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*Research Article*

# Robust Refinement of Built-in Network Information System Based on Nonparametric Density Estimation

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In the research process of robustness refinement solution of built-in information systems for electronic networks, there are too many factors related to robustness in the current system robustness design, and different factors have different influences on robustness. In stochastic programming problems, uncertain variables usually obey a certain probability distribution, but in real decision-making, these determined distributions are often unknown or we only know part of the information of the distributions, and distributed robust refinement solution is just an effective solution to solve uncertain problems. The robustness measurement solution of information systems for electronic networks is analyzed. The robust refinement of information system is deeply studied by nonparametric density estimation solution, which is based on the strict robustness requirements put forward by users. Based on the research results of interdependent network theory and aiming at "improving the robustness of electronic information system," this paper makes an in-depth study on the robustness refinement strategy of power information system. The comparison between the companies that adopted the robust refinement of built-in information systems for electronic networks based on nonparametric density estimation and the companies that did not adopt it shows that the refinement rate of the companies that adopted it in the first three years was 82%, while that of the companies that did not adopt it was only 57%, and the overall misjudgment rate was 43%. Therefore, it is proved that using the proposed reliability refinement solution to optimize, the embedded system can improve the service life, modeling accuracy, and availability of the system and has certain practicability.

## 1. Introduction

With the continuous rise of China's network technology level, the built-in information systems for electronic networks have entered a rapid development, and it also makes its role in application construction more prominent. [1]. Vigorously promoting informatization is a strategic measure of China's overall modernization drive and an urgent need and inevitable choice for building an innovative country [2]. Nonparametric density estimation is an important direction of modern statistics development in recent years, which has changed the development pattern of traditional statistics [3]. For the system of network operation platform, built-in information systems for electronic networks are essential. As an index, robustness can measure the ability of network electronic information system to maintain normal operation under pressure environment or abnormal input environment. [4]. The nonparametric density estimation solution does not need to assume the parameter form of point sample distribution in advance, and can estimate the probability density function accurately and robustly only from the sampled data itself, which provides a new solution for the analysis and modeling of unknown distribution point samples [5].

For multiobjective refinement problems, the existing research mainly focuses on searching high-quality solutions, and many multiobjective refinement algorithms based on Pareto optimal set are proposed, but the research on multiobjective robust refinement solutions is relatively less [6]. For example, in the part processing system, the machine cannot process in strict accordance with the specified specifications, and there are often certain errors, which require that the design parameters can meet a certain tolerance [7]. In some special cases, sufficient conditions are provided to ensure the uniqueness of the robust solution and the continuity of the data on the undisturbed problem [8]. The research of complex network theory in power system mainly focuses on the actual power network, which can be obtained through the geographical wiring diagram of power network. Some studies directly use the topology diagram of IEEE node system as the research object [9]. Driven by technological progress and external demand, the function of embedded system continues to expand, the scale of the system is becoming larger and more complex, and the defect and failure rate of the system are also increasing.

The nonparametric density estimation is a developing field with a short history. People are still unfamiliar with it and lack of understanding of it. Its application in practice, especially in the economic field, is less, and its application field needs to be further expanded [10]. However, as a new thing, people are relatively unfamiliar with the nonparametric density estimation solution compared with the traditional parametric solution and lack in-depth understanding of it. There are still many areas worthy of improvement in the specific application of combining with other algorithms, and the application field needs to be further expanded [11]. Due to the complexity of the research object, it is necessary to carry out comprehensive research of multidisciplines, such as computer science, management science, system science, information science, and cybernetics [12]. Not only that many control systems have a lot of noise and interference, which cannot be accurately expressed in the model, so the control system must have a little anti-interference ability, that is to say, but also it has certain robustness [13]. To study robustness, it is necessary to fully understand the influencing factors of system robustness, identify the operating mechanism of the system in essence, and then explain the external behavior characteristics of the system [14]. At this time, if we want to use nonparametric statistical solutions, the only remedy is to increase the sample size and use large samples to make up for the losses caused by using nonparametric statistical solutions [15]. Sometimes, the solution of the refinement problem is very sensitive to the parameters. When the parameters are slightly disturbed, the solution of the problem will fluctuate greatly, which makes it no longer the solution of the problem or even highly infeasible, which is of great significance in practical problems.

The innovation of this paper:

(1) The principle of nonparametric discriminant analysis based on nonparametric density estimation is introduced in detail, which makes the application of nonparametric discriminant solution reasonable

(2) The application of nonparametric density estimation solution can calculate the density value of arbitrarily distributed difference matching samples at the test sample points in the feature space

(3) The electronic information system must keep advancing and developing, so as to gain advantages in the fierce market competition environment. Information resources are one of the important components of enterprise management information system. Using component solution to complete the analysis and design of information resources of electronic information system greatly enhances the reusability of electronic information system

The research framework of this paper includes five parts, and the specific arrangements are as follows: the first chapter introduces the research background and significance and then introduces the main work of this paper. Chapter 2 focuses on the current status of research related to nonparametric density estimation and robust reinforcement of embedded information system. Chapter 3 proposes a specific solution and implementation of robust reinforcement of embedded information system design. In Chapter 4, the nonparametric density discrimination is analyzed in detail. The fifth chapter is the summary of the full text.

## 2. Related Work

*2.1. Nonparametric Density Estimation.* Because nonparametric estimation does not assume the mathematical form of unknown density function, it is difficult to expect to get deep small sample properties. Although this solution is accurate, real, and relatively simple, when the system structure is huge, its closed-loop structure will become very complicated correspondingly, resulting in unstable reliability. Samples within a certain distance play the same role. Intuitively, it can be imagined that for estimating the density function, the close samples seem to play a greater role than the far samples.

Therefore, nonparametric density estimation is only an effective tool for point sample analysis or modeling in many cases. Many specific problems need to be combined with other algorithms or processing solutions to be solved. It is proved that the linear feedback system with single gain and infinite gain has good stability [16]. Chao et al. focused on a robust refinement solution for embedded information systems based on Markov algorithm. The histogram density estimation solution is used to model the moving target color features, but the weight kernel function related to the pixel position features is also introduced in the modeling process, which improves the accuracy of density estimation and suppresses the influence of interference and deformation on the tracking accuracy to a certain extent [17]. Garroppo et al. proved the estimated point-by-point strong phase coincidence speed problem in robust optimal design of networked information systems by building a stochastic response model and Markov time chains for networked information systems [18]. Andreagiovanni et al. focused on the application of nonparametric estimation; first, construct the model of network electronic information system and sample from the known probability distribution of network electronic information system [19].

*2.2. On Robust Refinement of Embedded Web Information Systems.* Nyikes et al. first proposed a convex programming model, then solved this problem through an auxiliary linear programming model, and finally applied this model to an inexact linear programming problem. Until 1990s, robust refinement attracted extensive attention of scholars [20]. Rodrigues et al. proposed a solution to improve the system reliability by connecting the system with its cross-linked physical equipment [21]. The whole system is truly connected with its cross-linked physical equipment to form a closed-loop structure to increase the reliability of the system. Sun et al. aimed at analyzing the growth and evolution mechanism of information systems and at the same time built the generation and evolution model of small-world information systems. By analyzing the correlation between network topology and information flow characteristics, it was finally verified that small-world characteristics are the result of long-term refinement evolution of information systems [22]. Gramacki and Gramacki believe that robust refinement is a modeling solution combined with computational tools, which is mainly used to deal with the refinement problems with uncertain data and the real data only belong to some uncertain sets [23]. Chauveau et al. proposed a robust refinement solution of built-in information systems for electronic networks based on simulated annealing algorithm [24]. This solution calculates the global optimal solution of the objective function of the built-in information systems for electronic networks according to the mapping characteristics of the probability sudden jump characteristics of the built-in information systems for electronic networks in the solution space and realizes the robustness refinement of the built-in information systems for electronic networks. Trentin discusses the robustness refinement solution of built-in information systems for electronic networks based on branch and bound algorithm [25].

Aiming at the above problems, a robust refinement solution of built-in information systems for electronic networks based on nonparametric density estimation is proposed. Thus, the robustness refinement design of built-in information systems for electronic networks is realized, which has high application value [26]. In the development and management of large-scale Internet software system, the robust refinement of built-in information systems for electronic networks with obvious self-organization characteristics of complex system is a subversive innovation of traditional structured information system.

## 3. Embedded Information System Refinement

*3.1. Solution of Failure Probability of Built-in Information Systems for Electronic Networks.* The word "robustness" comes from Latin, meaning robustness [27]. In engineering refinement design, there are two kinds of parameters: design parameters and environmental parameters. The design parameters change during the refinement process, and the objective refinement is realized by their changes. The satisfaction of performance is subjectively determined by the expectations of designers and users, so the measurement index of robustness is not unique, which means that robustness analysis is a necessary link in the process of information system design and operation [28]. For stable systems, the real part of eigenvalues is greater than zero, so only $P \underline{\underline{\Delta}} W_c$ $(\infty)$ needs to be considered. That is to say, $(A, B)$ is a controllable state if and only if it is a controllable matrix:

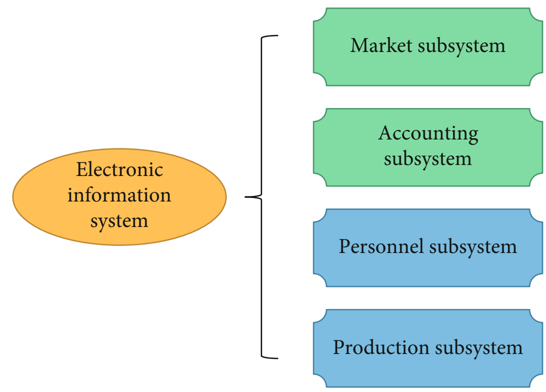


Figure 1: Structure diagram of internal management system of electronic information system.

$$\mathrm{P} \underline{\underline{\Delta}} \int_0^\infty e^{\mathrm{A}\tau} \mathrm{B}\mathrm{B}^{\mathrm{T}} e^{A^T \tau} d\tau. \tag{1}$$

The value of environmental parameters is generally given in advance and fixed in the refinement process [29]. Although the theorem only gives the sufficient conditions for the robust stability of the system, it also satisfies the necessary conditions. Because the robustness of the two types of parameters needs to be considered, for convenience, these two types of parameters are not distinguished, which are collectively referred to as the parameters of the refinement problem. The use of information technology gradually rises from the management of operation level to the management of decision-making level. Enterprise management is based on the decision-making system model. The internal management system structure of electronic information system is shown in Figure 1.

Firstly, the failure modes of built-in information systems for electronic networks are divided into single limit state and multilimit state. The topological integrity of the network after being attacked is higher than that of the initial network, which indicates that the recovery speed of the system from the failure state is faster. Obviously, the solution of failure probability of built-in information systems for electronic networks can effectively improve the ability to resist cascading failures. For incomplete controllable multi-input-multioutput continuous-time linear time-invariant systems

$$\begin{aligned} x &= Ax + Bu, \\ y &= Cx. \end{aligned} \tag{2}$$

We assume that users have fully understood the essence of the problem and clearly know the disturbance amplitude and disturbance range of each parameter. On this basis, a strict robustness requirement is given. The input to the controller is $r - y_m$, $y_m = y + n$ is the measurement output, and it is the measurement noise, so the input to the object $G$ is

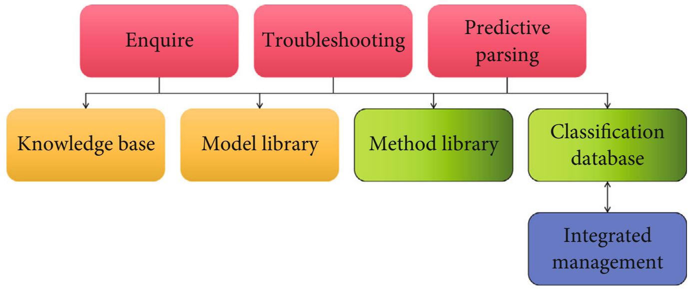


Figure 2: Robustness improvement process.

$$u = K(s)(r - y - n). \tag{3}$$

The algebraic connectivity is used to measure the robustness of the network, and the system robustness is improved by optimizing the component-level network structure and ensuring the rapid propagation of the best behavior model. The promotion process is shown in Figure 2.

Secondly, random sampling cannot accurately reflect the situation of each point in the neighborhood. For the robust solution obtained by this measurement solution, the variation of the function value of the point disturbed by the parameter may fall outside the specified variation range in practical application. Therefore, the failure probability of built-in information systems for electronic networks in two states is calculated, and the robustness refinement function of built-in information systems for electronic networks is given based on the obtained failure probability. The influence of configured physical nodes on the robustness refinement of electronic information system is related to the relative power load of neighbor nodes in the physical layer. When there are small power load nodes in the adjacent nodes of the physical nodes, it can greatly improve the robustness of the information system. $S$ is the system output, while $n$ is the closed-loop transfer function from the reference signal to the system output. From $S + T = I$

$$\begin{aligned} |1 - \sigma(S)| &\le \sigma(T) \le 1 + \sigma(S), \\ |1 - \sigma(T)| &\le \sigma(S) \le 1 + \sigma(T). \end{aligned} \tag{4}$$

The failure mode consists of single limit state and multi-limit state. When the failure factors in the failure mode of the system are all connected in series and each failure factor contains common variables, this failure mode is defined as a single limit state. The traditional solution includes solving the overall refinement problem and making all decisions at the same time. With the increase of the number of variables and constraints, the problem may soon become difficult. However, the solution of built-in information systems for electronic networks failure probability mainly strips the code of embedded electronic information system software, then tests it with digital platform, and then improves the reliability in a targeted way. Therefore, how to define an appropriate image problem under the framework of image space analysis so that it can be equivalent to robust correspondence problem and contain uncertain parameters is very important.

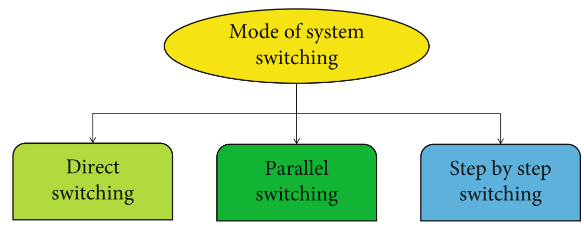


Figure 3: System switching mode.

*3.2. Robustness Refinement Solution of Built-in Information Systems for Electronic Networks.* Integrating the combination of chaos optimization and particle swarm optimization is based on determining the robustness refinement objective function of built-in information systems for electronic networks [30]. The information network is composed of information communication equipment and communication lines. Among them, information communication equipment includes computing equipment (computer, server, and embedded computing equipment) and data acquisition equipment (sensor, PMU, and embedded data acquisition equipment). In the process of system switching and delivery, make a system switching plan, control the progress of work, check the quality of work, and timely coordinate all aspects to ensure the successful switching and delivery of the system. There are usually three ways to switch and deliver the system, as shown in Figure 3.

Firstly, the robust refinement area of embedded electronic information system is dynamically analyzed with the help of robust refinement function. The purpose of computer programming is to realize the management mode and business application proposed in system analysis and design. The calculation of embedded electronic information system is mainly composed of operating system and application program. It needs to make up for the differences in hardware in the calculation, provide a unified system interface for the application program, and complete the control of memory management and task scheduling. Assuming a multivariable system $P(S)$, find a stable controller $K(s)$ so that the transfer function $T_{ZW}$ of the closed-loop system, that is, the transfer function from input Z to output e, satisfies the following relationship:

$$\frac{1}{F_M(T_{ZW}(j\omega))} < 1. \tag{5}$$

According to the robustness function of built-in information systems for electronic networks, the robust refinement area of built-in information systems for electronic networks is dynamically searched, and the robustness refinement objective function value of built-in information systems for electronic networks is calculated. The solution of the above problem involves the nonconvex refinement problem of $\Delta$, which cannot be calculated by the standard nonlinear gradient descent solution, because the convergence of the algorithm cannot be guaranteed. However, because $\mu$ has an upper bound, $F_M$ can be calculated by the following formula:

$$\frac{1}{F_M(T_{ZW})} = \mu(T_{ZW}) \leq \inf \|DT_{ZW}D - 1\|. \tag{6}$$

Among them, data aggregation preprocesses the data obtained from various data sources and then stores the data in the database. Data analysis is to further process data and produce valuable information by using tools such as stream computing and data mining.

Secondly, the global refinement is carried out by calculating the robustness refinement objective function value of built-in information systems for electronic networks. This refinement work may be realized through certain test solutions. The test solution of any product is general if you already know the functions that the product should have and if you can test whether each function can be used normally. Using the separation theory or the principle of definite equation, the solution of this problem can be understood as finding a simple state feedback law:

$$u(t) = -K_r x(t), \tag{7}$$

where $K_r$ is the constant matrix.

Due to the limited capacity of the embedded system's own ROM, the system's application programs need to complete specific application tasks based on EOS. However, the embedded electronic information system itself has no independent development capability, and users must carry out secondary development through a set of development tools and environment, which will also lead to the decline of system reliability. In the context-aware design and production, based on the massive data collected by sensors, platforms, and websites, it automatically evaluates and analyzes the operation status of enterprises and provides improved solutions for product design, resource allocation, preventive maintenance, and supply chain management of enterprises. The sensor obtains the output of the sensor by performing proportional, integral, and differential operations on the error signal and weighting the results, which is the control value of the controlled object. The mathematical description of the sensor is

$$u(t) = Kp\left[e(t) + \frac{1}{T_i}\int e(t)dt + T_d\frac{de(t)}{dt}\right], \tag{8}$$

where $u(t)$ is the controller output; $e(t) = r(t) - c(t)$ is the system error signal; $r(t)$ is the system input quantity; and $c(t)$ is the system output.

Based on the value of robustness refinement objective function of built-in information systems for electronic networks, the speed and position of update particles are calculated. Regardless of its internal structure and processing process, give it appropriate inlet parameters to see whether its outlet parameters are correct or whether the corresponding functions are realized. The built-in information systems for electronic networks discussed in this paper is a multi-input-multioutput linear time invariant system, which is expressed in state space as follows:

$$P\begin{cases} x = Ax + B_w w + Bu \\ y = Cx + D_w w \\ z = C_z x + D_{zw} w + D_z u \end{cases}, \tag{9}$$

where $u \in R^{n_w}$ is the control input vector; $w$ is the external input vector; $y \in R^{n_v}$ is the measure of the output vector; and $z$ is the output signals related to the performance of the control system.

If you know the internal working process of the product, you can test whether the internal actions of the product are carried out normally according to the specifications.

## 4. Nonparametric Density Discriminant Analysis

*4.1. K-Nearest Neighbor Discriminant Analysis.* The so-called discriminant analysis is a statistical analysis solution that establishes a discriminant criterion according to the observed data of a batch of samples, which are known to be different types of research objects, and then discriminates and classifies the unknown types of samples. This solution realizes the direct intelligent control of the embedded electronic information system by adding a control module to the embedded electronic information system and increases the reliability of the system. If the kernel function is uniformly distributed, the final probability density is estimated as the proportion of the number of sample points falling into a form to the number of all sample points. Figure 4 lists the expressions and function curves of some one-dimensional kernel functions.

According to different node configuration strategies, physical nodes are added to reduce the load; then, information nodes are added; and edges are added according to the principle of topological similarity. In the theory of nonlinear dynamics, the attributes or characteristics of the system are represented by state variables, and the change of state variables reflects the operating rules of the system. If we calculate the difference between the eigenvectors of the pixel samples at the corresponding positions of the two window matching primitives, it can be known from the compatibility constraint that all the difference eigenvectors should be zero vectors in an ideal situation. When carrying out robustness refinement activities, it is necessary to consider the differences of the action intensity of each element on the system,

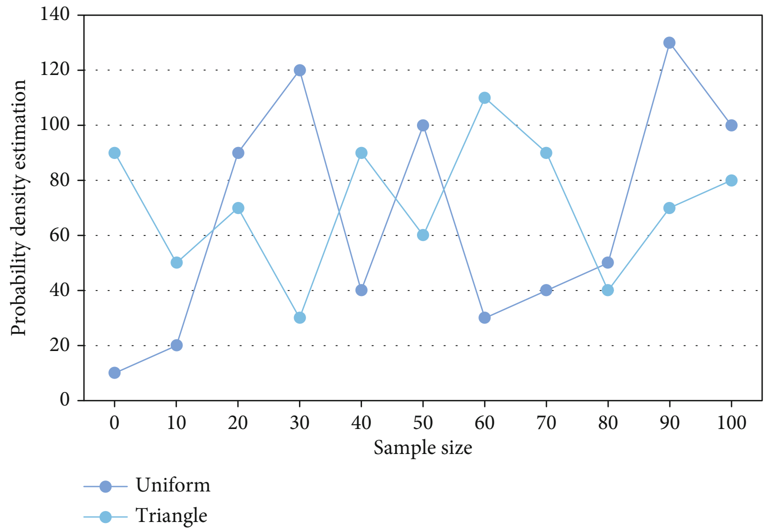


FIGURE 4: One-dimensional kernel function curve.

TABLE 1: Coupling strength of each node.

| Variable | $\|M_{xi}\|$ | $\|R\max(x_i)\|$ | $d(x_1)$ | $x_i$ |
|---|---|---|---|---|
| $p1$ | 0.421 | 17 | 0.3 | $t_1$ |
| $p2$ | 0.413 | 13 | 0.4 | $t_2$ |
| $p3$ | 0.501 | 15 | 0.1 | $t_3$ |
| $p4$ | 0.623 | 14 | 0.6 | $t_4$ |
| $p5$ | 0.459 | 16 | 0.5 | $t_5$ |
| $p6$ | 0.437 | 13 | 0.4 | $t_6$ |

which is conducive to taking control measures more carefully and clearly in priority subconsciously. Table 1 shows the coupling strength of each node.

First of all, both the positive and wrong judgment rates indicate a good judgment effect, and the latter indicates a good judgment effect. Therefore, we can estimate the probability density function $p$ by estimating probability $P$. Because the electronic information system contains many connected by nonlinear interaction relations, it can be deduced that its operation model is a multidimensional logical mapping. Parameters $\alpha_{i1}$ and $\alpha_{i2}$, respectively, represent the change rate of technical level and management level when the technical system and organizational system operate independently and the input is constant. Consider how the singular value of the auxiliary sensitivity function $T(s)$ determines the stability margin of the multivariable multiplicative disturbance $\Delta_M$. It is found that when $k_n$ is an even number, it is judged as other, indicating that the sample mixing is serious. At this time, $k_n$ can only take odd numbers, and finally, the discriminant function of $k_n = 1$ is established. The greater the value of $\alpha_{i1}$, the more technical system investment, the same as $\alpha_{i2}$. The same analysis can also be made for the additive uncertainty $\Delta_M$, and the results are similar to those of $\Delta_{A(s)}$. The kernel density estimation can be regarded as the sum of the windows centered on each observation sample point, while the smooth kernel estimation is the sum of the smooth "bulges" placed at the observation points, as shown in Figure 5.

Secondly, the chaos factor is used to identify the main failure modes of the built-in information systems for electronic networks, and the robustness of the system structure is analyzed to calculate whether each particle meets its constraint conditions. In each step, firstly, the power loads of all physical nodes are recalculated, and the nodes are sorted according to the load from large to small. Let the candidate solution be and the corresponding objective function vector of $x$ is $f(x)$. In the process of implementation, due to the influence of environment or other inevitable factors, it is impossible for the implementer to implement strictly according to its specified quantity $x$. Therefore, when the number of samples $n$ tends to infinity, the distribution becomes steep (the variance becomes smaller), and we can get a good estimate of the probability $P$ from the proportion of samples falling into the region $R$. And find out all the dependent nodes of these nodes as neighbors of the newly configured information nodes. In the process of robust refinement design of built-in information systems for electronic networks, the remaining 70% of the population is randomly generated in the searched space. The larger the value of the probability density function at the sample of the test point, the more concentrated the distribution of all sample points near the point. To characterize the robustness of a solution, we should know the disturbance distribution of parameters in advance, including the disturbance distribution and joint disturbance distribution of each parameter near the solution. Therefore, by changing the value of this register, the smaller phase error can be corrected, and the larger phase error can be realized by anti-aliasing filter. Let $\{x_n\}$ be the generated sequence and $x_0$ be a limit point. If every $\xi \in f(x)$ is continuously differentiable and $X$ is a convex function, then $x_0$ is the optimal solution.

The results show that the company that adopted the robust refinement of built-in information systems for

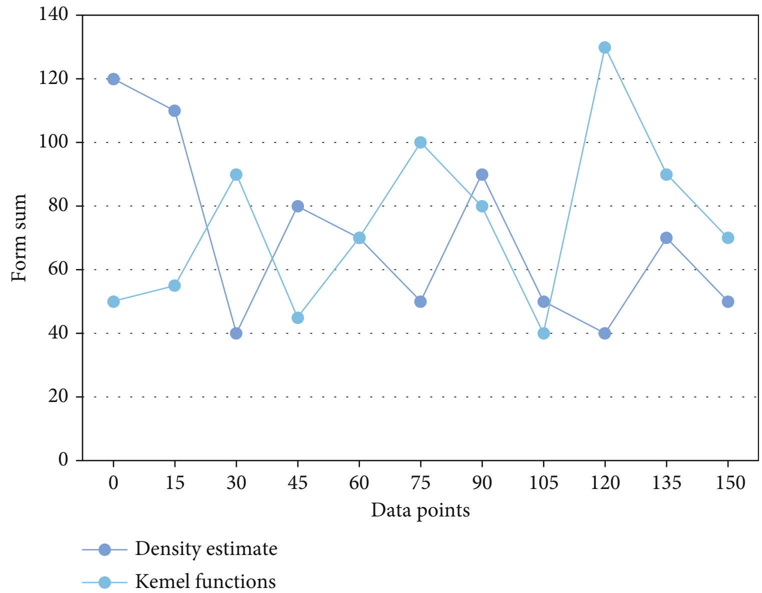


FIGURE 5: Schematic diagram of kernel density estimation.

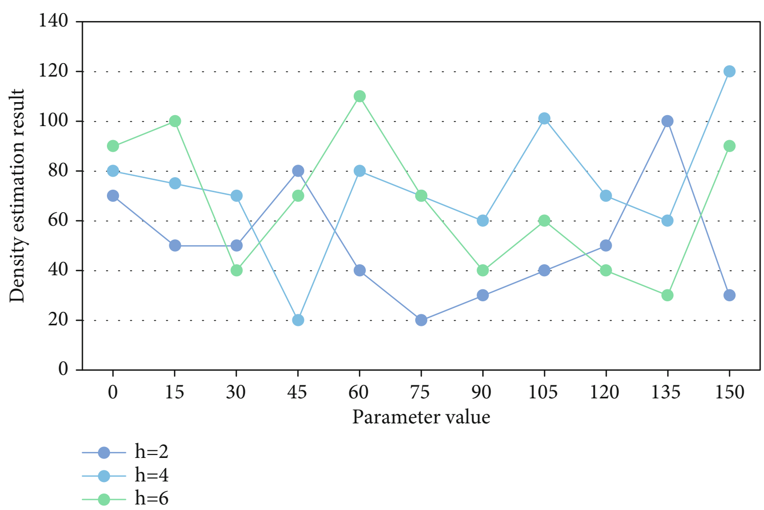


FIGURE 6: Kernel density estimation results under different bandwidth.

electronic networks based on nonparametric density estimation achieved a refinement rate of 82% in the first three years, while the company that did not adopt it achieved a refinement rate of only 57%, and the overall error rate was 43%. To sum up, it can be explained that the robust refinement principle of built-in information systems for electronic networks effectively completes the robust refinement design of the system.

TABLE 2: Parameter results calculated by Bayes solution.

| $\varepsilon$ | Optimal value | Optimal solution | Iter |
|---|---|---|---|
| 1 | $x^* = (0, 0, 0, 0, 0, 0.1, 0, 0)$ | 2.156 | 4 |
| 0.1 | $x^* = (0, 0, 0, 0, 0.2, 0.3, 0, 0)$ | 3.261 | 4 |
| 0.01 | $x^* = (0, 0, 0, 0, 0.4, 0.5, 0, 0)$ | 4.895 | 4 |
| 0.001 | $x^* = (0, 0, 0, 0, 0.6, 0.7, 0, 0)$ | 5.732 | 4 |
| 0.0001 | $x^* = (0, 0, 0, 0, 0.8, 0.9, 0, 0)$ | 6.573 | 4 |
| 0.00001 | $x^* = (0, 0, 0, 0, 1, 1.1, 0, 0)$ | 7.648 | 4 |

*4.2. Bayes Discriminant Analysis.* The traditional Bayesian discriminant solution specifies that the population follows the normal distribution, but in practical application, especially some economic problems, the population does not meet the normal distribution at all. Therefore, in the Bayesian discriminant solution, it is not assumed that the population satisfies any distribution; of course, it does not satisfy the normal distribution, but directly estimates the probability density of various types in the population through the nonparametric density estimation solution, which forms the nonparametric discriminant solution. In embedded system, computer system is generally embedded into the whole application system as an intelligent control component. It is

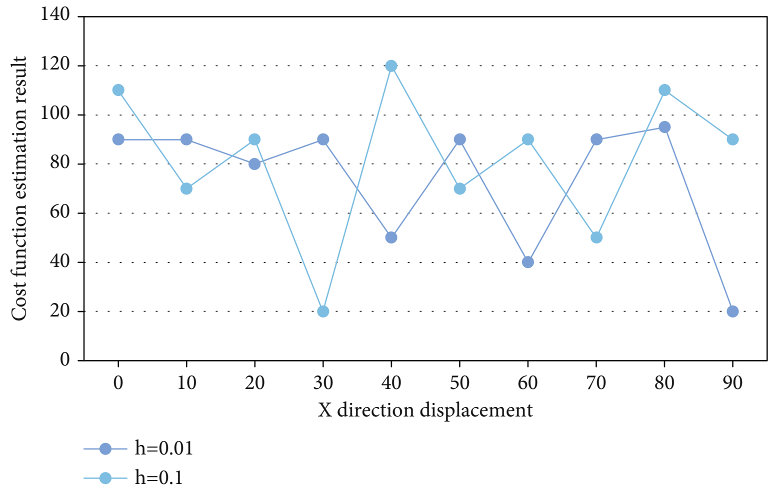


Figure 7: Relationship curve between bandwidth and cost function.

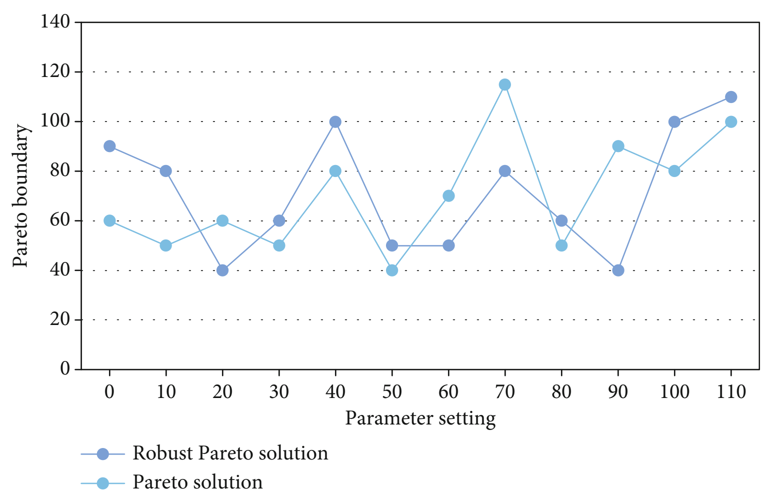


Figure 8: Pareto boundary simulation results.

the control center of the whole system. It is mainly used to control the information processing component and user interface of the system. The task of discriminant analysis is to establish a discriminant function according to the mastered sample data and then judge which population it comes from for a given new observation. It can be divided into two population discrimination and multipopulation discrimination. Figure 6 shows the density estimation results obtained when the Gaussian kernel function is also selected and the bandwidth is 2, 4, and 6, respectively.

First of all, if you know something, it can be divided into $k$ population: $G_1$,...,$G_2$, $G_k$, the characteristics of this thing are described by $p$ indicators. Before analysis, samples in each population have been observed. The specified range of a function variation and the radius of a spherical neighborhood with parameter variation are determined in advance. The robustness refinement area of built-in information systems for electronic networks is dynamically searched by using the acquisition function, and the global optimal solution of robustness design of built-in information systems for electronic networks is carried out by calculating the robustness refinement objective function of built-in information systems for electronic networks. When $f_n = 5\%$, the proportion of physical nodes with power load above 800 in the original physical layer and its four strategies was 15%, 24%, 36%, 22%, and 50%, respectively. With the increase of the proportion of configuration nodes, the digitized voltage and current values are sent to each calculation unit to obtain various power parameters, and these parameters are saved in the corresponding registers. Next, Table 2 shows the experimental results that the proportion of physical nodes is 15%, 24%, 36%, 22%, and 50%, respectively, and the power parameters are calculated in Bayes solution.

If the system has a stable controller and satisfies the frequency constraint, the function must be able to find at least one such global optimal solution. After getting the global optimal solution, we try to get the similarity relationship between the reference matching window and the target matching window by analyzing the distribution of the set in the feature space. The fault density function of embedded electronic information system is optimized to reduce the number of system faults. In the process of cost function refinement, the choice of bandwidth will affect the shape of the relationship curve between parameter values and cost function values and then affect the solution of quasi-Newton refinement process. Figure 7 shows two sets of laser scanning data obtained at two adjacent times.

Secondly, the estimated prior probability and density function are substituted into the discrimination rules to obtain the posterior probability for comparison. $H_\infty$ theory is used for the preliminary design of the system, and then, the appropriate criteria are selected according to the results of the preliminary design. Finally, Pareto boundary theory is used to complete the final system design. Figure 8 shows the Pareto boundary obtained by running under the same parameter setting and the Pareto boundary meeting the user's robustness requirements.

The failure modes of built-in information systems for electronic networks are divided into single limit state and multilimit state, and the failure probability of built-in information systems for electronic networks in these two states is calculated. The failure rate of embedded electronic information system is defined as the probability that the embedded system will fail in a certain period of time; that is, the ratio of the number of failed devices in a unit period of time to the devices still works normally at the moment after the system works until the moment. The reason is that the technical level and the management level gradually consume limited resources in the evolution process, and when the consumption reaches a certain level, there will be a self-restraint effect. For each candidate solution, a certain number of points are randomly sampled in a spherical neighborhood with a given radius. If the number of points whose function value does not exceed the specified range is not lower than a given threshold compared with the number of all sampling points, the candidate solution is considered to be robust.

## 5. Conclusions

When using the current algorithm to optimize the robustness of the system, it is difficult to determine the global optimal solution of the system, and there is a problem of large refinement design error. However, while improving the automation level, social production efficiency, and user experience, informatization also brings many hidden dangers to the security of intelligent system. The commonly used multiobjective refinement control algorithms include linear programming, genetic algorithm, evolutionary algorithm, and neural network refinement. The failure of the information system may affect the other party's network, resulting in cascading failure propagation, which seriously affects the safe operation of the electronic information system. Driven by the competing development of probability theory and statistics and the trend of overlapping applications, various application studies based on nonparametric density estimation and statistical analysis have been proposed and developed and gradually show good application performance.

Therefore, in this paper, nonparametric density estimation is used as a means to analyze point samples, and the solutions of failure probability and robustness refinement of built-in information systems for electronic networks are studied, respectively. Compared with traditional solutions, the reliability refinement solution proposed in this paper can improve the service life, availability and efficiency of embedded system to a certain extent, and it has certain reference value. The interaction threshold condition determined by model analysis and corresponding algorithm is the key to robust operation, which can provide reference for system planning, design and operation and maintenance management. In addition, for multi-input and multioutput systems, multiobjective control system design is carried out by using multichannel design idea, and robust refinement of built-in information systems for electronic networks based on nonparametric density estimation is more simple and effective.

## Data Availability

The labeled dataset used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The author declares no competing interests.

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