Overall Design of Artificial Intelligence Applications Based on the Electric Power Big Data Platform

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Abstract. Electric power big data is a new cross-domain data that appears with the development of smart grid and big data technology, and it is a specific application of big data technology in modern smart grid. This article mainly introduces the overall design of artificial intelligence applications based on the electric power big data platform. This article will explain in detail the construction process of the electric power big data platform and the overall design of artificial intelligence applications. This article introduces the specific significance of power big data as the main technical department of artificial intelligence, from the main links of demand analysis, architecture design, detailed design, and system implementation to the overall process of artificial intelligence application design from demand to realization. First, the overall requirements of the system are analyzed in detail from two aspects: functional requirements and non-functional requirements, and then the business architecture, application architecture, data architecture and technical architecture of the system are designed. Taking the functional modules of the electric power big data platform as an example, the detailed design of the functions is explained from the point of view of the class diagram, sequence diagram, and data model. This paper uses a self-organizing patch antenna calculated based on the power big data platform to search for the lowest voltage standing wave ratio of 1.0068 and the corresponding return loss of 45dB. However, regarding the antenna bandwidth, the self-organizing patch antenna still has the characteristics of a traditional patch antenna with a relatively narrow working bandwidth, and the working bandwidth of 13dB is less than 12%.

Keywords: Electric Power Big Data, Artificial Intelligence, Intelligent Algorithm, Application Design

1. Introduction
With the continuous development and improvement of the power system, various technologies in the traditional power system are gradually becoming mature. How to conduct intelligent and efficient management of the entire life cycle of the production, transmission, sales and use of the power system, so as to ensure the power system on the basis of safe and stable operation, the economic efficiency of
the entire system operation is maximized, and the development potential of the entire power industry is further released, which has become a new development trend of the modern power system [1-2].

At present, many scholars have intensified their research on power big data. According to the research of Ni Z and Li Q, in view of the development of power enterprise network technology, traditional or new log processing systems are completely unable to meet the log analysis requirements in the current situation of big data, and proposed a time series-based system quantity estimation algorithm, The algorithm integrates a variety of classification prediction algorithms to classify the collected log data, so as to achieve the purpose of predicting the number of abnormal systems in the most accurate way. The evaluation system also supports the algorithm to improve the security of the log analysis platform [3]. Wang L proposed a new method of power grid fault tracking based on big data platform, which extends the data source of fault diagnosis to substations, and uses Spark technology to process the change of the fault date to solve the problem. She uses data mining technology to analyze the fault information. Through the decision tree to trace the wrong operation of the protection or circuit breaker, find out the components of the fault. The reason and function of the failure are given. Compared with the traditional fault diagnosis system based on alarm information, this method can effectively use the monitoring data at all levels of the substation and give the cause of the fault. However, the artificial intelligence application design they studied is not enough to solve the current problems [4].

Under this opportunity, my country's power system is also undergoing continuous transformation and optimization. The research and development model of this article has shifted from quantitative development under government control to a policy-oriented and market-led dual-core drive model, which improves power quality and user experience at the same time, Use artificial intelligence technology to improve management efficiency, promote the implementation of policies related to energy conservation, emission reduction and energy revolution, thereby driving the sustainable development of the entire source industry.

2. Method

2.1 Definition of Power Big Data Analysis
Before understanding the definition of big data in electricity, please conduct a survey on the definition of big data. Generally speaking, big data refers to mining and analyzing the meaning of data from a large amount of irregular data, accurately classifying and merging the data, and then communicating it to users, so users can refer to these data to make decisions [5-6]. It is the meaning of big data analysis to establish specific association relationships by mining the rules between data. Through data mining and analysis, the utilization rate of data is improved, and users can make correct judgments, which not only improves work efficiency, but also improves the direction of decision-making [7]. The application of big data to electricity and quantitative analysis of electricity marketing work are the basis of big data market analysis. There is no scientific statement about the definition of power big data analysis, but the industry usually uses major data mining, data cleaning and sorting techniques to execute the data generated during the entire power business process. I think so. Analyze and obtain forecast information useful for the electric power industry [8-9].

2.2 Artificial Intelligence Technology Branch
Current research on artificial intelligence includes visualization, computer visualization, computer graphics, virtual reality, multimedia technology, human-computer interaction, knowledge graphs, speech recognition, computational theory, information systems, information retrieval, databases, and machinery Learning, data mining and nature. Language processing and many other research directions. According to the process of information visualization, the above-mentioned artificial intelligence technology can be divided into three categories. The first category is information collection: data mining and information retrieval. The second category is information processing: computer vision systems, natural language processing, databases, mechanical learning and computational theory. The
third category is information prompts, visualization, multimedia technology, computer graphics, human-computer interaction, knowledge graphs, speech recognition, information systems, virtual reality.

2.3 Design of Power Data Acquisition Layer
The design of the power data acquisition layer is mainly to solve the accuracy and timeliness of data acquisition. Therefore, its design objects are mainly concentrated on the equipment side, which includes not only the components in the system such as transformers and generators, but also various energy-consuming equipment on the power user side and the corresponding smart meters [10-11]. The data collected by these devices is the basis for power system data analysis. Therefore, the design of the power data acquisition layer is the first step in building a power data management platform. The purpose of power data acquisition stage is to collect data information with accurate content, standardized format and reliable source in time. Its requirements can be summarized as four principles of timeliness, accuracy, standardization and reliability. Therefore, its construction should be planned as a whole around these four principles.

2.4 Fitness Function Transformation Strategy
The use of scale transformation method to scale each fitness value can eliminate the early phenomenon of genetic algorithm to a certain extent. In the early stages of evolution, if the individual's fitness level is lower than the average fitness level of the population, then fitness can be appropriately expanded. If the individual’s fitness is greater than the population’s average fitness, the fitness can be reduced. The processing methods in the later stages of evolution are opposite to those in the early stages of evolution. Use expression (1) to transform the fitness function. Among them, $f_{\text{max}}$ and $f_{\text{min}}$ are the largest and smallest fitness values in contemporary populations, $gen$ represents genetic algebra, and $\text{MAXGEN}$ represents the maximum number of iterations. It can be seen from the formula that the increment of fitness function gradually changes from close to 1 as the genetic algebra progresses is 0.

$$F_{\text{obj new}} = F_{\text{obj}} + \frac{e^{-\frac{\text{gen}}{\text{MAXGEN}}}}{e + e^{\frac{\text{gen}}{\text{MAXGEN}}}} \left(f_{\text{max}} - f_{\text{min}}\right)$$ (1)

3. Experiment

3.1 Lab Environment
The stand-alone experimental environment is shown in Table 1.

| Operating environment | Configuration |
|----------------------|--------------|
| CPU                  | Intel Core2 Duo3.0Ghz |
| RAM                  | 4G           |
| Operating system     | Win7 64 bit  |
| Hard disk space      | 32G          |

3.2 Real-Time Data Record Copying and Conversion
Use data replication software to capture data modifications in the business system database, and perform real-time replication and extraction of the modified data. At the same time, the data conversion tool will notify you to perform real-time standardized conversion of incompatible different data to ensure real-time and consistent platform data. The data is first copied and converted to the branch data platform through the branch's marketing business system through synchronization applications and real-time conversion, and then copied and converted into the power big data platform.
through the data application software and copied to the form to complete the data collection of the level 2 data platform jobs.

3.3 Design of the Overall Functional Module of Artificial Intelligence
This article will analyze in detail the functional requirements and specific technical methods of the distributed power big data computing and analysis platform. The overall general module design of the system can be divided into the front-end design of the platform and the back-end design of the platform. The back end of the platform mainly implements data storage management and supplies power to big data. The front end of the platform focuses on realizing the business logic functions of the system. The overall function modules of the distributed power big data analysis and computing platform can be divided into two parts: the distributed data storage management and computing module and the system business logic function realization module. The module can also be physically divided into the front-end module of the platform and the back-end service module of the platform. The back-end modules include business computing core modules, business support modules, data storage and access management modules. The front-end module mainly includes the basic module supported by the platform business, the core computing business module and the custom analysis and calculation support module dedicated to power big data.

4. Result

4.1 Single-Band Work Optimization
In this article, we investigated the structure of single-band operation through a self-organizing microstrip passive filter, set the operating frequency to 2GHz~10GHz, and optimized the operating frequency of every 1GHz. The optimized objective function is the voltage of the antenna. Bobby VSWR, using an improved algorithm to repeat calculations. The basic parameters of the improved algorithm are as follows. The total number is 15, the maximum number of iterations is 15, the initial temperature is 136, the cooling temperature is 1.2, and the ending temperature is 1.5. Individual length is the number of self-organizing antenna switches. The generated gap is 1.23, and the crossover probability and sudden mutation probability adopt an adaptation strategy. The calculation results of the wired self-organizing antenna are shown in Table 2. The calculation result analysis of self-organizing patch antenna is shown in Figure 1.

| Working frequency | Voltage standing wave ratio | Bandwidth (GHz) | bandwidth(%) |
|-------------------|-----------------------------|-----------------|--------------|
| 2GHz              | 1.537                       | 1.028           | 1.6          |
| 3GHz              | 1.177                       | 0.067           | 2.5          |
| 4GHz              | 1.912                       | 3.276           | 6.9          |
| 5GHz              | 1.085                       | 0.393           | 5.8          |
| 6GHz              | 1.325                       | 2.29            | 4.2          |
| 7GHz              | 1.654                       | 1.669           | 9.5          |
| 8GHz              | 1.196                       | 3.65            | 4.1          |
| 9GHz              | 1.454                       | 4.5             | 5.9          |
| 10GHz             | 1.736                       | 2.751           | 7.5          |
It can be seen from the calculation results that this paper performs structural search optimization on the self-organized patch antenna at 2GHz, 3GHz, 4GHz, 5GHz, 6GHz, 7GHz, 8GHz, 9GHz and 10GHz. Table 2 shows the corresponding switch codes of the self-organized antennas working at these frequency points, the corresponding voltage generation ratio, and the corresponding absolute bandwidth and relative bandwidth. It can be seen from the table that the lowest voltage standing wave ratio that can be searched by the self-organizing patch antenna calculated based on the power big data platform is 1.0068, and the corresponding return loss is 45dB. However, in terms of antenna bandwidth, the self-organizing patch antenna still has the nature of the traditional patch antenna with a relatively narrow working bandwidth, and the 13dB working bandwidth is all below 12%.

### 4.2 Power System Environmental Monitoring Data Power Big Data Analysis

With the rapid development of industrial production and agricultural production in China, the environment is deteriorating day by day, and many power system operating machines have been polluted to various degrees. Various accidents caused by this have seriously threatened the safe use of power transmission grids. Therefore, anti-fouling work is particularly important. Based on the pollutant monitoring data, analyzing and evaluating the regional pollution of the power system, thoroughly mining the potential laws of the monitoring data, is an important means to prevent power system pollution. Through the latest high-power data technology, scientifically and effectively analyze pollution monitoring data, provide scientific reference for the cleaning strategy of substations and lines, and the location of new stations and lines, thereby improving the safe operation of the power system and reducing the number of system operators. Materials and financial resources provide reliable analysis and evaluation for evaluating the working environment of the power system. Figure 2 shows the data obtained through two monitoring stations.

![Figure 1. Self-organized patch antenna calculation results](image1)

![Figure 2. Pollutant monitoring data at two sites](image2)
After comprehensively observing the data of all monitoring sites, according to the requirements of evaluating and analyzing the pollution levels of monitoring sites, this paper proposes a joint analysis scheme based on power big data and correlation coefficients, and through the distributed power big data calculation analysis proposed in this paper The back-end of the platform performs algorithm implementation and data processing, so as to realize in-depth law mining and pollution level assessment of pollutant monitoring data in the power system.

5. Conclusion
The research in this paper believes that as the power grid informatization work continues to deepen, as the management staff of the power industry, they are not only satisfied with the daily office functions of the marketing business system, but more hope that the overall design of artificial intelligence applications can deepen the data. The analysis of the power data can dig out the internal information useful for the power data. The application of big data analysis technologies such as data warehouse and data mining makes this demand a reality. Based on the daily work flow of electric power, this paper adopts advanced data analysis methods and models, with the core of serving customers and improving marketing services, combined with the current practical problems, design and development of electric power big data marketing analysis and decision-making system, using information The modernized method fills the gap in power analysis and decision-making by power companies.

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