Power Emergency Prediction Analysis and Emergency Decision Analysis Model

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ABSTRACT

The emergency prediction analysis and emergency decision-making are still largely dependent on the actual experience of relevant personnel involved in emergency response. The judgment of emergencies is greatly influenced by subjective factors, and the lack of relevant data and information for auxiliary analysis and Models and methods of decision making. Conduct correlation analysis of emergency big data, construct predictive analysis models for various emergencies, and establish data link relationships between emergencies and emergency decision-making through big data technology to support emergency analysis and decision.

KEYWORDS

Power Emergencies, Big Data, Predictive Analysis, Emergency Decision.

INTRODUCTION

Emergency decision is a key link in power emergency response. A large number and complex types of data, such as disasters, losses, and disposals, are often generated in a short period of time after power emergencies. In order to provide references for timely and reasonable power emergency decision, it is necessary to
excavate valuable information in big data and quickly form scientific decision references. It needs in-depth study that how to mine data value in power emergency big data, and quickly provide scientific and reasonable decision-making suggestions for emergency decision-makers when power emergencies occur. In this way, the optimal use of emergency resources is ensured, and the emergency response capabilities is improved.

**PROBLEMS OF BIG DATA TECHNOLOGY IN POWER EMERGENCY**

Although China's power companies have carried out a lot of research on various types of emergencies, the research on power emergency decision based on big data is still in the initial stage of exploration. Compared with developed countries in Europe and America, there are still many problems, mainly in the following three aspects.

1) Mining and acquisition capabilities of power emergency data are insufficient, and real-time data for emergency response cannot be obtained comprehensively and efficiently.

2) The correlation and application capability of power emergency data needs to be improved, and the data of various departments within the company and related external organizations are not comprehensively utilized.

3) Emergency response cases, emergency drill reports and other data have not been effectively utilized due to the lack of learning ability of electric power emergency historical data.

In response to the above problems, the big data technology method should be applied to dig deeper value of power emergency management, analyze the correlation law between various data, and provide technical support for scientific, reasonable and timely power emergency decision. Through the research on key technologies of power emergency assistance decision based on big data, it can be used to improve the scientific and rationality of company's emergency decision in responding to emergencies, provide guarantee for safe and stable power supply, and provide a powerful support for building a strong global energy internet.
RESEARCH STATUS OF BIG DATA ASSISTED DECISION

Due to the increasing investment in the field of internet information in China during recent years, the gap of relevant informatization level between China and foreign countries, especially in IT infrastructure construction, has been shrinking. As a research hotspot, the big data has drawn much attention of domestic scholars, which mainly focus on application platform. However, an imbalance in the development of big data application platforms has increased due to difference in the level of informatization and management in various industries in China. The e-commerce industry (Alibaba, etc.) is relatively well-developed, while in the security and emergency areas, it is still in the basic stage.

Many researchers have focused on the collection, storage and mining analysis of related big data from the perspective of emergency command information collection in public frontier security[1-10].

Zhou[11] describes the concept of big data and its relationship with cloud computing, and proposes the big data technology of chemical emergency information system by analyzing the demand for big data applications of chemical emergency information system. The analysis of key technologies can provide a reference for the application of big data technology in chemical emergency information systems.

Other researchers have talked about the big data technology and its core technology, including the construction of basic platform, the transformation to future production and business model of China's power industry, especially for the impact of China's smart grid construction. The big data technology can be applied in the field of intelligent dispatching of power systems, including grid state monitoring and diagnosis, power loss analysis, load distributed control, user-side short-term power load forecasting, online security and stability analysis, and intelligent early warning[12-20].

RESEARCH ROUTE

The Research of Power Emergency Prediction Model is to predict and analyze related types of power emergencies by comprehensively applying data mining technology based on historical power emergency big data, including prediction of event development, power equipment loss, power outage range prediction (substation and line outage prediction, power supply users, especially important
users' power outage range prediction), statistical analysis of disaster loss (quasi-real-time statistical analysis of loss load, outage substation, outage line, important outage users, number of power outage and other relevant data information). The prediction analysis results can be used as the basis for scenario rule extraction and emergency decision; The Research of Scene Rule Recognition and Extraction Technology Based on Power Emergency Prediction Model follows three steps in a main research line, including business logic interface, database access engine, scenario library, to realize the instantiation and accessibility of the scenario library, which provides the basis for the next step of emergency decision based on scenario rules; The Research of Emergency Decision Model Based on Event Prediction Model and Scenario Rules is to study the data representation and recognition method in related "scenario library-task library-capability library" based on "power emergency type" and "scenario data". In this way, the "scenario task" based on event type and scenario rule is automatically extracted, which provides support for automatic generation of scenario-based emergency decision schemes.

POWER EMERGENCY PREDICTION ANALYSIS AND RESEARCH

![Power emergency report prediction analysis research route.](image)

Figure 1. Power emergency report prediction analysis research route.
According to the relevant accident cause theory, the element structure in typical power emergencies is designed from five perspectives of "human, machine, object, methods and environment" based on the existing historical power emergency big data of actual accident cases and simulation exercise process. It can be used to perform data integration, transformation and specification on the existing historical power big data, and to construct a data set of event inducement state before the occurrence of power emergencies. On the basis of the data set, the training set and test set required for the corresponding data mining are generated. And then, the classification and prediction model construction within supervised learning is carried out. In evaluation process, the classification and prediction models are evaluated using training sets and test sets, while the correlation analysis models are evaluated using support and credibility. By analyzing the business logic in the evaluated models, the relationship between the power emergency prediction model library and the event-inducing factors is proposed.

EMERGENCY DECISION TECHNOLOGY BASED ON BIG DATA

Scenario Rule Identification and Extraction Technology Based on Power Emergency Prediction Model

Based on typical power emergency types, the corresponding power emergency scenario representation and recognition interface are studied, and the power emergency scenario library based on the distributed storage and computing framework can be dynamically accessed and applied.

The structure and content of scenario database of the power emergency are constructed, and the corresponding emergency business scenario is designed (input condition, processing process, output result). By studying the database storage and access engine technology within the distributed storage and computing architecture (HBASE/Phoenix) and external API, the "power emergency scenario rule representation and identification standard interface" is developed. And the automatic extraction from "typical power emergency type" to "related scenario rules" can be realized, which leads visual display of power emergency scenario data.
Emergency Assistance Decision Model Based on Event Prediction Model and Scenario Rules

Based on the power emergency prediction model and event scenario rules, the data representation and identification interface in corresponding power emergency of "scenario-task-capability" is studied. By doing this, the power emergency "scenario base-task base-capability base" under the distributed storage and computing framework can be dynamically accessed and applied. When the main line of "emergency-event scenario-scenario task-task ability" is finally realized in the logic and data level, it will provide support for the generation of the corresponding emergency decision program.

In the existing historical power emergency big data, the relevant "scenario construction" data, i.e., the "scenario-task-capability" data is extracted to construct the power emergency scenario rule library. When the corresponding emergency business scenario (input condition, processing process, output result) and the interface business with the "scenario library-task library-capability library" are logically designed, the database storage and access engine technology within the distributed storage and computing architecture (HBASE/Phoenix) and external API is studied to realize the standard interface of "Power Emergency Scenario-Task-Capability Data Representation and Identification". By doing this,
the automatic extraction process from the "typical power emergency type" to "related scenario rules", and from the "relevant scenario rules" to the "relevant tasks" and "related capabilities" can be achieved. This will provide support for the generation of the corresponding emergency decision program within the main line of “emergency-event scenario-scenario task-task ability”.

Figure 3. Emergency assistance decision model.

CONCLUSION

In the field of emergency management, the formulation of emergency response decisions depends on the actual experience of the relevant personnel involved in emergency response, which leads the judgment greatly influenced by subjective factors. It is difficult to make scientific and reasonable decisions quickly and timely after emergencies, especially in complex emergencies. Through mining big data in historical power emergencies, the prediction model of power emergencies is studied. According to the relevant prediction results, the main line of "emergency-event scenario-scenario task-task ability" is realized. Emergency resource allocation and decision models, including emergency team, emergency supplies and emergency equipment, are proposed for typhoon, rain and snow, earthquake, flood and other disasters. When the resource allocation plan is generated, the models of event development forecast, power equipment loss and
power outage range prediction, and statistical analysis of disaster loss are proposed. The models can be applied in the prediction of emergency trends, material needs, and power outages before emergencies, and in the real-time statistical analysis of loss of power equipment and resource allocation schemes during emergency process.

ACKNOWLEDGMENTS

This work was financially supported by State Grid Corporation Science and Technology Project (SGAH0000AJQT1700299).

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