Research on Optimization Method of Computer Network Service Quality Based on Feature Matching Algorithm

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Abstract. On the whole, the main basis for strengthening the quality of network service is the construction of network system, reasonable arrangement of network and adjustment of information resources. In order to enhance the quality of network services, we should minimize the problems. In order to improve the quality of network, we should study more new network technologies and make up for network loopholes in time. In this study, in order to solve the efficiency problem brought by mass candidate services to quality-aware service selection, a service selection strategy based on feature matching algorithm is proposed. Based on statistical method, a probability matrix describing the mapping relationship between quality demand pattern and quality-oriented service pattern is established, and the service selection algorithm is improved by using the probability matrix. A series of experiments on artificial simulated data sets generated from real service data sets prove the feasibility and effectiveness of the proposed method.

Keywords: Feature matching algorithm; Computer network; Service quality optimization

1. Introduction
With the rapid development of science and technology, the network has entered thousands of households. With the popularization of science and technology and information network, people's requirements for computer network service level are gradually improving. The service level of computer network is not only simply combining and piecing together some hardware devices, but also requires the quality of personnel. On the one hand, the exploration space of computer technology is further expanded, providing perfect technical support for the development of modern computer field; On the other hand, the computer network service system has been gradually optimized, gradually forming a management platform for computer transmission content, transmission rate and other aspects, and bidirectional computer management promotes the improvement and gradual expansion of modern science and technology level [2-3].

Optimizing the quality of network service can ensure the needs of netizens to a great extent, and at the same time, it can make our country's network develop faster and faster, which is of great significance to the rapid development of modern science and technology. Great changes have been made in the previous network operation mode, and the network service quality has been optimized to make the network speed faster [4]. With the continuous integration of services in various fields in the
service system, the orders of magnitude of available services are increasing, more and more services with the same function and different quality are available, and the relationship between services is becoming more and more complex, which makes the search space expand exponentially in the process of solving, and brings great challenges to service selection. In order to solve this problem, based on the feature matching algorithm, we adopt the idea of supply and demand matching in the demand-service two-stage service development paradigm, and propose an efficient service selection strategy based on the demand-service probability matrix.

2. Main contents of computer network service quality
The quality of network service mainly shows the running status of data in the network, and it can effectively evaluate the service level according to the actual role of business, delay, data acquisition and packet loss rate. In fact, the quality of network service is mainly based on its overall understanding and strengthening of data packet queuing, optimizing and rating some special data according to a specific principle, further strengthening data transmission and realizing information exchange. Network service quality is to better meet the basic criteria of network services and further strengthen the service level of services.

When data packets are transmitted, some routers' own data buffers have reached the limit. When data is transmitted through these routers, routers need to filter relevant data so that the network can exchange information more quickly. At the time of transmission, it is impossible to judge the integrity of data, and it is necessary to transmit data many times, thus causing data delay [5]. Because the way of data dissemination is uncertain, if the router encounters problems in data dissemination, it will cause network delay, which is the main reason for the continuous decline of network service level.

3. Implementation principles of computer network service quality optimization approach

3.1. Principle of comprehensiveness
Optimization management of computer network service quality is a development channel for modern network resources and information resources to gradually expand and improve computer optimization. Based on the optimization approach of modern computer network service quality, the implementation of optimization approach of computer network service quality must comply with comprehensive criteria. The control and management of network service level is not a certain aspect of network management, but a system management structure relative to the overall network structure. To ensure the gradual improvement of modern network management, we must base ourselves on the network reality, promote the comprehensive planning structure of network resources in China, and promote the optimal development of the overall network environment.

3.2. System principle
Systematic principle refers to the development of network service quality optimization, which should follow certain development rules. For example, the optimization of network service quality can be divided into internal network quality optimization and external quality optimization, so as to ensure that the development of network service quality optimization can be reflected in every system part of the system.

For example, when a computer network service quality is optimized, it pays attention to the overall internal distribution of the system, and gradually establishes the internal structure distribution order according to the network resource distribution structure. This system control system not only greatly improves the way of system quality optimization, but also ensures the further innovation and development of the computer network service quality optimization process, providing a broader development space for the implementation of computer network service quality optimization.

4. SURF feature extraction algorithm
The detection of SURF feature points is based on Hessian matrix [6-7]. The hessian matrix of a pixel
\((x,y)\) in image \(I\) at scale \(\sigma\) is defined as:

\[
H(x,y,\sigma) = \begin{bmatrix}
L_{xx}(x,y,\sigma) & L_{xy}(x,y,\sigma) \\
L_{yx}(x,y,\sigma) & L_{yy}(x,y,\sigma)
\end{bmatrix}
\] (1)

In the formula, \(L_{xx}(x,y,\sigma)\) represents the convolution between Gaussian second derivative \(\frac{\partial^2}{\partial x^2} g(\sigma)\) and image \(I\), and \(L_{yy}(x,y,\sigma)\) have similar definitions.

The bottom layer of the scale space pyramid is obtained by the box filter template with the size of \(9\times 9\), which corresponds to the Gaussian second-order filter scale \(\sigma=1.2\). The convolution results of the box filter template and the image are represented by \(D_{xx}, D_{xy}, D_{yy}\), and they are replaced by \(L_{xx}, L_{xy}, L_{yy}\), so that the approximate representation \(H_{approx}\) of hessian matrix can be obtained, and its determinant is obtained by the following formula:

\[
det(H_{approx}) = D_{xx}D_{yy} - (wD_{xy})
\] (2)

In the above formula, the relative weight coefficient \(w\) is introduced to ensure the energy conservation between Gaussian kernel and approximate Gaussian kernel, and its value is given by the following formula:

\[
w = \frac{\|L_{xy}(1.2)\|_F}{\|D_{xy}(9)\|_F} \approx 0.9
\] (3)

In which \(\|x\|_F\) represents the \(F\) norm of \(x\). In fact, the value of \(w\) should change according to the change of scale, but it has little influence on the result. Therefore, in practical application, \(w\) is usually set as a fixed constant of 0.9.

Usually, in order to eliminate unstable points, it is necessary to set a threshold value for the determinant value of Hessian matrix, and only points whose determinant value of Hessian matrix is larger than the set threshold value will be retained as feature points. Then, the feature points are accurately located by using the method of three-dimensional quadratic function fitting, so that the feature points have sub-pixel and sub-scale accuracy.

5. Analysis on optimization methods of computer network service quality

When we optimize the quality of computer network service, we should grasp the primary and secondary relationship, increase research efforts, and determine the optimization time and location [8]. From these two aspects, we are actively seeking solutions. The existing optimization methods are mainly centralized and distributed. We should adhere to the principle of specific analysis of specific problems and carefully analyze them from different angles to effectively improve the quality of computer network services.

5.1. Establishment of network QoS optimization model

The establishment of network QoS optimization model can play a key role in solving the algorithm used in QoS optimization. The deployment mode of the algorithm will not only affect the establishment of the optimization scheme and the guarantee of the optimized service quality, but also affect the actual operation performance of the network. Specifically, the network QoS model can be optimized and established according to the following four aspects:

1) Allocation of network resources. Including how to ensure the connectivity of the network, the placement of interconnected devices, the placement of software to maximize resource utilization in server clusters, and the coverage of servers with minimum cost.
(2) Parameter configuration of the system. Includes the configuration of system parameters such as power consumption configuration of transmission nodes and size configuration of control window.

(3) Task scheduling. Include single-to-column multi-service scheduling, multi-queue single-server scheduling, multi-queue multi-server scheduling and so on.

(4) Resource allocation. Include the allocation of link broadband, the allocation of queue space and so on.

The scale space of the image is defined as a function \( L(x, y, \sigma) \), which is obtained by convolution of the variable scale Gaussian function \( G(x, y, \sigma) \) and the input image \( I(x, y) \):

\[
L(x, y, \sigma) = G(x, y, \sigma) \times I(x, y) \quad (4)
\]

Among them,

\[
G(x, y, \sigma) = \frac{1}{2\pi\sigma^2} e^{-(x^2+y^2) / 2\sigma^2}.
\]

Gaussian difference scale space \( G(x, y, \sigma) \) is defined as the convolution of the difference of adjacent scale Gaussian functions with constant multiplicative scale factor \( k \) with the original image, and the local extremum in these Gaussian difference images is taken to obtain the image feature points in the scale space domain. \( G(x, y, \sigma) \) can be expressed as [9]:

\[
G(x, y, \sigma) = \left( G(x, y, k\sigma) - G(x, y, \sigma) \right) \times I(x, y) \quad (5)
\]

Because some feature points extracted from two images to be registered are unmatched, if all feature points are matched according to Euclidean distance between feature description vectors, there will be some mismatches in the results. Therefore, this paper will improve this feature search and matching method, so as to improve the accuracy and speed of feature matching.

5.2. Resource management

Based on the basic management objectives of network services, resource management is a comprehensive resource optimization management system that gradually expands the new economic management structure, establishes a relatively perfect computer network service resource management library, and forms the structure of internal transmission resource management and external system network information transmission from the gradual expansion and improvement of resource management structure.

When users choose standardized business processes provided by the system to meet functional requirements and put forward corresponding quality requirements for business processes, the goal of the service system is to quickly select corresponding services for each task in the business process on the premise of meeting the quality requirements put forward by users, so as to form a service solution with the best quality. This problem is called quality-aware service selection problem [10]. Therefore, this paper studies the characteristics of service selection problem, the dependence between algorithm parameter values and optimization results, and provides the basis for the optimal setting of algorithm parameters. It avoids many tedious attempts to find the optimal parameter setting, thus improving the efficiency of solving the service selection problem.

This paper introduces the formal mathematical model of quality-aware service selection and the mathematical symbols used. The quality-aware service selection problem can be described as: given a business process \( BP = \langle A, E \rangle \) composed of a plurality of task nodes \( A \) (also called abstract services) and the control relationship \( E \) among the nodes, the total number of task nodes is marked as \( SSP \), and the process is used to describe and express the functional requirements \( FR \) of users. The quality constraint \( QC \) and the quality preference \( QP \) describe the user's quality demand \( QR \leq QC \). The algorithm selects the most suitable entity service \( S_{i,j} \) from the service candidate set \( S_j \).
corresponding to each abstract service (the total number of candidate set services is denoted as $ASC$) to form the final service solution $sol = \langle SL, E \rangle$, where $sol.SL = \{s_{i,j}, \ldots, s_{i,j}, \ldots, s_{n,j} \}$ makes $sol$ have the best global service quality on the premise of satisfying the quality constraints and quality preferences proposed by users.

Services in the service candidate set have $D$-dimensional quality of service attribute, which is represented by symbol $s_{i,j}^k$. Among them, the larger the value, the higher the quality of service (e.g., reliability, availability, trustworthiness and willfulness, etc.), while the smaller the value, the higher the quality of service (e.g., cost, response time, etc.). Therefore, the problem can be described as:

Enter:

$$r = \langle FR, QR \rangle, 1 \leq i \leq SSP$$ (7)

Output:

$$sol = \langle SL, E \rangle$$ (8)

Objective function:

$$\text{Minimise} \sum_{k=1}^{D} q_{P_k} \cdot F_k^k(sol)$$

$$s.t. F_k^k(sol) \leq q_{C_k}, k = 1, 2, \ldots, D$$

$$\sum_{k=1}^{D} q_{P_k} = 1$$ (9)

In which $q_{P_k}$ represents the user's preference for the $k$-th dimension quality parameter, and $q_{C_k}$ represents the user's constraint on the $k$-th dimension quality parameter. $F$ is the aggregation function of service quality, and the overall QoS value of service solution is calculated according to the business process structure $E$ in requirements.

The topology in the network has a link state, and only by collecting resources to complete the overall control can the fundamental problem be solved. After the data collection work is completed, specific strategies should be put forward according to specific conditions to effectively separate the data transmission layer from the control layer. Only after the above procedures are completed can the configuration operation efficiency be effectively improved and the overall optimization of the computer network service quality be ensured. In addition, a comprehensive service model should be established to complete the exchange between analog circuits and digital circuits.

For example, in the external resource management of computer network service quality optimization, the security protection system determines the modern network management structure more perfectly on the basis of network resource firewall, and forms the external security management structure of network service quality optimization, thus providing a more comprehensive resource management guarantee for the optimal management of computer system resources.

5.3. Build comprehensive services

Integrated service is a summary of network services. By building a comprehensive service type, we can make maximum changes and help to network services, thus helping to optimize the quality of network services. When operating, we should sort out the network signals sent by the computer network integrally and separately through the server to prove the authenticity and reliability of the network service.

Therefore, when using computer network services, we need to ensure the stability of network signals distributed by the server and the integrity of transmitted data, and ensure that when users use computer network data, the whole network is smooth and not stuck, and the network channels used are also independent and smooth, so there are relatively few cases of computer network jamming in
specific use. However, when optimizing the quality of service of computer network in this way, the server bears too much data, so in many cases, such a quality of service optimization method is only used in small networks.

6. Experiment and analysis
In order to verify the feasibility and effectiveness of the proposed method, this section uses artificial simulation data based on real data sets for experimental verification. Firstly, the two service selection algorithms are compared with two improved algorithms based on probability matrix from two aspects of optimization efficiency. The four algorithms are global optimization algorithm (GP), artificial bee colony algorithm (ABC), global optimization algorithm based on probability matrix (PM-GP) and artificial bee colony algorithm based on probability matrix (PM-ABC).

The experimental parameters are set as follows: there are 10 task nodes A in the business process, and the service candidate set scale G of each task node gradually increases from 50 to 1000. For PM-GP and PM-ABC algorithms, the parameters are set as the total number of service demand classes $m = 30$, the number of historical service records $h$ is 1000, and the minimum support threshold $\xi = 100$, which is the optimal parameter setting of the algorithm under the current conditions. The average optimality of service solutions obtained by two improved algorithms PM-GP and PM-ABC is about 97%, which is similar to the solution quality obtained by artificial bee colony algorithm. Therefore, it is considered that the improved algorithm based on probability matrix will not affect the solution quality, as shown in Figure 1.

![Figure 1 Optimality](image1)

At the same time, it can be concluded that compared with the global programming algorithm and artificial bee colony algorithm, the two improved algorithms PM-GP and PM-ABC have significantly reduced the running time and greatly improved the algorithm efficiency. Compared with the original algorithm, the efficiency has increased by 35.20% and 42.78% respectively, as shown in Figure 2.

![Figure 2 Run time](image2)

Experiments show that the probability matrix can improve the efficiency of the algorithm to a certain extent without affecting the optimality of the results. The main reason is that by establishing
the probability matrix, the prior knowledge implied in the probability matrix is used to guide the construction of service solutions, thus avoiding the algorithm from building service solutions from scratch, and enabling the algorithm to quickly find an approximate optimal solution in a short time.

7. Conclusion

The research on the optimization measures of computer network service quality is the way to further improve our country's computer network resources, realize the rational management of modern network system resources, and combine the basic components of modern computer network service quality optimization. In this paper, the prior knowledge obtained from historical data is used to guide the construction of probability matching matrix, which can effectively reduce the search space of service selection problem and improve the efficiency. The time complexity is reduced by finding the approximate optimal solution. Explore the improvement of computer network service level, promote the development of modern computer technology, and provide an effective exploration space for the development of modern computer network platform.

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