

Development of an automatic customer service system on the internet

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Abstract

Most existing network-based customer services heavily rely on manpower in replying e-mails or on-line requests from customers, which not only increases the service cost, but also delay the time for responding the service requests. To cope with these problems, this paper proposes a customer service system, which can automatically handle customer requests by analyzing the contents of the requests and finding the most feasible answers from the frequently asked question (FAQ) database. In the situation that a customer is not satisfied with the reply, the system will forward the request to the appropriate service personnel for further processing. An assistance mechanism has been developed to help the service personnel in finding potential answers from existing FAQ data or creating more appropriate answers. Experimental results on practical applications showed that over 87.3% of users were satisfied with the replies given by the system; therefore, we conclude that the system can significantly reduce the service cost and provide more efficient and effective customer service.

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1. Introduction

Researchers showed that enterprises would increase over 60% profits if they can build strong relationships with customers [15]. Nevertheless, some investigations also indicated that most businesses lose their customers by 25% rate per year in average [14]. The cost of finding new ones, however, is five times that of keeping original customers. Therefore, one of the most important issues for increasing enterprise competitive advantages is the development of new mechanisms to provide good service to customers.

Customer relationship management (CRM) is an integrated solution designed to reduce costs and increase profitability by solidifying customer loyalty. A successful CRM

includes four key elements: consumer communication management, customer relationship management, decision support management and integration of financial or logistic system. WorldTalk Corporation estimates that over 60 millions of people prefer to deal with their work by e-mail. The investigation of Department of Industrial Technique in Taiwan also observed that 96% of companies have employed e-mail systems to serve their customers. It seems that e-mail has become an important communication tool for most people. However, an investigation in 1998 has pointed out that enterprises gave no response to 65% of customer's inquiry [17]. The report also indicated that 63% of responded customers spend 5 days or longer to wait for the response. From these observations, it seems to be valuable to build up an efficient system for dealing with customer requests.

In recent years, e-mail based customer service system has been discussed and presented in several researches [3,5]. In most existing systems, automatic e-mail reply

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functions and customer request classification functions are not taken into consideration. Li and Tseng [13] proposed a system that can automatically handle customer requests by analyzing the request contents; however, the domain expert must define the weight of each keyword in advance, which is time-consuming and will decrease the accuracy of the analysis results.

To cope with these problems, this study proposes a new system, automatic customer service system (ACSS), which can automatically reply the requests from customers by invoking a knowledge base containing a set of frequently asked questions (FAQ's) and the corresponding character vector (CV) of each FAQ. While receiving a request, ACSS will generate a CV for the request, and compares it with those of the FAQ's by employing the space vector concept to find the most feasible answer for the customer. If no feasible answer can be found, ACSS will forward the inquiry to the appropriate service staff. Once the service personnel has provided an answer to the request, the new request as well as its answer will be recorded in the FAQ database, such that the system will be able to reply similar requests automatically.

2. Relevant works

Since 1985, enterprises started to build up call centers to provide customer services. Most of the call centers only serve consumers at regular office hours. Moreover, the service personals must receive a series of training courses before they can offer appropriate customer service, which implies the requirement of a large amount of training cost. It can be seen that such traditional service systems not only provide inefficient and ineffective service, but also increase the service cost; therefore, the development of automatic customer service systems has become an important issue for enterprises. Witt et al. [22] examined the relationship of the interaction between emotional exhaustion and conscientiousness with objectively-measured call volume performance and subjectively-measured service quality ratings among 92 call center customer service representatives of a financial service institution. They indicated that the interactive effects on call volume but not service quality; therefore, it might be a good idea to develop automatic customer service systems.

A call center and its associated information technology (IT) provide an opportunity to redesign and improve service-delivery operations [1]. On-line FAQ database are frequently adopted in traditional customer service systems, especially in the Internet environment [2]. Many technical companies not only employ on-line call centers to improve the service quality, but also provide relevant techniques and software to assist other companies in maintaining customer relationships; for examples, the call center systems of Ticali, Dell and IBM.

Although providing FAQ database can reduce service cost, the web site users need to select the possible category, link to the database and search for the answers manually,

which is usually time consuming, and the customers are likely to reach the limits of their patience, especially when the system load is heavy or the network traffic is burdened with a large amount of requests.

To more accurately identify the requests of customers, researchers have proposed several methods in recent years. For example, Hoch [8] presented the statistical methods of information retrieval used at INFOCLAS, which is capable of classifying print business letters according to message types such as order, offer and enclosure. In 1996, Cohen [5] proposed the "key word spotting rule" approach, which can efficiently classify e-mails and has been applied to the development of e-mail management systems. In the meantime, Cooper[6] reported the FAQfinder, which employed a set of weighted parameters to determine the similarity between the customer's request and the FAQ. Later, Li and Tseng [13] proposed an intelligent network-based customer service system (INCSS), which assigns a weighted keyword set to each FAQ, and then compares the keyword set of the customer's request and that of each FAQ to find the most feasible answer. INCSS can automatically reply the requests submitted from the customers; however, the weighted keyword set of each FAQ need to be assigned manually, which is time-consuming.

Other relevant studies include the issues of keyword retrieval and sentence similarity comparison. There are several ways to retrieval keywords, e.g., term extraction method [17], phrase extraction method [11], and Statistic analysis method [9]. Term extraction method can detect important terms from classified input text; phrase extraction method is used to detect phrases in the text; statistic analysis method can identify possible keywords from a large amount of unclassified input text by computing the occurrences of each keyword.

3. Structure of the automatic customer service system

Fig. 1 presents the structure of the automatic customer service system (ACSS), which consists of four databases and six modules. In the Keyword Database, a set of domain-relevant keywords is maintained. Once a question has been submitted by the customer, the Question Identification Module will try to identify the features of the question by checking if any word of it is in the Keyword Database. The matched keywords of each question form a characteristic vector (CV), which represents the features of the customer's question, and is then used to find the best-fit answer by applying the similarity comparison algorithm addressed in the next section. The FAQ and the corresponding answers are kept in the FAQ database.

The workflow of ACSS is given as follows:

- (1) Receives a user's e-mail.
- (2) Invoke the Question Identification Module to decompose the e-mail into several terms defined in the Keyword Database. Accordingly, the question submitted by the customer is transferred into a CV.

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