological standpoint, the study employs text mining and topic modeling analysis on Chinese policy documents, which is expected to contribute to the expansion of methodologies for future research on China.

This study has some limitations. While it conducted text analysis on policy documents, it did not examine the interactions between actors in the specific policy decision-making process. Additionally, although the study assumed the existence of policy diffusion at the local government level, it did not determine whether the role of local governments is limited to policy implementation or extends to policy decision-making. Continuous research covering the entire process of policy formulation, implementation, and evaluation in China is necessary.

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