Method for Creating, Updating and Maintaining a Case Library of Service Business Guidance

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Abstract. This article provides a method for creating, updating and maintaining a case library of service business guidance. On the one hand, it uses genetic algorithm to filter and summarize cases that have been processed in the service business area to form a guidance case library. Therefore, service business staff are able to query and refer to similar existing cases when dealing with business in a follow-up; on the other hand, in the follow-up continuous use of new cases, new business in accordance with the new policy to update the guidance case base, the guidance case library always has the latest and most comprehensive cases to meet the needs of various service business.

1. Introduction

95598 is a customer-oriented service window for power supply enterprises. It is a direct channel for communication with the public and service objects. It is also a vital part of building a harmonious power supply environment. With the enhancement of social service supervision and customer service demands, the service quality of 95598 service also has higher requirements.

Prior to the operation of 95598, in order to provide business guidance to the service staff of the power supply service, the case summary of various business types is generally classified into a guidance case by the manual, which is completely dependent on the manual completion. The efficiency is low, and the maintenance cost is high. After the operation of 95598, in order to ensure that the service personnel of the power supply service of the provincial and municipal remote workstations can be familiar with the processing flow of various business work orders, the provincial power companies need to carry out pre-job system training and operation exercises for the service personnel of the power supply service. However, due to the change of the working mode, the manual summary guidance case is more complex, which brings great difficulty to the training work.

In addition, with the introduction of the new policy, there will be a new type of business appearance, which will provide the service personnel of the power supply service with a good command of the process, and can bring a lot of difficulties to the accurate strain in the case of various types of business cases. The case keywords can be selected by the genetic algorithm\cite{1-8}, and the case library can be created according to the keywords, and the case database can be updated and maintained by the latest policies and new cases, so as to form the latest and comprehensive guidance case library, and provide pre-job training for the service business personnel and business processing.

2. Creation method of case library of service business guidance
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Depending on the characteristics of the service business, the keyword "9" needs to be extracted in each case to identify a number of alternative keywords. When implemented, a number of words reflecting the business characteristics of this type of service are identified as alternative keywords depending on the type of service business to be applied. For example, for the power supply service business, the following alternative keywords can be identified: power outage, re-power, ladder electricity price, electric vehicle, photovoltaic power generation, meter reading, low voltage, power theft, home appliance damage, arrears, default electricity, electricity invoices, fault repair...

Using genetic algorithm to screen the optimal keyword from alternative keywords, the method comprises the following steps: establishing an initial population by using a plurality of alternative keywords as an individual, and calculating a short-term ratio and a total proportion of each individual in the current population. The near-term ratio refers to the proportion of the case with the individual in the recent case, and the total proportion refers to the proportion of the case with the individual in the total case source. For example, in the field of power supply services, the "total case source" includes all business cases received over the past two to three years as of the creation of the service business guidance case base. "The source of the recent case" includes all business cases received in the last quarter as of the creation of the service business guidance case library.

All individuals in the current population are sorted in ascending order of the recent share. Using the following fitness functions to calculate the fitness of each individual in the current population:

\[ f_t(i) = \sum_{n=1}^{i} CR(n) \]  
\[ CR(i) = \begin{cases} 
1, & |PO(i) - AO(i)| \leq T \\
0, & |PO(i) - AO(i)| > T 
\end{cases} \]

Where \( i \) is the ranking ordinal of an individual in the current population, \( PO(i) \) is the recent share of an individual with serial number I, \( AO(i) \) is the total share of an individual with a serial number \( i \), and \( f_t(i) \) is the fitness of an individual with an ordinal number \( i \), and \( T \) is the threshold value.

Since \( f_t(i) = CR(1) + CR(2) + CR(3) \ldots + CR(i-1) + CR(i) \), therefore, the larger the number of individuals, the more matching coefficients included in their fitness calculation; the smaller the number of individuals, the less the matching coefficient included in their fitness calculation; When an individual with an ordinal number \( i \), the matching coefficient \( CR(i) = 1 \), the fitness of the individual is greater than that of any individual in front of it; When an individual with an ordinal number \( i \), the matching coefficient \( CR(i)=0 \), the fitness of the individual is not less than the fitness of any individual in front of it; In other words, individuals with larger serial numbers are likely to be more adaptable and have a higher probability of being retained in the population.

The average of the fitness of all individuals in the parent population of the current population is calculated. For each individual in the current population, it is determined whether the fitness of the individual is less than the average of the fitness of all individuals in the parent population, and if so, the individual is determined to be a non-conforming individual. All non-qualified individuals are discarded from the current population. A genetic operation is performed on the remaining individuals in the current population to produce a new generation of populations.

In which, for the initial population, the initial population is considered to be the average of the fitness of all individuals as a result of their absence of a parent population.

For example, the average value of the fitness of all individuals in the parent population is 2, the case of the current population is shown in Table 1 below, in which the non-conforming individuals are "Web service", the remaining eligible individuals are "test list", "paid service", and "frequent power failure", and the remaining individuals are copied, crossed. The genetic manipulation, such as mutation, is used to breed the population.
Table 1. Individual fitness of the current population

| Individual | Web service | Test list | Paid service | Frequent power failure |
|------------|-------------|-----------|--------------|-----------------------|
| Recent share PO | 3% | 5% | 12% | 17% |
| Serial No. | 1 | 2 | 3 | 4 |
| Total Share ratio AO | 1% | 4% | 1% | 13% |
| Matching coefficient CR | 1 | 1 | 0 | 1 |
| Degree of adaptability ft | 1 | 2 | 2 | 3 |

(1) Copy

After the non-qualified individuals are deleted from the current population, the remaining individuals in the current population are copied so that the remaining individuals are all in the next generation population.

(2) Crossing

Pre-setting the crossing condition, and after the non-qualified individuals are deleted from the current population, cross-combining any two remaining individuals in the current population according to a preset crossing condition to generate a cross-individual; the fitness function of the cross-individual is calculated by the fitness function of the formula 1; And judging whether the fitness of the cross-individual is greater than or equal to the average value of the fitness of all the individuals in the parent population, and if so, allowing the cross-individual to enter into a new generation population. The cross-conditions set in advance are as follows: a cross probability is set in advance (the value range is generally 0.5 to 0.95), and a floating point number between 0 and 1 is generated for the remaining individuals in the current population before crossing, and the floating point number is smaller than that of the cross-probability.

For example, in the current population, the remaining individuals that meet the cross-conditions are “Web service” and “first-aid repair quality”, then the two individuals are subjected to cross-processing, and the resulting cross-individuals are “Site Quality” and “emergency repair service”. The fitness of the crossover individual is then calculated according to Formula 1, as shown in Table 2, the fitness of the “emergency repair service” is equal to the average 2 of the fitness of all individuals in the parent population, retained, and entered into a new generation population.

Table 2. Individual fitness after cross-combination

| Cross-individual | Site Quality | Emergency repair service |
|------------------|--------------|---------------------------|
| Recent share PO | 0 | 3% |
| Serial No. | 1 | 2 |
| Total Share ratio AO | 0 | 4% |
| Matching coefficient CR | 1 | 1 |
| Degree of adaptability ft | 1 | 2 |

(3) Variation

Pre-setting the variation condition; after the non-qualified individuals are deleted from the current population, each of the remaining individuals in the current population meets the preset variation condition is subjected to the mutation operation to generate a variant; the fitness function is used to calculate the fitness of the variation individual; And judging whether the fitness of the variation individual is greater than or equal to the average value of the fitness of all the individuals in the parent population, and if so, allowing the variant to enter into a new generation population. Wherein the preset variation condition is as follows: a mutation probability is set in advance (the value range is...
generally 0.01 to 0.1), a floating point number between 0 and 1 is generated for the remaining individuals in the current population before the mutation is carried out, and the floating point number is smaller than that of the variation probability, The specific gene position of the mutation is determined by generating a random number.

For example, in the current population, the remaining individuals in accordance with the variation conditions are “test list”, and the individual is subjected to a mutation treatment, and the resulting variation is an “electroscope”, a “look-up table”. The fitness of the variant is then calculated according to the formula 1, as shown in Table 3, the fitness of the “look-up table” is equal to the average value 2 of the fitness of all individuals in the parent population, retained, and entered into a new generation population.

Table 3. Individual fitness after variant operation

| Crossover individuals | Power inspection | Table checking |
|-----------------------|------------------|---------------|
| Recent share PO       | 1%               | 2%            |
| Serial No.            | 1                | 2             |
| Total Share ratio AO  | 0                | 4%            |
| Matching coefficient CR| 1                | 1             |
| Degree of adaptability/ $t$ | 1              | 2             |

According to the above algorithm, the genetic operation is carried out until the preset termination condition is met, and the “preset termination condition” can be designed as a population update algebra to reach a certain preset value, for example, the termination condition is to stop when the fifth generation population is generated; In addition, the termination conditions can also be designed as the fitness average of all individuals in the population to a certain preset value. An individual in the current population is selected as an optimal keyword when the preset termination condition is met, and an optimal keyword corresponding case is selected, and all cases are stored in the classification of each keyword to form a service business guidance case library.

3. Update and maintenance method of service business guidance case base

3.1. The case library itself is purified and streamlined.
Because the optimal keywords represent a lot of and centralized demands on the customer, it is necessary to include some duplicate case data in each keyword case sub-set, so that the case library is too large to cause the information explosion and influence the typical case search. The call and learning speed, in order to ensure that the case in the case database is typical in all kinds of problems, it is necessary to perform self-purification and reduction for each keyword case sub-set to eliminate the duplicate redundant data.

The main steps of the purification and reduction work are to carry out the accurate matching of the case service classification and the power supply unit area attributes within a certain keyword case subset, and for the service of the power supply service, the business classification includes consulting, failure, complaints, reports, opinions, suggestions, praise, and the like; Take Jibei Electric Power Co., Ltd. as an example, the power supply unit includes Tangshan Power Supply Company, Zhangjiakou Power Supply Company, Qinhuangdao Power Supply Company, Chengde Power Supply Company and Langfang Power Supply Company. If a case of a certain keyword case contains a large number of the same business classification and the case of the power supply unit, only the most recent case is reserved as a typical case of such a case, and the other cases are deleted as redundant data, and the self-purification of the sub-set of each keyword case can be obtained to obtain a typical case base.

3.2. Learning and maintenance of case base
With the development of the society and the development of the economy, the electric power industry has changed constantly, and in order to change the relevant rules and regulations and the policy documents, the processing method of the same case is changing constantly due to the change of the related policies. Although the service business staff deal with the case according to the new processing method, the original processing method needs to be reserved as the basis of the case processing effect comparison. In order to change the case, the policy Aisle shall be set in the case database maintenance system. The newly issued related policies enter the case database through the policy Aisle, and the case keyword information contained in the policy is extracted.

When a new case enters a typical case library, the keyword information in the new case is first matched with the keyword information in the recent publishing policy, and if the matching key can be matched, the matching key is label, and the new case enters the case database; If the new case keyword does not match the keyword in the policy file, the new case directly enters the case library. The new case is matched to the information in the case library. If the same key is not retrieved, the new case is included in the typical case library to form a new typical keyword case. If the same keyword is searched, the new case is added to the corresponding keyword case sub-set, the new case is exactly matched with all the cases in the keyword case sub-set, the power supply service is taken as an example, the accurate matching of the two attributes of the service classification and the power supply unit can be carried out, if all the above two attributes match successfully, and the new case key is the label key, the new case is saved, the old case in the case sub-set corresponding to the new case is set to the read-only mode, only the call is allowed, and the update is no longer carried out, and is stored in a temporary library as an expired case for use. If the new case key is an unlabeled key, delete the old case corresponding to the new case, and keep the new case. If one of the above two attributes fails to match, the new case is saved as a new typical case in the keyword case collection.

![Figure 1. Case Library learning and maintenance flowchart](image-url)
4. Conclusion:

This article presents a method for creating and updating a service business guidance case base, which is to filter the keywords in the case by the genetic algorithm, to set up a typical case base according to the keywords, and to update and maintain the typical case base according to the new policy, and the case library is kept real-time and comprehensive. Due to the fact that a specific fitness function is set, the optimal keywords that are finally screened can not only reflect the frequently occurring cases in a long period of time, but also reflect the frequently occurring cases in a short period of time. The screening method fully considers the common types of the service business, so that the created guidance case library has good practicability and can bring very practical guidance value to the service business staff. When the service business people deal with the case, the case sub-set in the typical case base can be called according to the case key words, the accurate meaning of the case information can be learned, a plurality of response schemes in the client demands can be given in real time, or a plurality of elimination schemes for determining the fault can be provided. It is possible to infer the future evolution of a customer or a work process based on past and present conditions of the case operation information, in addition to the past and present circumstances of the case operation information. The typical case library as a content covers a wide range of data sets with typical experience in various fields, and provides offline knowledge reference for each discipline, and becomes an important source for the extraction of relevant knowledge organize teaching and training. This article introduces the service of power supply service in the power industry as an example, and the method can also be applied to the service industries such as water supply and gas supply.

References
[1] Qu Zhijian, Zhang Xianwei, Cao Yanfeng, Liu Xiaohong, Feng Xiaohua. Genetic Algorithm Research Based on Adaptive Mechanism[J]. Computer Application Research. 2015 (11).
[2] Chen Chao. Improved research and application of adaptive genetic algorithm[D]. Institutes of Technology of South China. 2011.
[3] Sun Guoqiang. Multi-center mass data layout research based on genetic algorithm[J]. Software guidance. 2015 (1).
[4] Zhuang Jian, Wang Sun'an. Research on the Self-adjusting Genetic Algorithm[J]. Journal of System Simulation. 2003 (2).
[5] Tian Yanshuo. Research and Application of Genetic Algorithm[D]. Electronic Science and Technology University. 2004.
[6] Ma Yongjie, Yun Wenxia. Research progress of genetic algorithm[J]. Computer application research. 2012 (4).
[7] Dunwei Gong,Guangsong Guo,Li Lu,Hongmei Ma.Adaptive interactive genetic algorithms with individual interval fitness[J].Progress in Natural Science.2008(03).
[8] Guangmin Wang,xianjia Wang,Zhongping Wan,shihui Jia. An adaptive genetic algorithm for solving bilevel linear programming problem[J]. Applied Mathematics and Mechanics (English Edition).2007(12).
[9] Gao Junbo, Luan Cuiji, Wang Xiaofeng. New keyword extraction algorithm research[J]. Computer engineering and design. 2008 (3).
[10] Research on keyword extraction strategy based on word network[D]. Southwest University. 2008.