Research on dynamic perception and early warning technology and legal regulation of risk management in grass-roots social grid empowered by generative artificial intelligence

Lanping Kang[1], Anxiang Gu[2,*]

[1]School of humanity and Law, Hefei University of Technology, Hefei, Anhui, 230009, China
[2]School of Management, Hefei University of Technology, Hefei, Anhui, 230009, China

*Correspondence: gax604@126.com; Tel.: +86-551-62901956

Abstract. The specific contents of the new era Fengqiao experience mainly include upholding the party's mass line, correctly handling contradictions among the people, relying on the masses, and resolving issues locally. These aspects not only reflect the core concepts of grassroots social governance but also represent the inheritance and development of the traditional "Fengqiao experience".Grass-roots social grid governance is the innovative development of "Maple Bridge Experience" in the new era, and it is also the concrete embodiment of the modernization of grass-roots social governance system and national governance capacity. In recent years, Dongcheng District of Beijing, Zhoushan City of Zhejiang Province, Zhuji City, Changning District of Shanghai and other places have successively implemented grid governance of grass-roots society, making "small grid" play a "big role" in grass-roots governance and service, and really get through the last mile of serving the masses. Subsequently, the grass-roots social grid governance model blossomed all over the country, and digital and information technology was continuously introduced in the follow-up practice, showing a trend of "grid+digitalization+refinement". The introduction of digital technology has greatly improved the quality and efficiency of grid governance in grassroots society. Generally speaking, it is a bottom-up practice-oriented development to use digital technology in grass-roots social grid governance in various places, which has achieved remarkable results, but it is difficult to form a set of replicable and popularized experiences due to the lack of systematic, legal, standardized, refined and practical thinking. Therefore, on the basis of clarifying the technical problems and rationalizing the operation mechanism, it is necessary to raise the practical experience to a theoretical and normative level, build a model of grass-roots social grid governance mechanism, including multi-collaboration, consultation and judgment, and democratic consultation mechanism, and formulate guiding norms for grass-roots social grid governance. Especially, it explores the dynamic early warning, forecasting, monitoring and legal regulation scheme of grass-roots grid governance driven by the generative big model. Through the generative artificial intelligence technology, we can more accurately and quickly perceive various risks and dynamic changes in the grass-roots social grid. Empowering

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through technology will help managers find problems early and respond in time, thus improving the efficiency and accuracy of governance.

Keywords: generative artificial intelligence; Grass-roots grid governance; Dynamic forecasting and early warning; Legal regulation

1 Introduction

With the rapid development of information technology, Generative Artificial Intelligence (AI), as a cutting-edge technology, has gradually shown a wide range of application potential in various fields. In the field of grass-roots social grid governance, the application of generative AI not only improves the efficiency and accuracy of governance, but also promotes the innovation and upgrading of governance model[1]. The overall goal of this project is to provide key technical support, normative standards and implementation scheme of rule of law for dynamic early warning and legal regulation of grass-roots social grid governance under the background of generative artificial intelligence. Specifically: (1) In order to promote the modernization, standardization and legalization of grass-roots social grid governance, a set of replicable and popularized grass-roots social grid governance mechanism model and guiding norms will be constructed at the top-level design level. (2) On the technical level, we should deepen the application of modern technologies such as big data, cloud computing and artificial intelligence in the grass-roots social grid governance, and realize the digitalization and intelligence of the grass-roots social grid governance, including: ① researching a new model of community governance with democratic consultation, social coordination and public participation; (2) Build a corpus of grass-roots social grid governance, build a coding system of social governance elements, and conduct full-cycle early warning and risk assessment; ③ Study the methods of association, convergence and fusion of social spatio-temporal big data; ④ Research on multi-parameter accurate detection and multi-element ubiquitous sensing technology of community hazards; ⑤ Study the standards and specifications of event classification, build a unified event distribution platform, and realize the whole life cycle management of events; ⑥ Study the evaluation technology of the hazard index of the portraits of key personnel, and establish the classification and grading management and control system and trajectory analysis system; ⑦ Study the integrated middle platform technology with common supporting ability and integrating the existing grass-roots service applications and carry out application demonstration. (3) Application scenarios and research progress: ① Social event prediction and dynamic perception. The application of generative AI in social event prediction can effectively predict major events that may occur in the grass-roots social grid, such as community conflicts and public health events, through the study and simulation of historical data. The research shows that by combining deep learning model and real-time data stream, generative AI can improve the accuracy and timeliness of forecasting and provide early warning and decision support for managers. ② Data-driven intelligent decision support system. The application of generative AI technology is also reflected in the design of intelligent decision support system. Based on big data

analysis and generation model, these systems can extract patterns and laws from massive data and provide personalized decision-making suggestions and action plans for grassroots managers. For example, the demand of community residents is predicted and analyzed by generating models, and the allocation of social resources and the provision of services are optimized. ③ Data privacy and legal regulation challenges. The application of generative AI in grass-roots social grid governance is also facing the challenges of data privacy protection and legal regulation. With the increase of data collection and analysis, personal privacy protection has become an increasingly important issue. The research points out that it is necessary to establish a sound legal framework and technical safeguard measures to ensure the legal and compliant application of generative AI, while balancing the relationship between innovation and personal privacy protection. To sum up, the application of generative artificial intelligence technology in grass-roots social grid governance not only improves the governance efficiency and resource utilization efficiency, but also promotes the modernization and intelligent transformation of governance mode. Future research needs to further deepen the understanding of the application effect and social impact of generative AI in different governance scenarios, and actively explore the coordinated development path of technology and legal regulation, so as to provide early warning indicators and visual decision-making for the sustainable development of social governance and emergency management of megacities[2].

2 Literature Review

(1) In the field of big data coding in grass-roots grid, there are currently three modes of collecting governance data by digital technology in China: ① grid workers visit and check regularly, and then record and report to the community through APP; ② Through the establishment of WeChat group, community residents can immediately reflect their demands, and community cadres can collect information in time; ③ Use intelligent access control system, street monitoring system and 110 alarm system to collect data information on community security, property management, community service and key personnel control. Generally speaking, there is a lack of unified data coding and data standards for collecting grassroots governance data by digital technology in China, which is not conducive to the expansion of digital applications and cross-system connection and integration. Therefore, a unified "block data" standard and element coding system for grassroots social governance elements should be compiled as soon as possible in the future.

(2) In the field of hazard perception in grass-roots communities, most of China pays attention to the collection of all kinds of governance business data, but less attention to the collection of social hazard data, which is not conducive to the prevention and control of emergencies. On the technical level, it is relatively developed outside the country. For example, Figaro Company of Japan specializes in researching and producing different types of gas sensors, which are widely used in environmental monitoring, safety protection and other fields. However, the company mainly focuses on improving the detection performance of a single gas sensor, lacks the integrated and multi-

parameter detection capability, and has a single function, which makes it impossible to achieve all-weather accurate state monitoring and early warning. Therefore, China should focus on multi-parameter accurate detection and multi-element ubiquitous sensing technology of community hazards in the future[3].

(3) In the field of spatio-temporal big data technology of grass-roots grid governance, at present, data from different sources in China can not be smoothly shared and communicated, and the "island effect" of data is still unresolved, which may limit the development of social digital governance. There have been studies on this outside the domain. For example, Amazon Company of the United States has studied a variety of data association and fusion technologies and developed a unified data storage platform (AWS Data Lake). However, this technology has limitations in data processing types and data storage. Therefore, in the future, it is necessary to focus on the research on the correlation, aggregation, fusion methods and integrated modeling technology of multi-source, dynamic, heterogeneous and massive social spatio-temporal big data and grass-roots social grid governance business data[4].

(4) In the field of distribution of grass-roots social governance events, the research on distribution, disposal and assessment of existing grass-roots social governance events is relatively loose and cannot form a complete technical system. In the distribution stage, the existing event classification methods rely on the experience and knowledge of the event handling department, which can not realize automatic processing and optimize the classification of events, and only judge according to a single event, ignoring the correlation between events; In the disposal stage, the available resources of various departments are not fully dispatched, so it is difficult to achieve efficient coordination across departments and dynamic adjustment and optimization of event handling schemes; In the assessment stage, it is mostly based on the satisfaction of the object of event handling, and there is no multi-angle comprehensive assessment of the event. Therefore, it is necessary to deeply develop the unified distribution platform of grassroots social governance events and realize the whole cycle management of events[5].

(5) In the field of grass-roots grid classification and hierarchical control, during the epidemic prevention and control, China has made a major breakthrough in using digital technology to control key personnel. For example, Aerospace Smart Company developed and launched the functional module of "Focus on Personnel Management and Control" in the grid-based grassroots social governance platform in Jiangdu District of Yangzhou City, realizing zero blind area and full coverage of epidemic prevention and control. Further development of this experience can effectively promote the modernization of grassroots social governance. On the one hand, broaden the scope of key people, such as community prisoners, drug addicts, severely mentally ill people and people in need of help, so as to make grassroots social governance more comprehensive. On the other hand, develop and improve portrait recognition technology, trajectory analysis technology, risk pre-judgment evaluation technology, etc., and build an accurate and efficient management and control service system focusing on personnel classification[6].

(6) In the field of building the middle platform of social grid governance at the grass-roots level, the technology is currently in the initial experimental stage, which mainly

shows as follows: ① advocating the top-level design idea of data middle platform and business middle platform and adopting the design mode of "data governance+cloud platform"; ② The traditional B/S architecture has been transformed into microservices and general big data components such as Hadoop, that is, the architecture design of "microservices+big data platform"; ③ The new architecture mode of "data center+business center +AI center". In the future, it is necessary to study and integrate the integrated middle platform technology of existing grass-roots service applications, build a data resource model of grass-roots social grid governance collaborative middle platform, develop a grass-roots social grid governance middle platform with common collaborative support ability and common governance, build a "one network unified management" portal for grass-roots governance, and carry out application demonstrations. The future development direction of grass-roots social governance is the mode of "integrated information system+integrated command center". Aiming at the difficulties and pain points in the current grass-roots social grid governance, this project will build a set of digital key technologies for grass-roots social grid governance, build a set of grass-roots social grid governance mechanism on the top-level design, technically build a social governance coding system, ubiquitous perception and accurate governance of big data, event distribution and full-cycle management, improve the ability of event classification and management, build a middle platform with commonality and synergy, and realize "one network unified management" for grass-roots governance.

(7) Application scenarios and research progress of dynamic early warning technology: ① Prediction and trend analysis of social events. A key application of generative AI in grass-roots social grid governance is the prediction and trend analysis of social events. By combining historical data with real-time data streams, generative AI can identify potential social event patterns and predict the possible event types and influence ranges. This ability not only helps to take preventive measures in advance, but also optimizes resource allocation and emergency response strategies. ② Emergency monitoring and early warning system. Generative AI technology is also applied to the monitoring and early warning system of emergencies in grass-roots social grid. Through the integration and analysis of multi-source data (such as social media information and sensor data), the system can monitor and identify abnormal situations in real time, such as natural disasters and public safety incidents, so as to issue early warnings in time and assist decision makers to take effective measures. ③ Data-driven intelligent decision support. Generative AI is not only limited to event prediction, but also can provide personalized data analysis and decision-making suggestions for grassroots social grid administrators through intelligent decision support system. Based on big data analysis and generation model, these systems can extract key information from sea volume data and help decision makers to formulate more scientific and accurate governance strategies. ④ Legal regulation and technical challenges. Although generative AI shows great potential in dynamic early warning technology, its application also faces many legal and ethical challenges. Especially in data privacy protection, algorithm transparency and responsibility sharing, it is necessary to establish a sound legal framework and technical standards to ensure its legal, fair and transparent application.

3 Research Design

3.1 The Main Research Content of the Project

(1) How to build a new model and mechanism of grid governance in grass-roots society? How to build a mechanism model of multi-collaboration, consultation and judgment, democratic consultation and other systems in grass-roots social grid governance? How to synthesize the existing grass-roots social governance system to formulate the guiding norms of grid governance? (2) How to unify and standardize multi-source heterogeneous and coded data identification? How to support the intelligent application of grassroots social grid governance from the structural level of big data coding? How to standardize the methods and steps of grass-roots social governance with different processes, standards and forms? (3) How to uniformly represent multi-source heterogeneous data to support accurate governance? How to realize data association, unified storage and intelligent fusion for grass-roots social grid governance? How to break the data barrier and realize data interconnection? (4) How to realize accurate positioning and early warning of hazard sources in grass-roots communities? How to improve the ubiquitous perception and precise governance ability of big data in grassroots social grid? (5) How to construct the standard of event classification and realize the whole life cycle management of events? How to unify the classification standards of various events? How to realize the full-cycle management of events and its closed-loop optimization based on unified standards and norms? (6) How to control key personnel by digitalization, differentiation and classification? How to use digital technology to improve public security prevention and control ability? How to implement classification, dynamic service and accurate management and control mechanism for key personnel? How to analyze and evaluate high-risk personnel and key personnel? (7) How to construct the integrated platform technology of grid governance in grass-roots society and combine it with grass-roots service applications? How to use multi-source heterogeneous data in grass-roots social grid governance to realize the universality, common governance and sharing of the whole link in an integrated digital middle station? How to realize the application demonstration of "one network unified management" for grassroots services?

3.2 Key Technical Problems to be Solved

(1) Based on the "principal-agent" model, how to construct an analysis model of social utility maximization mechanism of grass-roots social grid governance? Based on the framework of maximizing social benefits, how to build a mechanism model such as information multi-collaboration, intelligent consultation and judgment, and intelligent democratic consultation? (2) How to extract data from multi-source information to meet the digital needs of grass-roots social grid governance business? How to build an efficient structured and modular data coding system? How to design data standard specifications and management standard specifications with wide applicability (3) How to construct accurate association, unified storage and intelligent fusion of social spatio-temporal data and business data? How to achieve accurate governance of grassroots

social grid driven by big data? (4) How to combine new micro-nano sensors and intelligent algorithms such as machine learning to realize accurate positioning and early warning of hazards in complex environment, so as to improve the ubiquitous perception ability of hazards? (5) How to solve the problems of extraction and unified representation of multi-source and cross-domain standard common information, as well as the effective mining and collaborative disposal of event elements, development models and related relationships? (6) How to integrate the relationship between people and events, and study the full link prediction model of the relationship between people, events and places? How to build a key personnel management and control system for feature tag extraction for decentralized multi-modal heterogeneous dynamic grass-roots communities? How to evaluate the high-risk population with multi-dimensional and digital risk index? (7) How to build a grass-roots social grid governance platform and its application demonstration based on distributed micro-service integration? How to realize the semantic technology based on deep integration of multi-source heterogeneous full-link big data, NLP and knowledge map?

3.3 Research Methods and Technical Route Ideas Include

(1) The multi-sensor technology of community hazards is studied, and the response characteristics of micro-nano structures are discussed based on new sensors with different micro-nano structures; The preparation method and sensitization performance of new nano-functional materials are studied to realize accurate detection of various hazard parameters such as position, temperature, humidity, air pressure and hydrogen concentration. (2) Develop an integrated sensing system for monitoring community hazards, study the miniaturization and integration methods of the sensing system, and realize real-time monitoring of multi-parameters of community hazards; Based on algorithms such as deep learning, multi-sensor feature extraction and data analysis are realized, and a monitoring system for all-weather monitoring and early warning of community gas is built. (3) Study the unified representation model of social spatio-temporal big data to effectively represent its inherent semantic information; This paper discusses the association method of social spatio-temporal big data, deeply excavates the semantic association characteristics and similarity between social spatio-temporal big data, and realizes the accurate association of data. (4) Explore the unified storage model of heterogeneous spatio-temporal big data and build a unified data interface; Design a hybrid storage index to provide efficient access and management of heterogeneous spatio-temporal big data, and support efficient complex related queries and interactive real-time analysis. (5) Study the fusion technology of multi-source heterogeneous big data, and organize the data effectively by using preprocessing technology; Discuss data exchange and sharing technology, abstract data entities, support entity disambiguation, reference resolution and entity unification, and ensure data consistency; Build a data fusion system/platform to provide data retrieval and display functions for grass-roots social grid governance[7].

4 Primary Results

Topic 1: Research on the Governance Mechanism Model of Grass-roots Social Grid. (1) By analyzing the characteristics of typical scenes of grass-roots grid governance, based on the mechanism model, this paper analyzes the optimal strategies that may be adopted by grass-roots governance implementers at all levels, and how these strategies affect the overall social utility, so as to construct the social utility maximization mechanism analysis model of grass-roots social grid governance; (2) Based on the framework of maximizing social utility, this paper studies and constructs the mechanism models of information multi-collaboration, intelligent consultation and judgment, intelligent democratic consultation, etc. in grass-roots social grid governance, and applies them in real scenes. (3) According to the mechanisms of information multi-collaboration, intelligent consultation and judgment, intelligent democratic consultation, the guiding norms of grass-roots social grid governance are formulated.

Topic 2: Research on the coding system of grass-roots social grid governance. (1) For multi-source data and grass-roots social grid governance business process, research the design and implementation technology and method of template data dictionary and coding system, covering residents, actual population, key population and other categories of content, coding level is not less than 3, covering at least 10 kinds of grass-roots public service governance elements, including: communication, urban management, education, training, health, social security, vehicle traffic, water and electricity, market supervision, etc. (2) To form an information coding system and standards to support the digital application of grass-roots social grid governance; Study the definition method of structural information and data and the analysis method of coded data under the functional framework of grid governance in grass-roots society, and form an adaptive coding structure to support the digital application of grid governance in grass-roots society; (3) Construct data standards and specifications related to social grid governance at the grass-roots level, and compile management standards and specifications based on business processing mechanism and modular "block data" form of process[8].

Topic 3: Research on Ubiquitous Perception and Accurate Governance of Big Data in Grassroots Social Grid. (1) Research the multi-sensor technology of social hazards for multi-parameter detection, and develop a high-performance sensor combining micro-nano electrode design, processing and interface assembly of sensitized nano materials to realize accurate detection of various hazard parameters; (2) Develop an integrated intelligent sensing system, study the feature extraction and analysis algorithm based on multi-parameter sensing, design the community gas leakage detection algorithm and build a monitoring platform to realize all-weather monitoring and early warning of community gas leakage; (3) Study the association method of social spatio-temporal big data, based on the unified representation of social spatio-temporal big data, deeply explore the semantic association characteristics between data, break down data barriers, and realize data interconnection; (4) Explore the unified storage model of spatio-temporal big data, provide a unified data interface, design a hybrid storage index, and realize efficient query and analysis; (5) Propose multi-source heterogeneous big data fusion technology to realize data exchange and sharing, support entity disambiguation, reference resolution and entity unification, and maintain data consistency.

Topic 4: Research on the Distribution Platform of Grass-roots Social Governance Events and Whole-cycle Management. This topic mainly studies the distribution platform and full-cycle management of grass-roots social governance events, providing the standard and specification of event classification and full-cycle management technology support for the whole project; (1) An integrated standard for event collection, distribution, disposal and assessment will be established; (2) Research the intelligent event allocation method, and realize the effective extraction of event element information and correlation and intelligent event allocation in time-sharing and batch; (3) Study the method of collaborative disposal and optimization of events, formulate the disposal scheme according to the event elements and classification, and realize the dynamic optimization of the disposal scheme based on assessment; (4) Study the multi-dimensional event assessment method, design a comprehensive and complete event assessment mechanism and an automatic assessment report generation method; (5) Integrate the above technologies, and develop a platform for the distribution and full-cycle management of grassroots social governance events.

Topic 5: Construction of the classified management and control system for key personnel and the middle platform of grass-roots social grid governance: (1) Establish the portraits of key personnel's attributes and behaviors, and explore the hazard index evaluation technology to deal with early warning risk sources; (2) Study the personnel classification and alarm system in social governance, accurately identify key personnel through the holographic portrait intelligent system, and classify and control potential social hazards and those who need help; (3) Using digital detection system to classify and evaluate the risk degree of key personnel, and construct a scientific and feasible evaluation technology system; (4) Through trajectory recognition and portrait recognition of key people, the abnormal trajectory and abnormal behavior are forewarned and analyzed; (5) Building an integrated platform of grassroots social grid governance with data cleaning, data standards, data quality and data exploration as the whole link in data governance; (6) Aiming at the multi-source heterogeneous data of grass-roots social grid, this paper puts forward the integrated platform technology and application service platform of grass-roots social grid governance based on knowledge map and natural language understanding technology, depicts the data resource model and business model, and provides application verification support for the whole project with concepts, entities, events and their relationships; (7) On this basis, aiming at the relationship prediction model driven by time, event and place of data flow, the technologies of knowledge representation, knowledge extraction, ontology construction and knowledge reasoning are realized. (8) Build a demonstration of the application of "one network unified management" in grass-roots social grid governance based on distributed microservice architecture.

Grid governance at the grassroots level is a new social governance model that divides urban communities into several grids and uses information technology and grassroots resources to provide services and management. The following are some practical experiences accumulated in the implementation of grid governance in areas like Beijing Dongcheng District, Zhoushan City in Zhejiang Province, Zhuji City, and Shanghai Changning District:(1)Clear Division of Grids and Responsibilities: Based on local characteristics, each area is divided into different grids according to geographical

location, population density, management needs, and other factors. Each grid is equipped with full-time or part-time grid members who are responsible for collecting public opinions, reporting information, mediating disputes, and other tasks to ensure clear governance responsibilities and specific tasks.(2)Information and Intelligent Management: Many areas leverage technologies such as big data, cloud computing, and the Internet of Things to build grid governance information platforms that enable real-time data collection, analysis, and sharing within grids. Through mobile terminal devices, grid members can report issues at any time, and managers can respond promptly, enhancing service efficiency and precision in problem-solving.(3)Diversified Linkage and Coordination Mechanisms: A "grid + department" linkage mechanism is established, integrating the forces of multiple departments such as public security, community services, environmental protection, and health into the grid governance system, creating a synergy for grassroots social governance. Various functional departments respond quickly to issues reported by grid members, forming a closed-loop governance model of "identifying problems - reporting problems - solving problems."(4)Community Participation and Co-Governance: Emphasis is placed on encouraging residents and social organizations to participate in grid governance, fostering a sense of community ownership. By establishing resident councils and community volunteer teams, residents become not only beneficiaries of governance but also key stakeholders, working together to maintain community safety and order.(5)Enhancing the Quality and Capabilities of Grid Members: Local governments focus on the professional development of grid members by providing regular training and assessments to enhance their understanding and practical skills in grassroots governance. Grid members serve as multifunctional roles, including information collectors, communicators, service providers, and coordinators, effectively expanding the scope and precision of grassroots governance and services.

These practices demonstrate that grid governance not only effectively improves the refinement and precision of grassroots social governance but also bridges the "last mile" of service to the public, becoming a powerful tool for innovative grassroots governance.

4.1 The Key Points to be Broken Through in this Topic Are

Focus 1: Research on the integration platform and application demonstration of grassroots social grid governance. Aiming at the key problems of grass-roots social grid governance, such as single application, single function and difficulty in coordination, a set of grass-roots social grid governance application platform based on distributed micro-service architecture is integrated. Aiming at potential social hazards, a classified management and control system is established by machine learning and IDMAPPING technology, including full-cycle management of events, and a visual framework with modules as service units provides common business construction such as unified portal, situation display of people and events, information interaction, service push, unified information reporting, risk discovery, and incident handling, and supports the construction of at least 20 typical governance business models such as community key personnel management, social hazard management, and commercial subject supervision.

Focus 2: This topic puts forward a model of grass-roots grid governance based on information multi-collaboration, intelligent consultation and judgment, and intelligent democratic consultation mechanism. On the one hand, the adaptive training of intelligent collaboration and consultation system forms a negative time lag, that is, the prediction time lag; On the other hand, the phase difference between implicit factors and observed factors causes negative time lag. Generative large model algorithm can describe all the above situations comprehensively and clearly, visualize the intermediate product of social grid governance process well, is a means to guide practice through quantitative indicators, is a scientific and effective method of computational sociology, and is helpful to the design and optimization of intelligent grid governance system, social public opinion analysis and dynamic governance, smart city and sustainable governance.

4.2 The Difficulties to be Broken Through in this Topic Are

Difficulty 1: Solve the problem of deep integration of semantic information and deep integration of semantic relationship between multi-source heterogeneous data islands, data chimneys and fragmentation in grass-roots social grid. Multi-source heterogeneous data in grass-roots social grid has the characteristics of voice, text and image acquisition and reporting structure, semi-structure/structure information and data diversity and complexity, which makes it difficult to unify data standards, effectively express text semantic information, obtain knowledge representation and infer the existence of implicit semantic relationship in ontology, and then realize the deep fusion representation and calculation of semantic information and semantic relationship.

Difficulty 2: Solving the problem of efficient and common collaboration between Taiwan and grass-roots service applications in the integration of grass-roots social grid governance: deeply analyzing the business attributes such as social hazards and key people in the community, how to find the relationship prediction model driven by events, people and places, and how to realize the typical governance business model and build a common business model are all thorny and "stuck" problems in this field. Therefore, how to effectively build a distributed micro-service architecture, co-manage and share an integrated digital platform and knowledge map application platform is an urgent problem. At the same time, the smart governance model of "one network unified management" for grassroots social grids in megacities is developed.

Difficulty 3: Building a digital panorama of grass-roots society. Digital technologies such as ubiquitous perception of big data and standardized coding provide it with all-round technical support, making digital governance reform a reality. At the same time, due to the immature technology and algorithm dependence, the digitalization of grass-roots social grid governance has also brought multiple risks from the technical and legal levels. The regulatory path should adhere to the principle of balance between governance needs and personal information protection, improve the security system of governance data, construct the regulatory system of technical governance at multiple levels, determine responsibilities as the main body of collaborative governance, and promote the construction of substantive participation system of social governance. Realize the multiple perception of hazard sources in grass-roots communities. Aiming at the

problem of accurate location and real-time warning of hazardous sources, a multi-parameter integrated intelligent sensing system is developed, and the miniaturization design method of the system is studied and optimized to realize multi-parameter, accurate and real-time monitoring of community environment. Combined with intelligent algorithms such as neural network and deep learning, the intelligent feature extraction and analysis of multi-sensor response are realized, which improves the anti-interference ability and identification accuracy of hazardous source identification, solves the technical problems of low accuracy and slow response of hazardous source identification in complex environment, and provides technical support for digital management and safety protection of grassroots communities.

5 Conclusions

Innovation 1: Research the precision governance technology of big data in grass-roots social grid, establish a new method of big data association, unified storage and intelligent integration for grass-roots social grid governance, and build a modern social governance system with precision, transparency, convenience and full coverage as the core. Aiming at the association of big data, a unified representation model based on temporal information is designed to solve the problem that the existing representation methods are not easy to be unified because of the heterogeneous underlying characteristics of social spatio-temporal big data, and support the unified representation of data in dynamic scenes; Based on this, the semantic information contained in data and the similarity between data are deeply mined, and the similarity calculation is accelerated without losing the association accuracy, so as to realize efficient data association. Aiming at unified storage, the unified storage model and access interface, mixed storage index, complex query and real-time analysis methods based on spatio-temporal data and grid data are studied to solve the problem that the existing technology can not support the unified and efficient storage, query and analysis of spatio-temporal big data in heterogeneous society; Aiming at intelligent fusion, this paper discusses the methods of multi-source data organization and management, cleans data entities through data sharing and exchange, so as to solve the difficulties of data sharing and application caused by information islands, and builds an application and display platform/system for grassroots social grid data fusion, which provides technical support for digitalization of social grid data governance.

Innovation 2: Study the common characteristics and differences of multi-source and cross-disciplinary grass-roots social governance events, explore the standardized disposal theory of grass-roots social governance events, and lay a legal regulatory foundation for realizing the digitalization of grass-roots social grid governance in China; In terms of standards, we will realize the integration of standards and norms of multi-source and cross-disciplinary grassroots social governance events, unify national standards, regional standards and industry standards, and build a unified classification and classification standard and norms covering contradictions and disputes, hidden problems, mass demands, administrative law enforcement, public services and other typical grassroots social governance events; In terms of technical methods, based on the

established standards and norms, we can accurately obtain social governance elements such as people, places, things, things and organizations, analyze and explore the development trend of events and the relationship between events, realize intelligent classification and classification of events, formulate a multi-department collaborative disposal scheme, and dynamically adjust according to the development and evolution of events, so as to realize the full-cycle management and closed-loop optimization of grassroots social governance events, effectively improve the efficiency and level of event handling, and build a basic foundation for grassroots social event management. In the application of results, it studies how to use text mining and sentiment analysis technology to analyze the public opinion dynamics and public opinions in grid governance, and explore the design of dynamic governance mechanism based on public opinion data, including how to respond to public opinion, policy adjustment, transparency of grid governance, and legal protection.

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