Evaluation Method of Service Quality in Power Station Area Considering Customer Satisfaction

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Abstract. In order to improve the service quality of the power station area, a service quality evaluation method of the power station area considering customer satisfaction is proposed. Establish an evaluation index system and evaluation model, and obtain the index weight value; use the fusion algorithm of XGBoost and logistic regression to predict and classify user satisfaction, and establish a service risk prediction model according to the classification results; The algorithm combining "soft classification" of Gaussian mixture model and EM model is applied to build a customer behavior portrait and realize personalized service. Taking Ningxia Wuzhong Company as an example for experimental analysis, the experimental results show that the evaluation results of the proposed method match the actual situation by up to 92%. The application of this evaluation method has a high excellence rate in the background area and a low unqualified rate in the station area, indicating that the application of "station area service quality management" has achieved initial results.

Keywords. Customer satisfaction; Power station area; Service quality assessment; Fuzzy Analytic Hierarchy Process; logistic regression

1. Introduction

The government functions have gradually changed from management to service. The social public service system has been continuously improved and perfected. People are more urgent to obtain basic and livelihood needs, and put forward higher requirements for the perception and essence of service consumption. This has prompted the public service industry to strengthen the improvement of the service system and the performance of social responsibilities according to its own characteristics, so as to promote the continuous improvement of enterprise service level. Power supply enterprises shoulder the task of ensuring people's livelihood for economic and social development and people's living and working in peace and contentment, and are an indispensable part of the construction of social public service system. Through the analysis of 95598 service history work orders, it is found that provincial and municipal power supply companies have invested more resources in grid construction, but the improvement of customer experience perception is not obvious [1]. There are mainly three problems in the existing service quality management and control mode of the Taiwan TV station: First, the station management quality evaluation is not carried out from the perspective of customer perception; Second, there is a lack of intelligent analysis and early warning tools as a starting point when implementing the service risk assessment of the Taiwan

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Observatory; The third is the lack of cross professional planning ability, unclear customer group portrait, and lack of decision-making tools to match personalized services [2-3].

In view of the above problems, relevant scholars have put forward different evaluation methods of service quality in power stations. Gu Guohua [4] and others have put forward a dynamic comprehensive evaluation method of power supply service quality in the environment of electricity-selling side liberalization. According to the time-series change characteristics of service quality, the reward and punishment system is adopted to evaluate the service quality, and the evaluation results are obtained. The experimental results show that this method can help electric power enterprises to perceive users' feelings in real time, which is conducive to improving the service level of enterprises. Cao Yang [5] et al. put forward an evaluation method of power supply service quality of power sales companies based on TOPSIS and BPNN. According to the concept of power sales and service types, an evaluation index system of service quality was established, and then TOPSIS and BPNN methods were used to realize service quality evaluation. According to the analysis results of an example, it can be seen that this method can provide reference for power supply enterprises, and is conducive to improving the service quality of enterprises. However, there is a big gap between the evaluation results and the actual situation, and there is still room for improvement. In addition to the above two methods, some researchers put forward a design method of comprehensive evaluation model of power supply service quality based on fuzzy analytic hierarchy process, which combines fuzzy analytic hierarchy process (AHP) and fuzzy mathematics to establish a service quality evaluation model. Finally, the effectiveness of this method is verified by an example analysis, but the unqualified rate in the background area is still high.

Although the above methods have improved the service quality evaluation effect to a certain extent, there is a problem that the evaluation results do not match the actual situation very well, and the excellence rate of the substation area is low. In order to effectively solve the above problems, this paper proposes a service quality evaluation method of power substation area considering customer satisfaction. Firstly, the evaluation index system and evaluation model are established to obtain the index weight value; Then the customer satisfaction is predicted and classified, and the service risk prediction model is established according to the classification results; Finally, the Gaussian mixture model is used to build a customer behavior portrait to achieve personalized service. The experimental results show that the proposed method is effective.

2. Service quality evaluation of electric power station area

In order to ensure the power supply, improve the quality of service, and promote the digital, networked, and intelligent transformation of power supply services, the State Grid Customer Service Center gives full play to its professional advantages, carries out innovation in power supply service quality management, and builds "station service quality management" products with multiple dimensions such as "power recovery response", "recharge perception", "emergency repair experience", "power supply quality", and "equipment operation and maintenance", empower provincial and municipal power supply companies to build a

"boutique service district", and build a service quality evaluation system for the district with improving customer satisfaction as the core.

2.1. Evaluation model of service quality in the station area

Through the analysis of internal system data, we can accurately locate service quality problems, and deal with satisfaction according to customer demands to clarify the room for service quality improvement. In order to ensure the comprehensive and accurate evaluation results of the service quality of the station area, firstly establish the service quality evaluation index system of the station area, as shown in Table 1.

Tab. 1 The service quality evaluation index system of station area

	First-level indicator	Secondary indicators
Station area service quality evaluation index system	Information processing effect	Customer contact collection rate Customer base information accuracy System site matching degree Accurate positioning of internal system data
	Tariff execution	Whether the electricity price can be implemented correctly Electricity recovery rate Current year electricity bill recovery rate Monthly issue of electricity bill recovery rate
	Line loss management in station area	Line loss management pass rate Replacing a smart meter The ratio of rectified and unrectified areas
	Customer satisfaction	Customer complaint rate Service complaints without human responsibility No handling of unsatisfactory work orders User rating

According to the service quality evaluation indexes listed in Table 1, an evaluation index $P = \{p_1, p_2, \dots, p_n\}$ is established, where n represents the number of evaluation indexes and the specific weight of each evaluation index is calculated by establishing a judgment matrix:

$$P_k = \left(p_{ijk}\right)_{n\times m} = \begin{bmatrix} p_{11k} & p_{12k} & p_{1nk} \\ p_{21k} & p_{22k} & p_{2nk} \\ p_{n1k} & p_{n2k} & p_{nmk} \end{bmatrix} \quad (1)$$

In the formula, k represents the fuzzy judgment degree of the evaluation index; m represents the weight vector of the index.

According to formula (1), with the help of the fuzzy number comparison principle, the ranking result of the evaluation index is calculated, and the weight value of the index is obtained:

$$W_p = \frac{1}{N}\sum_{i=1}^{n}\sum_{j=1}^{n} p_{ijk} \quad (2)$$

Through the fuzzy analytic hierarchy process [6], the fuzzy sets of weights of different index sets are obtained, the comprehensive weights of the evaluation indexes are obtained, and the final service quality evaluation results of the station area are obtained.

2.2. Construction of service risk prediction model

On the basis of the service quality evaluation model in the station area, a service risk prediction model is constructed, and the “dissatisfied customer group” is predicted and classified based on the fusion algorithm of XGBoost [7] and logistic regression [8], mining customer behavior characteristics, assisting business personnel to formulate business strategies, and effectively improve the satisfaction of business processing in the station area.

First, analyze the historical customer demand data, and then use the fusion algorithm of XGBoost and logical regression to predict and classify the "dissatisfied customer group". According to the classification results, use neural network algorithm to establish a customer complaint prediction model. Figure 1 is the service risk prediction model flow chart.

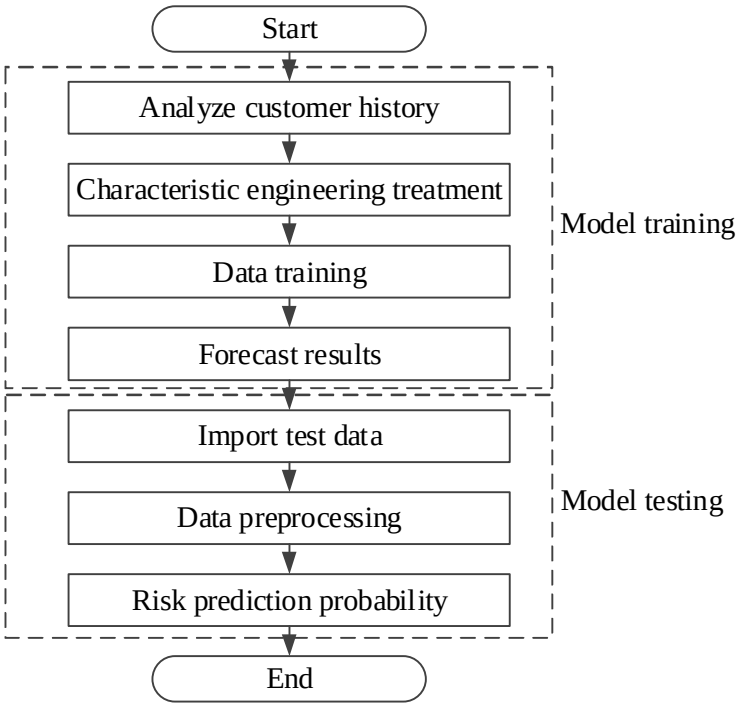

Fig. 1 Flow chart of service risk prediction model

2.3. Construction of customer group behavioral portraits

Construct customer group behavior profiles, apply Gaussian Mixture Model [9-10] (GMM) algorithm combining "soft classification" and EM model, locate customer group characteristics, and realize customer group and personalized service. User portrait, in simple terms, is the process of extracting feature sets based on user attributes and behavior data, and labeling users. Through user portraits, users can be described in various aspects, and users can be described in detail.

This paper proposes to use a Gaussian mixture model to fit the customer group behavior data, and then use the EM algorithm to solve the model parameters and calculate the user characteristic indicators. The Gaussian mixture model is represented as follows:

$$y(x \mid \Theta) = \sum_{k=1}^{n} u_k s_k(x \mid \Theta) \tag{3}$$

In the formula, s_k represents the Gaussian probability density; u_k represents the mixture weight coefficient; x represents the parameter set of the model.

The EM algorithm is a maximum likelihood estimation method for solving model distribution parameters. Using this algorithm to solve formula (3), it can get:

$$y_c = m\log(x \mid \Theta) + 2\log(x \mid \Theta) \tag{4}$$

In the formula, c represents the model boundary likelihood function.

According to the above model construction and solution process, the behavior characteristics of the power customer group are obtained, and the behavior portrait of the customer group is obtained.

3. Experimental studies

In order to verify the application effect of the method in this paper, an experimental study is carried out. Take Ningxia Wuzhong Company as an example to conduct experimental analysis, and collect the relevant data of the company's station area in the past six months, including user complaints, electricity bill recovery, line loss management, etc. as experimental data. Test the gap between the evaluation results of the method in this paper, the method in the literature [4] and the method in the literature [5] and the actual situation, and the results are shown in Figure 2.

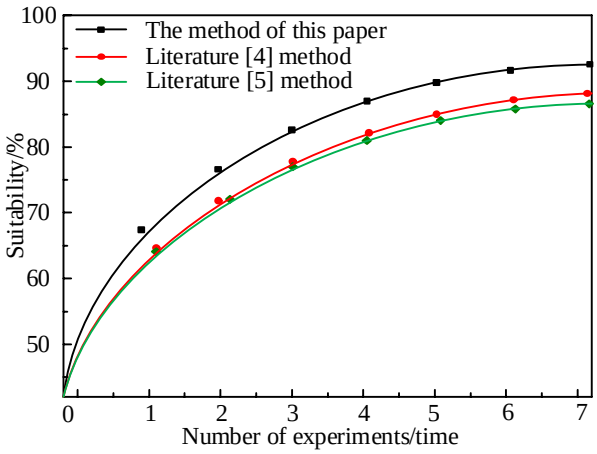

Fig. 2 Comparison of the evaluation results with the actual situation

It can be seen from Figure 2 that in many experiments, the matching degree between the evaluation results of this method and the actual situation is high, with the highest value reaching 92%, indicating that the evaluation results of this method are in line with the actual situation and have the advantage of more accurate evaluation results. This is because this method, based on the service risk prediction model, predicts the service risk, and combines the risk prediction results with the evaluation results, effectively improving the evaluation effect.

In order to better judge the application effect of this method, the excellent rate and unqualified rate of the test bench area are shown in Table 2:

Tab. 2 User satisfaction test results

Station area No	Excellent rate/%	Rejection rate/%
Station area A	95%	5%
Station area B	93%	7%
Station area C	90%	10%

According to Table 2 above, after the application of this method to the evaluation of the service quality of power stations, the service quality management level of the stations has been significantly improved, with the highest excellence rate reaching 95%. It shows that the application of the evaluation results of this method to guide the comprehensive management of power stations can intuitively determine the satisfaction of users, obtain the needs of power users in real time, achieve communication and interworking, and enable users to get the best service experience through multi aspect collaborative acceptance.

4. Conclusion

This paper proposes a service quality evaluation method for power stations considering customer satisfaction. Combined with the service quality evaluation results, the power supply company can continuously strengthen the service quality management of the stations, optimize the outage maintenance plan, reasonably plan the distribution network operation and maintenance cost investment and other related services, and improve the customer power supply service experience. The following conclusions are drawn from the study:

(1) The matching degree between the evaluation results of this method and the actual situation is high, with the highest value reaching 92%. The evaluation results are in line with the actual situation and have the advantage of more accurate evaluation results.

(2) After using this method to evaluate the service quality of power stations, the service quality management level of stations has been significantly improved, with the highest excellence rate reaching 95%. Users can get the best service experience through various collaborative acceptance.

In the future, it can be evaluated according to the service demand of different groups, and repeated value calculation is required to obtain a comprehensive and objective comprehensive evaluation of grass-roots stations. In the future research process, it is necessary to pay attention to the different characteristics of different regions, promote the improvement and improvement of power supply enterprise services with the evaluation results, implement each service detail and enterprise internal control link, effectively improve the power supply service level, further optimize the evaluation index system and evaluation methods, ensure the operability of the evaluation process and the authenticity of the evaluation results, and help power supply enterprise grass-roots stations improve the management and service system.

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