数据驱动下应急管理的实践需求与理论前瞻：
2023 年"万众杯"应急管理数据分析大赛

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摘　要：为了解决数据驱动下应急管理面临的应急数据严重异构、跨部门应急业务数据缺乏共享等实践难题，充分发挥社会救援力量在应急抢险救援中的作用，建立大安全大应急框架，东北财经大学公共管理学院、大连万众应急救援队和《运筹与管理》编辑部共同发起"万众杯"应急管理数据分析大赛。大连万众应急救援队为参赛者提供自2020 年以来近 5000 余次救援/培训任务的相关数据，每份数据涉及求助信息记录、任务指派和调度记录、队员出勤和参与情况、出勤资源配置记录和任务执行结果等要素。欢迎国内外研究人员利用这些应急救援数据集，围绕着大安全大应急框架下防灾减灾下沉基层的实施路径、政府部门与非政府组织目标差异下的应急救援任务协调、大安全大应急框架下社会救援力量的参与途径、互联网时代下社会公益救援组织的运行模式优化、政府数据与资源开放和共享的应急数据治理、数据驱动下走失人员追踪搜救措施优化和基于 GIS 的城市急救资源优化配置等实践需求，开发质性研究、计量经济模型、数据驱动的优化技术、社会仿真模型和智能算法设计等，着力解决数据驱动下应急管理的实践需求，并做出适度的理论前瞻。

关键词：应急管理；数据驱动；数据分析大赛；实践需求；社会救援力量

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Practical Demand and Theoretical Prospect of Data-driven Emergency Management：
2023 "Wanzhong Cup" Emergency Management Data Analysis Competition

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Abstract：**Motivation**：The 20th National Congress of the Communist Party of China（CPC）has made strategic arrangements to "improve the level of public safety governance", with one of the important tasks being to "establish a comprehensive safety and emergency framework and improve the public safety system". Given China's vast territory, large population, and diverse types of disasters, the task of preventing and responding to disasters is extremely demanding. The Chinese government adheres to the principle of putting people first in disaster relief work and fully leverages the institutional advantage of socialist "mobilizing resources for major undertakings". Social rescue forces are an important complement to professional rescue forces and play a significant role in establishing a closely coordinated mechanism for emergency response to disasters. In recent years, China's social rescue forces have continuously grown and developed, playing a crucial role in strengthening the foundation of disaster prevention, mitigation, and relief, promoting popular science knowledge, and engaging in emergency rescue operations. They have become an integral part of the emergency rescue system. However, the "14th Five-Year National Comprehensive Disaster Prevention and Mitigation Plan"（National Reduction Letter［2022］）still emphasizes that China currently faces issues such as the need to improve coordination and coordination mechanisms, the inadequacy of mechanisms such as social mobilization to adapt to new situations and requirements, and insufficient application of new technology and techniques. From the perspective of emergency management, the aforementioned issues reflect the imperfect mechanism and unclear path of social participation under the government-led disaster management model in the current stage. There is a need to optimize the management processes of social rescue organization and address issues related to the incomplete effectiveness of new technolo-

gies such as GIS and artificial intelligence. It is necessary to further strengthen organizational guidance, standardize rescue operations, enhance capabilities, and promote the greater role of social rescue forces.

Dalian Wanzhong Emergency Rescue Team was established in April 2015 and has been in operation for 8 years. Since its establishment, the team has been committed to emergency disaster relief, urgent rescue operations, social assistance, public promotion of disaster prevention and mitigation skills, and providing security for large-scale mass activities. Its goal is to promote the development of non-governmental public welfare rescue undertakings and become a professional, standardized, and standardized rescue organization covering various fields such as life rescue, humanitarian assistance, and disaster prevention. Over the years, it has become a collaborative unit of the Liaoning Provincial Public Security Department's Patrol and Special Police Brigade, Liaoning Maritime Search and Rescue Center, Dalian Maritime Search and Assistance Center, provincial, municipal, and district emergency departments, 110 command centers, armed forces, maritime police, and border police. It undertakes emergency warehouse management services for the Jinpu New Area Development and Reform Bureau and has established cooperative relationships with several universities, including Dongbei University of Finance and Economics, Dalian Jiaotong University, and Dalian Community College. The team has basic equipment and various vehicles used for training in urban search and rescue, earthquake rescue, water rescue, mountain rescue, and pre-hospital emergency care, with a total value of over 5 million yuan. It currently has more than 3 000 active volunteers, including nearly 100 professional rescue personnel with national qualifications. Since the recording of rescue operations began in March 2018, as of May 2023, the team has carried out over 3 400 rescue operations, saving more than 300 people, and assisting in the search for nearly 2 000 missing persons.

The participation of social forces in emergency rescue under the framework of comprehensive security and emergency response has positive significance. Due to the potential negative impacts of human activities on disasters, the management of social rescue forces becomes particularly important. Firstly, the participation of social forces can expand the scope and scale of rescue resources. Not only government departments but also volunteer organizations, non-governmental organizations, businesses, and ordinary citizens can provide rescue resources and assistance, increasing the strength of rescue operations. Secondly, the participation of social forces can improve the response speed of emergency rescue. Social organizations and volunteers are often more flexible and agile, able to quickly organize actions and provide rescue and support in emergency situations, thereby shortening the response time. Finally, the participation of social forces can bring diverse professional knowledge and skills. Different organizations and individuals possess different professional backgrounds and skills, and have better acceptance of soft technologies such as GIS, artificial intelligence, and emerging equipment. They can provide a wider range and more comprehensive rescue services and support to meet various rescue needs.

In order to address the challenges of emergency data heterogeneity and lack of interdepartmental sharing of emergency business data in data-driven emergency management, and to fully leverage the role of social rescue forces in emergency response and rescue, the School of Public Administration at Dongbei University of Finance and Economics, Dalian Wanzhong Emergency Rescue Team, and the journal Operations Research and Management Science jointly initiated the "Wanzhong Cup" Emergency Management Data Analysis Competition. The goal is to promote the integration of cutting-edge theories in emergency management with practical rescue practices in China, and to leverage the advantages of universities, industrial enterprises, and journals to accelerate the development of a Chinese-style modern emergency management system and capacity building. Participants will have the opportunity to utilize the abundant emergency management data of Dalian Wanzhong Emergency Rescue Team, conduct in-depth data analysis, and reveal the patterns and trends of emergency management in specific contexts, providing scientific decision-making basis for emergency response and rescue work.

Data and Task Flow：Dalian Wanzhong Emergency Rescue Team is a nonprofit social organization, and the equipment needed for its daily operations is mainly acquired through self-raised funds. The rescue team currently provides two main services：Rescue operations and training. The information for rescue tasks comes from government departments and civilian requests for assistance. When responding to rescue tasks, the rescue team primarily mobilizes volunteers through a call-to-action approach. On the other hand, training tasks are carried out through signed training agreements with specific departments. In order to assist researchers in gaining a better understanding of the operational flow of the rescue team and analyzing potential scientific issues, the following sections will provide a detailed overview of the daily management process of the team and the available data.

Dalian Wanzhong Emergency Rescue Team is a collaborative rescue organization with a 24-hour hotline, and its daily management processes ensure efficient rescue operations. Different rescue tasks correspond to different sources of information. For example, search and rescue operations for missing persons are typically initiated by local 110 command centers or the relatives and friends of the missing individuals. Maritime rescue missions primarily originate from the Maritime Search and Rescue Center, Coast Guard, and Border Patrol. Mountain rescue operations are mainly sourced from local police stations or fire departments within the jurisdiction. The process begins with the transmission of distress signals, whereby victims report their requests for assistance either directly

to the rescue team headquarters or through government agencies. Upon receiving the information, the rescue team headquarters notifies the sectional team leaders in the respective regions to ensure prompt response to the task. Subsequently, the duty secretary verifies the distress information and provides feedback to the sectional team leader. Through communication tools such as WeChat groups, the sectional team leader summons participating team members and other relevant personnel, who then assemble at designated locations before proceeding to the rescue site for the operation. Upon completion of the task, the secretary's team assesses and archives the attendance and performance of the sectional team leader and team members.

Each step in this management process holds significant importance. The transmission of distress signals serves as the starting point for rescue operations. Timely and accurate information dissemination ensures swift response by the rescue team, thereby enhancing the efficiency and success rate of rescue missions. The verification of distress information is a crucial step to ascertain the authenticity and feasibility of the rescue operation, ensuring effective utilization of resources. The gathering of team members and relevant personnel is an essential stage to ensure organized actions by the rescue team. Efficient communication tools enhance the efficiency of information dissemination and improve communication accuracy. Lastly, the assessment and archiving process contributes to the summary of experiences and lessons learned from rescue operations, providing reference and improvement directions for future rescue work.

Dalian Wanzhong Emergency Rescue Team maintains comprehensive records of various rescue cases and task data before and after the rescue operations. The volunteer-based organization offers abundant data for research analysis. This includes nearly 5000 pieces of relevant data on rescue and training tasks from January 2020 to February 2023. Each year is represented by a separate Excel spreadsheet, and each spreadsheet is divided into six sub-tables based on the type of tasks, namely maritime rescue, urban search and rescue, mountain rescue, training support, epidemic prevention and control, and team organization and equipment maintenance. Each sub-table contains seven categories of information, including event ID, event summary, deployment time, number of deployed personnel, number of deployments, team name, and remarks. Through the analysis of this data, researchers can explore various scientific questions in depth. For example, based on the records of distress signals, researchers can study the distribution patterns of different types of disasters in different regions and the characteristics of emergency calls for help. This information can be used to formulate corresponding rescue strategies. Task assignment and scheduling records can be utilized to assess the response speed and resource utilization efficiency of the rescue team, providing references for improving the effectiveness of rescue operations. The data on team attendance and participation can be used to evaluate the enthusiasm of team members and the effectiveness of teamwork, thereby enhancing team management and training mechanisms. Additionally, the analysis of rescue resource allocation records can contribute to optimizing resource allocation and utilization, improving rescue efficiency and flexibility. The results of task execution can be used to evaluate the effectiveness of rescue command processes.

In summary, the daily management processes and provided data of Dalian Wanzhong Emergency Rescue Team offer researchers an opportunity to gain in-depth understanding of the operation of the rescue team and analyze potential scientific issues. Through the study and analysis of these processes and data, the scientific and efficient nature of rescue work can be promoted, enhancing the emergency response capabilities of the rescue team and better addressing various disaster events.

Potential Research Directions: Dalian Wanzhong Emergency Rescue Team has decided to provide detailed rescue data to support the 2023 "Wanzhong Cup" Emergency Data Analysis Competition. This article provides a detailed description of the dataset. Interested researchers can choose appropriate research methods based on their research questions and expertise. Qualitative research, econometric modeling, optimization modeling, social simulation, data-driven optimization techniques, and research on intelligent algorithms are all popular areas of study. Specifically, emergency rescue managers in the industrial sector strongly recommend researching the following issues.

Direction 1:**Mechanism analysis in the context of government-led and social participation**

First, *the implementation pathway of disaster prevention and reduction at the grassroots level within the framework of comprehensive safety and emergency management.*

With the increasing frequency of disasters and the growing demand for emergency response, it has become an urgent task to implement disaster prevention and reduction at the grassroots level within the framework of comprehensive safety and emergency management. In order to effectively address disaster risks, the research competition solicits research achievements on the pathways and approaches for disaster prevention and reduction at the grassroots level. Under this theme, participants are encouraged to explore the following aspects:

Collaboration between grassroots organizations and the government: Research on how to strengthen the collaboration between grassroots organizations and government departments, establish a collaborative working mechanism, and jointly promote disaster prevention and reduction efforts. This can include exploring the establishment of effective information sharing and communication channels, enhancing the emergency response capabilities of grassroots organizations, and the government's support in resource allocation and guidance.

Training and capacity building for grassroots personnel: Explore how to enhance the training and skills development of grassroots personnel, enabling them to effectively organize and guide emergency response efforts during disasters. This can involve researching the development of tailored training programs for grassroots personnel, providing opportunities for practical experience exchange, and establishing training institutions and resource support systems.

Community participation and awareness enhancement: Study ways to enhance the disaster prevention and reduction awareness and engagement of community residents, encouraging them to take proactive actions when disasters occur. This can involve exploring the implementation of public education activities, organizing simulation drills, establishing community networks, and stimulating community residents' participation and improving their emergency self-help capabilities.

Technological innovation and information support: Explore how to leverage modern technology and information tools to improve the efficiency and effectiveness of grassroots disaster prevention and reduction efforts. This can include researching the development of intelligent emergency management systems, emergency resource dispatch platforms, and disaster information platforms, as well as utilizing technologies such as big data and artificial intelligence to provide scientific decision-making support and real-time monitoring and early warning capabilities.

Second, emergency rescue task coordination between government departments and non-governmental organizations (NGOs) under goal disparities.

Under the goal disparities between non-governmental organizations (NGOs) and government departments, achieving coordination and collaboration in emergency rescue tasks is an important issue. This theme aims to solicit research achievements on the coordination of emergency rescue tasks between NGOs and government departments. The following aspects are encouraged to be explored:

Goal compatibility and cooperation mechanisms: Research on how to align the goals between NGOs and government departments and establish mechanisms for collaborative cooperation. This can involve exploring the establishment of cooperation agreements, resource and information sharing, as well as developing clear cooperation frameworks and division of responsibilities.

Role positioning and complementary advantages: Explore the role positioning and complementary advantages of NGOs and government departments in responding to disasters and emergencies. This can involve researching how to leverage the flexibility and innovative capabilities of NGOs, combined with the resource allocation and regulatory management of government departments, to form a joint force in addressing disasters and emergencies.

Communication and collaboration platforms: Research on how to establish effective communication and collaboration platforms to facilitate information exchange and coordination between NGOs and government departments. This can include considering the use of modern technological tools to establish platforms such as online collaboration platforms, social media, as well as organizing regular meetings, workshops, and other forms of communication and cooperation.

Legal regulations and policy support: Explore how to improve relevant laws, regulations, and policies to support the coordination of tasks between NGOs and government departments. This can involve researching the development of clear policy guidance, providing preferential policies and funding support, as well as strengthening legal protection and regulatory measures to promote cooperation between both parties, and safeguard corresponding rights and interests.

Direction 2: **Optimization research on the operation mechanism of social forces**

First, the participation pathways of social rescue forces within the framework of comprehensive safety and emergency response.

Under the framework of comprehensive safety and emergency response, the participation of social rescue forces is crucial. To promote the effective participation of social rescue forces, the scientific research and innovation competition is soliciting research results related to this theme. Under this theme, we encourage participants to explore the following aspects:

Cultivation and development of social rescue organizations: Research on how to cultivate and develop social rescue organizations, including non-governmental organizations, volunteer organizations, and corporate social responsibility projects. Consider providing training and guidance to stimulate the enthusiasm and professionalism of social rescue forces, as well as establishing cooperative networks and resource support systems for social rescue organizations.

Interdepartmental cooperation and coordination mechanisms: Explore how to establish mechanisms for interdepartmental cooperation and coordination, enabling social rescue forces to collaborate effectively with government departments, public safety agencies, and other relevant organizations. Research the formulation of cooperative agreements, mechanisms for information sharing and resource allocation to facilitate cross-sectoral cooperation and coordination.

Technological innovation and application: Study how to enhance the response speed and efficiency of social

rescue forces through the use of modern technologies. Explore the application of technologies such as unmanned aerial vehicles, artificial intelligence, and big data to provide real-time disaster information and warnings, supporting rescue decision-making and resource allocation.

Social participation and public awareness: Explore ways to enhance public awareness and participation in social rescue forces, thereby improving the overall capacity of social rescue. Consider conducting public awareness campaigns, organizing public visits to rescue exercises, and sharing case studies to inspire public social responsibility and participation.

Second, optimization of the operational models of social welfare and rescue organizations in the Internet era.

In the Internet era, the operational models of social welfare and rescue organizations need to be optimized and innovated. To promote the development of social welfare and rescue organizations, the scientific research and innovation competition is soliciting research results related to this theme. Under this theme, we encourage participants to explore the following aspects:

Social media and public participation: Research how to utilize social media platforms and Internet tools to facilitate interaction and engagement between social welfare and rescue organizations and the public. Explore the establishment of online volunteer recruitment platforms, crowdfunding platforms for social rescue projects, and utilize social media for promotion and information dissemination.

Organizational structure and operational model innovation: Explore how to optimize the organizational structure and operational model of social welfare and rescue organizations to enhance their efficiency and sustainable development capabilities. Research the adoption of flat management structures, the introduction of specialized operational teams, and the establishment of partnerships with other charitable organizations to enhance organizational flexibility and professionalism.

Data management and decision support: Study how to utilize data management and analysis technologies to provide decision support and strategic planning. Explore the establishment of information-based data management systems to collect and analyze data relevant to social welfare and rescue, providing scientific decision-making basis for optimizing resource allocation and project management.

Risk management and supervision mechanisms: Discuss how to establish sound risk management and supervision mechanisms to enhance the transparency and trustworthiness of social welfare and rescue organizations. Research the establishment of assessment and monitoring systems, strengthen supervision and evaluation of rescue projects and the use of donations to safeguard the rights and interests of the public and ensure the effective utilization of donations.

Direction 3: The paradigm-shifting of emergency rescue driven by new technologies

First, emergency data governance: openness and sharing of government data and resources.

The openness and sharing of government data and resources play a crucial role in emergency data governance. To promote innovation and development in emergency data governance, the research and innovation competition is seeking research outcomes related to this topic. Under this theme, participants are encouraged to explore the following aspects:

Mechanisms for data openness and sharing: Research how to establish mechanisms for government data openness and sharing to facilitate data sharing and collaboration among different departments. This may involve establishing unified data standards and interfaces to promote data interoperability while ensuring data privacy and security.

Multi-source heterogeneous data fusion and big data analysis: It is necessary to explore how to integrate the multi-source heterogeneous data emerging in the process of emergency rescue, and use data analysis technology to extract valuable information and management insights from the "infodemic". Research on establishing an integrated platform for emergency data that enables real-time data collection, storage, and analysis to provide scientific basis for emergency decision-making.

Data governance and policy regulations: Study how to establish a sound data governance system and develop relevant policies and regulations to promote compliant and effective data usage and management. Consider the government to promote the establishment of a reward mechanism for data sharing and openness, and clarify the rights and responsibilities of data.

Data application and innovation in emergency rescue scenarios: Explore how to effectively apply government data to all aspects of emergency rescue, and promote the intelligence and precision of emergency decision-making and resource allocation. Research and develop a data-driven emergency management information system for specific emergency rescue scenarios, provide real-time disaster/public opinion monitoring and early warning, and optimize the allocation of emergency resources and response capabilities.

Second, optimization of measures for tracking and search of missing persons in the data-driven context.

Data-driven smart emergency management enables more accurate tracking and search operations for missing persons. The Emergency Rescue Team has been involved in search and rescue operations for Alzheimer's patients and runaway teenagers, accumulating a wealth of cases and data. In order to enhance the intelligence

level of the search and rescue work of missing persons, participants are encouraged to explore the following topics worthy of further study.

Data-driven tracking of missing persons：Research how data technologies such as GPS positioning, facial recognition, and mobile communications can enhance the localization and tracking capabilities of missing persons. Discuss the establishment of real-time databases and tracking systems for missing persons to provide fast and accurate location information.

Multi-party cooperation mechanism and resource integration platform：Explore how to realize cross-departmental and cross-organizational cooperation mechanisms and resource integration platforms to improve the efficiency and coverage of search and rescue for missing persons. Research on the establishment of an information cooperation platform for search and rescue of missing persons, and promote the organic collaboration of police, volunteers, communities and other forces.

Early warning mechanisms and emergency response：Study how to establish early warning mechanisms for identifying missing person risks in advance and implementing rapid and effective emergency response measures. Explore the establishment of intelligent warning systems that leverage artificial intelligence and big data technologies to provide accurate prediction and warning information about missing person risks.

Information dissemination and public participation：Explore how to expand the coverage and resources for searching and rescuing missing persons through information dissemination channels and public participation. Research the establishment of platforms for publishing missing person information and strengthen cooperation with media and social media to increase public awareness and participation in search and rescue efforts for missing persons.

Third, *optimization of urban emergency medical resource allocation based on GIS.*

With the support of Geographic Information Systems (GIS), the optimization of urban emergency medical resource allocation can be improved. To promote the optimization of urban emergency medical resource allocation, the research and innovation competition is seeking research outcomes related to this topic.

Spatial layout of emergency medical resources：Research how to use GIS technology to strategically allocate urban emergency medical resources, expanding their coverage and ensuring mutual coordination. Explore the use of GIS analysis methods to determine the most reasonable location of emergency centers, ambulance stations, AED devices, and other facilities to optimize resource allocation and distribution.

Traffic network and emergency route planning：Explore how GIS technology can be used to optimize emergency route planning for urban emergency medical resources. Research on route navigation systems based on real-time traffic information to provide the shortest time and optimal routes, thereby improving response times of emergency medical resources.

Spatial data analysis and resource scheduling：Study how to use GIS technology to perform spatial data analysis and resource scheduling for urban emergency medical resources. Explore the establishment of real-time resource scheduling systems that allocate and dispatch emergency medical resources based on the spatial distribution and demand of disasters and emergencies.

Public participation and information sharing：Explore how public participation and information sharing can enhance the effectiveness of optimizing urban emergency medical resource allocation. Research the establishment of interactive platforms for public reporting and seeking assistance, promoting close connections between the public and emergency medical resources, and improving resource utilization efficiency.

Through these research outcomes, we hope to promote emergency data governance through government data and resource openness and sharing, optimize measures for tracking and searching missing persons under data-driven approaches, and optimize the allocation of urban emergency medical resources driven by GIS. These contributions will provide innovative ideas and practical methods for the development of emergency management and public safety fields. Those interested in participating in the competition should contact the Secretariat of Higher Education Administration Branch, China Double-method Society, scopehe@163. com. Application deadline is September 1, 2023.

Research Objectives：The goal of this competition is to promote the deep cooperation between the theoretical research of emergency rescue and the practical needs of the industry based on the rich data of emergency rescue practice. Participants will have the opportunity to use the emergency rescue data of Dalian Wanzhong Emergency Rescue Team to conduct in-depth data analysis and mining in order to reveal the rules and trends and provide scientific decision-making basis for emergency rescue work. The joint organization of the School of Public Administration at Dongbei University of Finance and Economics, Dalian Wanzhong Emergency Rescue Team, and the journal editorial department of Operations Research and Management Science brings together the comprehensive advantages of university education, practical experience and academic research to this competition. Universities, as educational and research institutions, can provide theoretical guidance and academic support. Emergency enterprises or social organizations, as emergency rescue practitioners, can provide actual data and cases to strengthen the connection between theory and practice. Academic journals, as platforms for knowledge spreading and academic

exchanges, can facilitate the publication and communication of academic achievements. Through this competition, not only can promote the research and innovation in the field of emergency management, but also promote the deep cooperation between academia, universities and social organizations, and jointly promote the digital intelligence of emergency management and the modernization of social governance. At the same time, this provides researchers with an opportunity to understand the operational processes and management models of Dalian Wanzhong Emergency Rescue Team, conduct in-depth analysis of potential scientific issues, and provide valuable references and suggestions for enhancing emergency rescue capabilities and efficiency. Researchers, university teachers, graduate students and emergency rescue practitioners are welcome to actively participate in this scientific research competition, jointly promote the practical development and theoretical innovation in the field of emergency management, accelerate the construction of a safer, more sustainable and more intelligent Chinese modern emergency management system, and ensure a new development pattern with a new security pattern.

Key words: emergency management; data-driven; data analysis contest; practical needs; social rescue force

0 引言

二十大报告作出"提高公共安全治理水平"的战略部署,其中重要任务之一是"建立大安全大应急框架,完善公共安全体系"。我国地域辽阔,人口众多,灾害种类繁多,防范和应对灾害事故的任务十分繁重[1]。我国政府在灾害救援工作中坚持"以人为本",充分发挥社会主义"集中力量办大事"的体制优势[2,3]。社会救援力量是专业救援力量的重要补充,对建立密切协同的应急处置灾害事故工作机制具有重要意义[3,4]。近年来,我国社会救援力量不断发展壮大,在夯实防灾减灾救灾基础、推广科普知识、应急抢险救援等方面发挥了重要作用,已成为应急救援体系的重要组成部分。但是,《"十四五"国家综合防灾减灾规划》(国减发〔2022〕)中依然强调当前我国面临"统筹协调机制有待健全","社会动员等机制不适应新形势新要求"以及"新科技、新技术应用不充分"等问题。从应急管理的视角出发,以上问题反映出当前阶段在我国"政府主导-社会参与"的应急管理模式下,面临着政府主导下的社会力量参与机制不完善、路径不清晰[5,6],社会救援组织管理流程有待优化[7],地理信息系统(GIS)和人工智能等新技术效能并未完全发挥等方面的问题[8,9],需要进一步加强组织引导、规范救援行为、强化能力提升,推动社会救援力量发挥更大作用[10]。

大连万众应急救援队起步于 2015 年 4 月,自建队以来致力于抢险救灾、紧急救援、社会救助、面向公众的防减灾技能推广、大型群众性活动安全保障等应急救援需求,旨在推动民间公益救援事业的发展,发展成为一个涵盖生命救援、人道救助、灾害预防等各个领域的专业化、规范化、标准化的救援机构。至今已成为辽宁省公安厅巡特警大队、辽海上搜救中心、大连海上搜助中心、省市区应急部门、110 指挥中心、武装部、海警和边防公安系统的联动单位,承接金普新区发改局应急仓库管理服务,与东北财经大学、大连交通大学和大连社区大学等多家高校建立战略合作关系。万众救援队与东北财经大学公共管理学院校企共建联合实验室,可以满足城市搜救、地震救援、水上救援、山地救援和院前急救等各领域救援的基本装备及用于培训的器材和各种车辆,总价值 500 余万元,现有活跃志愿者 3000 余人,各类有国家级资质的专业救援人员将近百人。大连万众应急救援队自 2018 年 3 月开始救援编号记录以来,截止 2023 年 5 月,累积救援 3400 余起,300 余人获救,走失人员找寻已将近 2000 例。

在大安全和大应急框架下,社会力量参与应急救援具有积极意义。由于人为活动有可能激发灾害负面影响和政府机构存在"政府失灵"问题,社会救援力量参与就变得尤为重要[11]。首先,社会力量的参与可以扩大救援资源的范围和规模。不仅政府部门,还包括志愿者组织、非政府组织、企业以及普通民众都可以提供救援资源和帮助,增加了救援行动的力量;其次,社会力量的参与可以提高应急救援的响应速度。社会组织和志愿者往往更加灵活和敏捷,能够在紧急情况下迅速组织行动,进行救援和支援,缩短救援的响应时间;最后,社会力量的参与可以带来多元化的专业知识和技能。不同的组织和个人具备不同的专业背景和技能,对于 GIS 和人工智能的软技术以及新兴装备等硬技术有更好的接受度,可以提供更广泛、更全面的救援服务和支持,满足不同救援需求。

为了解决数据驱动下应急管理面临的应急数据严重异构,跨部门应急业务数据缺乏共享等实践难点,充分发挥社会救援力量在应急抢险救援中的作用,建立大安全大应急框架,东北财经大学公共管理学院、大连万众应急救援队和《运筹与管理》编辑部共同发起"万众杯"应急管理数据分析大赛,通过应急管理前沿理论与我国救援实践相结

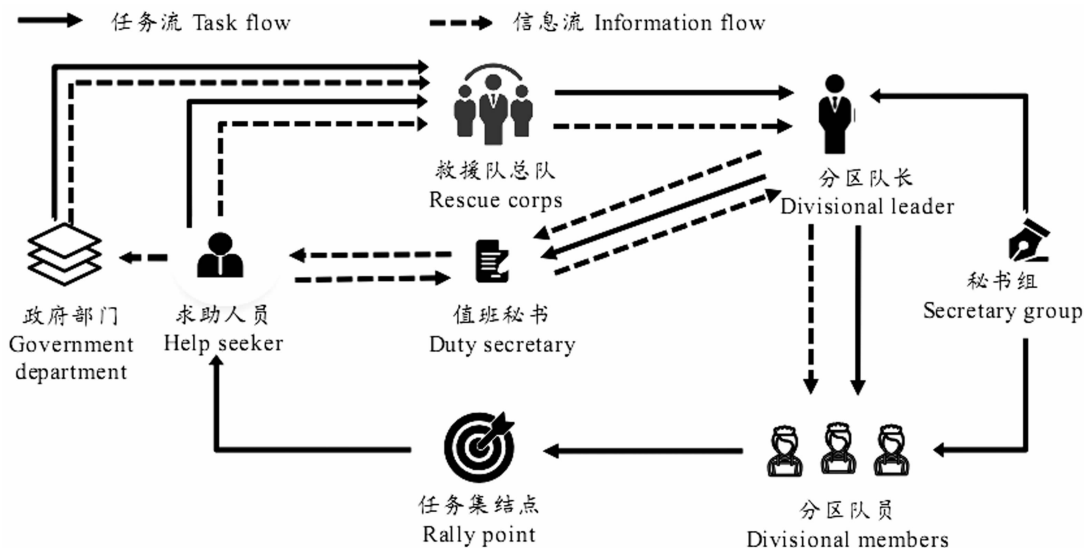合,发挥高校、社会力量与期刊编辑部三方优势,推进我国应急管理体系和国家治理能力建设。参赛者将有机会利用大连万众应急救援队丰富的应急管理数据,通过深入地数据分析,揭示在特定情境下应急管理的规律和趋势,为应急救援工作提供科学的决策依据。

1 任务流程与数据集流描述

大连万众应急救援队属于公益性质的社会团体,其日常运作所需的设备主要由自筹资金购置。救援队目前主要开展救援和培训两种服务,其中救援任务的信息来源包括政府部门和民间求助两类,救援任务出动时主要是通过救援队号召,志愿者响应的模式,而培训任务则是通过与特定部门签订培训协议的方式开展。为了帮助研究人员更好地了解大连万众救援队的运作流程以及分析潜在的科学问题,下面将详细介绍大连万众救援队的日常管

理流程和可提供的数据情况。

1.1 任务流程

大连万众救援队是一个协作救援组织,设有 24 小时值班电话,其日常管理流程确保了高效的救援行动。不同的救援任务对应不同的信息源,走失人员的搜救通常来自于属地的 110 指挥中心或走失人员的亲朋;海上救援任务主要来源于海上搜救中心、海警、边防等;山地救援任务主要来源于辖区派出所或者消防队等。流程始于求助信息的传达,受难人员直接或通过政府部门向救援队总队报告求助信息。救援队总队在收到信息后,通知属地的分区队长,以确保任务的有效响应。接下来,值班秘书负责核实求助信息,并将核实结果反馈给分区队长。通过微信群等通信工具,分区队长召集参与任务的队员和其他相关人员,在指定位置集合后前往救援地点展开施救行动。任务完成后,秘书组对分区队长和队员的出勤情况以及任务执行情况进行考核和归档。大连万众应急救援队管理流程见图 1。

图 1 大连万众应急救援队任务流与信息流概况

Figure 1. Task flow and information flow in the operations of Dalian Wanzhong Emergency Rescue Team

这一管理流程中的每个环节都具有重要意义。求助信息的传达是救援行动的起点,及时而准确的信息传递能够确保救援队能够快速响应,提高救援的效率和成功率。核实求助信息的过程是保证救援行动真实性和可行性的关键步骤,确保资源的有效利用。召集队员和相关人员的环节是确保救援队能够组织有序行动的重要环节,有效的通信工具能够提高信息的传递效率和沟通的准确性。最后,考核和归档过程有助于总结救援行动的经验教训,为未来的救援工作提供参考和改进方向。

1.2 数据集

大连万众应急救援队对各类救援案例以及救

援前后的任务数据有着完备的记录,救援队志愿提供丰富的数据资料供研究人员分析。其中包括 2020 年 1 月至 2023 年 2 月救援/培训任务的相关数据近 5000 条。每个年份对应一个单独的 Excel 表格,每个表格按照任务类型分为六个子表,依次为水上救援、城市搜救、山地救援、培训保障、疫情防控以及队伍整备与设备保养。每个子表中包含七个类别的信息。依次为事件编号、事件摘要、出队时间、出队人数、出队车次、分队名称、备注。通过对这些数据的分析,研究人员可以深入探讨多方面的科学问题。例如,可以基于求助信息记录研究不同地区灾害事件的分布规律和紧急求助的特点,

以便制定相应的救援策略。任务指派和调度记录可以用于评估救援队的响应速度和资源利用效率,为提高救援效果提供参考。队员出勤和参与情况的数据可以用于评估队员的积极性和团队协作效果,从而改善队伍管理和培训机制。此外,救援资源配置记录的分析有助于优化资源的分配和利用,提高救援效率和灵活性。任务执行结果可用于对救援指挥流程进行评估。

综上所述,大连万众救援队的日常管理流程和提供的大量应急救援数据资料为研究人员提供了深入了解应急救援队实践运作的机会,进而分析其中潜在的科学问题。通过对流程和数据的研究分析,可以推动救援工作的科学化和高效化,提升救援队的应急救援能力,更好地应对各类灾难事件。

2　潜在的研究方向

大连万众应急救援队将提供详细的救援数据,以支持 2023 年万众杯应急数据分析大赛。本文提供了该数据集的初步描述。有兴趣的研究者可以根据问题需求以及自身研究专长选择适当的研究方法,关于质性研究、计量经济模型、优化建模、社会仿真、数据驱动的优化技术和智能算法的研究都是受欢迎的。具体地说,应急救援管理者强烈建议对以下问题开展系统深入的学术研究。

2.1　政府主导-社会参与背景下的机制路径研究

第一,大安全大应急框架下防灾减灾下沉基层的实施路径

随着灾害频发和应急需求的不断增加,防灾减灾工作在大安全大应急框架下的下沉基层成为一项紧迫的任务。为了有效应对灾害风险,本次大赛征集关于防灾减灾下沉基层实施路径的研究成果。在这个主题下,我们鼓励参赛者探索以下方面的内容:

基层组织与上级政府部门的协同合作:研究如何加强基层组织与上级政府部门之间的合作,形成协同工作机制,共同推动防灾减灾工作。可以考虑建立有效的信息共享和沟通渠道,提升基层组织的应急响应能力,以及政府部门在资源调配方面的协调水平。

基层人员的培训与应急技能提升:探讨如何加强基层人员的培训和应急技能提升,使他们能够在灾害发生时有效地指导、组织和开展应急工作。研究制定适合基层人员的应急救援培训计划、提供实践经验交流机会,以及建立培训机构的资源支持体系。

社区参与与意识提升:研究如何增强社区居民的防灾减灾意识和参与度,促进他们在灾害发生时主动采取自救和互救行动。可以探索开展公众教育活动、组织模拟演练和建立线上社区网络等方式,激发社区居民的参与热情,并提高他们的应急自救能力。

技术创新与信息化支持:探索如何利用现代技术手段和信息化手段,提高基层防灾减灾工作的效率和水平。研究开发智能化的应急管理系统、应急资源调度平台和灾情信息化平台,以及利用大数据、人工智能等技术手段,提供科学决策支持和实时监测预警能力。

第二,政府部门与非政府组织目标差异下的应急救援任务协调

在非政府组织(NGO)与政府部门的目标差异下,如何实现任务的协调和合作一直是应急管理领域重要的课题。本主题旨在征集关于非政府组织与政府部门之间应急救援任务协调的研究成果。以下是鼓励探索的内容:

目标兼容与合作机制:研究面向救援任务,如何实现非政府组织与政府部门之间的目标兼容,形成有效的合作机制。探讨建立合作协议、共享资源和信息,以及制定明确的合作框架和责任分工。

角色定位与优势互补:探索非政府组织与政府部门在应对灾害和紧急情况时的角色定位和优势互补。研究如何发挥非政府组织的灵活性和创新能力,与政府部门的资源调配和规范管理相结合,形成合力有效应对各类灾害和突发应急情况。

构建沟通与合作平台:研究如何建立有效的沟通和合作平台,促进非政府组织与政府部门之间的信息交流和协调配合。利用现代技术手段建立平台,如在线协作平台、微信群社交媒体,以及组织定期会议、研讨会等形式,促进信息交流与长效的合作机制。

法律法规与政策支持:探索如何完善相关法律法规和政策,以支持非政府组织与政府部门之间的任务协调。研究制定明确的政策指导,提供优惠政策和经费支持,以及加强法律保障和监管措施,促进双方合作,保障相应的权益。

2.2　社会力量运行机制优化研究

第一,大安全大应急框架下社会救援力量的参与途径

在大安全大应急框架下,社会救援力量的参与至关重要。为了促进社会救援力量的有效参与,科研创新大赛征集与该主题相关的研究成果。在这个主题下,我们鼓励参赛者探索以下方面的内容:

社会救援组织的培育与发展:研究如何培育和发展社会救援组织,包括非政府组织、志愿者组织

和企业社会责任项目等。可以考虑提供培训和指导,激发社会救援力量的积极性和专业性,以及建立社会救援组织的合作网络和资源支持体系。

跨部门合作与协调机制:探讨如何建立跨部门合作和协调机制,使社会救援力量能够与政府部门、公共安全机构和其他相关组织进行有效的协同行动。可以研究制定合作协议、信息共享机制和资源调配机制,以促进跨部门的合作与协调。

技术创新与应用:研究如何利用现代技术手段提升社会救援力量的响应速度和效率。可以探索应用无人机、人工智能、大数据等技术,提供实时的灾害信息和预警,支持救援决策和资源调配。

社会参与与宣传教育:探索如何增强公众对社会救援力量的认知和参与度,提高社会救援的整体能力。可以考虑开展宣传教育活动、组织公众参观救援演习和案例分享等,激发公众的社会责任感和参与意识。

第二,互联网时代下社会公益救援组织的运行模式优化

在互联网时代,社会公益救援组织的运行模式需要进行优化和创新。为了推动社会公益救援组织的发展,征集与该主题相关的研究成果。在这个主题下,鼓励参赛者探索以下方面的内容:

社交媒体与公众参与:研究如何利用社交媒体平台和互联网工具,促进社会公益救援组织与公众的互动和参与。探索建立在线志愿者招募平台、社会救援项目众筹平台等,以及利用社交媒体进行宣传和信息传播。

组织架构与运营模式创新:探讨如何优化社会公益救援组织的组织架构和运营模式,提高其效率和可持续发展能力。研究采用扁平化管理结构、引入专业化运营团队,以及与其他公益组织建立合作伙伴关系等方式,提升组织的灵活性和专业性。

数据管理与决策支持:研究如何利用数据管理和分析技术,提供决策支持和战略规划。探索建立信息化的数据管理系统,即时收集和精准分析社会公益救援相关数据,提供科学应急救援决策依据,优化资源配置和项目管理。

风险管理与监督机制:探讨如何建立完善的风险管理和监督机制,提高社会公益救援组织的透明度和信任度。研究建立应急救援组织和行动的评估和监测体系,加强对救援项目和捐增使用的监督和评估,保障公众的权益和捐增财物的有效利用。

2.3 新技术对应急救援的模式变革

第一,政府数据与资源开放和共享的应急数据治理

政府数据与资源的开放和共享在智慧应急救援中发挥着关键的作用。为了促进应急数据治理的理论创新与实践发展,征集与该主题相关的研究成果。在这个主题下,面临着如下一些有待解决的实践需求,值得参赛者从理论上加以探索分析。

数据开放与共享机制:研究如何建立政府数据开放与共享的机制,促进不同部门之间的数据共享和协同。探索建立统一的数据标准和接口,推动数据的互操作性,同时确保个人数据的隐私和政府数据的安全。

多源异构数据融合与大数据分析:探讨如何整合应急救援过程中涌现的多源异构数据,利用数据分析技术在"信息疫情"(infodemic)中提取有价值的信息和管理的洞察。研究建立应急数据的整合平台,实现实时数据采集、存储和分析,为应急决策提供科学依据。

数据治理与政策法规:研究如何建立健全的数据治理体系,制定相关政策法规,推动数据的合规使用和有效管理。考虑政府推动建立数据分享和开放的奖励机制,明确数据的权益和责任。

应急救援场景下数据应用与创新:探索如何将政府数据有效应用于应急救援的各个环节,促进应急决策和资源调配的智能化和精准化。研究开发针对特定应急救援场景的数据驱动的应急管理信息系统,提供实时的灾情/舆情监测和预警,优化应急资源的调配和响应能力。

第二,数据驱动下走失人员追踪搜救措施优化

在数据驱动下智慧应急管理能够更加精准地开展走失人员的追踪搜救工作。大连万众应急救援队开展了阿尔茨海默症老人和离家出走青少年的走失搜救工作,积累了大量的案例和丰富的数据。为了提升走失人员追踪搜救工作的智能化水平,鼓励参赛者探索以下值得深入研究的内容。

数据驱动的走失人员追踪:研究如何利用数据技术,如 GPS 定位、人脸识别、移动通信等,提升走失人员的定位和追踪能力。探讨建立实时的走失人员数据库和追踪系统,提供快速而精确的定位信息。

多方合作机制与资源整合平台:探讨如何实现跨部门、跨组织的合作机制与资源整合平台,提高走失人员搜救的效率和覆盖范围。研究建立走失人员搜救的信息协同平台,促进警察、志愿者、社区等多方力量的有机协作。

预警机制与应急响应:研究如何建立走失人员的预警机制,提前发现走失风险,并采取快速有效的应急响应措施。探讨建立智能化的预警系统,结合人工智能和大数据技术,提供精准的走失风险预测和预警信息。

信息发布与公众参与:探索如何通过信息发布

渠道和公众参与,扩大走失人员搜救的覆盖范围和力量。研究建立走失人员信息发布的平台,加强与媒体和社交媒体的合作,提高公众对走失人员搜救的关注度和参与度。

第三,基于 GIS 的城市急救资源优化配置

在地理信息系统 GIS 支撑下,城市急救资源的优化配置可以得到改进。为了推动城市急救资源的优化配置,我们鼓励参赛者探索以下方面的内容。

急救资源的空间布局:研究如何基于 GIS 技术合理布局城市急救资源,使其覆盖范围更广、相互协调。探讨利用 GIS 分析方法,确定急救中心、救护车站点、AED 急救装置等最合理位置,优化资源的配置和分布。

交通网络与应急路线规划:探讨如何利用 GIS 技术,优化城市急救资源的应急路线规划。研究基于实时交通信息的路线导航系统,提供最短时间和最佳路线,优化急救资源的响应时间。

空间数据分析与资源调度:研究如何利用 GIS 技术,对城市急救资源进行空间数据分析和资源调度。探索建立实时的资源调度系统,根据灾害和紧急事件的空间分布和需求情况,合理分配和调度急救资源。

公众参与与信息共享:探索如何通过公众参与和信息共享,提升城市急救资源的优化配置效果。研究建立公众报警和求助的互动平台,促进公众与急救资源的紧密联系,提高资源的利用效率。

通过这些研究成果,我们期待推动政府数据与资源开放共享的应急数据治理、数据技术驱动下走失人员追踪搜救措施优化,以及 GIS 驱动下的城市急救资源优化配置,为智慧应急管理和公共安全领域的发展贡献创新思想和实践方法。参赛报名邮箱为中国双法研究会高等教育管理分会秘书处 scopehe@163.com,报名截止日期 2023 年 9 月 1 日。

3　结束语

本次大赛的目标是基于丰富的应急救援实践数据,促进应急救援的理论研究与业界实践需求的深度合作。参赛者将有机会利用大连万众救援队的应急救援数据,进行深入数据分析和挖掘,以揭示其中的规律和趋势,为应急救援工作提供科学的决策依据。东北财经大学公共管理学院、大连万众应急救援队和《运筹与管理》编辑部的联合举办,

为“万众杯”应急管理数据分析大赛带来了高校教育、实践探索和学术交流的综合优势。高校作为教育和研究机构,能够提供理论指导和学术支持。应急企业或社会组织作为应急救援的实践者,能够提供实际数据和案例,加强理论与实践的衔接。学术期刊作为知识传播和学术交流的平台,可以促进学术成果的发布和交流。通过这一大赛,不仅可以推动应急管理领域的研究与创新,还能够促进学术界、高校和社会组织之间的深度合作,共同推进应急管理的数智化和社会治理的现代化。同时,这也为研究人员提供了一个了解大连万众应急救援队的运作流程和管理模式的机会,深入分析其潜在的科学问题,以期为提升应急救援能力和效率提供有价值的参考和建议。欢迎广大科研人员、高校教师、研究生和应急救援从业人员积极参与本次科研大赛,共同推动应急管理领域的实践发展和理论创新,加快构建更安全、更可持续、更智能化的中国式现代化应急管理体系,以新安全格局保障新发展格局。

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