Computers & Industrial Engineering 84 (2015) 144–155

Contents lists available at ScienceDirect

Computers & Industrial Engineering

journal homepage: www.elsevier.com/locate/caie

Ontology-based reasoning for the intelligent handling of customer complaints

Ching-Hung Lee [a], Yu-Hui Wang [b,*], Amy J.C. Trappey [c]

[a] Department of Industrial and Management, National Taipei University of Technology, Taipei, Taiwan, ROC
[b] Department of Information and Finance Management, National Taipei University of Technology, Taipei, Taiwan, ROC
[c] Department of Industrial Engineering and Engineering Management, National Tsing Hua University, Hsinchu, Taiwan, ROC

ARTICLE INFO

Article history:
Available online 29 November 2014

Keywords:
Customer complaint
Ontology construction
Case-based reasoning

ABSTRACT

While responding to customer complaints and solving customer problems effectively contributes to high service quality, a customer complaint can also be regarded as a critical source of information for improving the firms' products and services. Handling complaints successfully can resolve crises and help maintain customer loyalty. Hence, from a customer relationship management (CRM) perspective, it is well worth collecting and analyzing complaint-related knowledge. Constructing ontology of customer complaints is the first crucial step in CRM. Web Ontology Language (OWL) is a formal tool for defining an ontology, providing a complete description of the domain knowledge. The ontological schema of complaint handling serves as the basis for case-based reasoning (CBR) mechanism which includes retrieving cases, using case indexing and similarity matrixes procedures. Thus, this research presents an interoperable ontology and case-based reasoning for intelligent complaint handling. The solution offers enterprises an informative and knowledge-based methodology to resolve customer complaints systematically with self-learning feature.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

Customer complaints convey important information directly from customers and are a major indicator of customer dissatisfaction. Complaint management is important for keeping regular customers as well as for attracting new ones and is a critical component of CRM (Goodman, 1992). There are different types of complaints, which are related to during- and after-sales experiences, quality of the product, and the service staffs' attitudes toward customers (Crié, 2003). It is very easy to lose customers if complaints cannot be resolved properly and quickly. A firm should develop different means for complaint-handling based on the severity of the complaint and/or the customer's emotions. The resolution of complaints can involve cash compensation, the improvement of services, or mental compensation (Bitner, Booms, & Mohr, 1994; Crié, 2003). Moreover, a complaint and its resolution can involve multiple departments and sometimes across the supply chain.

When taking resolutions for specific complaint, it is much relied on experts with experiences because of its complexity, difficulty and uncertain customer's feedbacks. It is more especially obvious in hospitality, catering, retail and tourism industries which are highly face-to-face oriented services. Such an experience-oriented approach are so-called heuristic approach (Recio-García & Díaz-Agudo, 2007). However, highly relying on experienced staffs has its limitation when facing the new and severe complaints that they never dealt with. Thus, many companies have paid more attentions on the applicable rules and resolutions to let staffs to follow. Moreover, data mining, web-based decision support system (Faed, Hussain, & Chang, 2014) are applied to get similar cases when handling customer complaints. Rule-based reasoning (RBR) and case-based reasoning (CBR) are generally applied to as the core of decision support system (Recio-García & Díaz-Agudo, 2007). RBR represents the decision-support knowledge based on experts' viewpoints; while CBR is the collection of experts' experiences. Thus, CBR have more inferring ability than RBR especially combined with ontology approach (Kolodner, 1993; Kolodner & Simpson, 1989). With ontology-based CBR, the heuristic approach can be enhanced with effective domain knowledge (Rissland & Skalak, 1989).

With clear ontology, people can use the knowledge map to make a better decision when facing complex problems. Ontology consists of the collection of concepts and the relationships between concepts (Agarwal, 2005; Guo, Schwartz,

---

* Corresponding author.
E-mail addresses: burning0831@gmail.com (C.-H. Lee), isecho@ntut.edu.tw (Y.-H. Wang), trappey@ie.nthu.edu.tw (A.J.C. Trappey).

http://dx.doi.org/10.1016/j.cie.2014.11.019
0360-8352/© 2014 Elsevier Ltd. All rights reserved.

Burstein, & Linger, 2009). The foundation ontology (or generic ontology/upper ontology) is a model constituted by the common elements that are generally applicable in various domain ontologies. Ontology can be seen as a tool that can provide sharing, common understanding, and reuse of the domain knowledge both between people and also between people and machines. It can be used to express structural and semi-structural semantics clearly in order to support the retrieval and maintenance of information and intelligence. When the ontology has been constructed, it can be expanded and interfaced to the system in order to provide the sharing of information between organizations or between departments within an organization (Yan & Zhang, 2006). The OWL representation has enabled the expression of semantic relationships through the building of a complaint ontology (Berners-Lee, Hendler, & Lassila. O., 2001; McGuinness & Van Harmelen, 2004; Yan & Zhang, 2006) on the semantic web, which enables the system to process and share information automatically without human interference (Patel-Schneider, Hayes, & Horrocks, 2004). Therefore, this research adopts OWL to develop a complaint ontology for enterprises.

The construction of ontology provides the foundation for case-based reasoning (CBR). This study develops a mechanism for case retrieval, using case indexing and similarity matrix, based on the constructed ontology. The proposed case-based reasoning mechanism is described in Section 5. The implementation of data analysis of the current electronic customer complaint handling (e-CCH) records and case-retrieval approach are also described in the section. After the core of this case-based reasoning has been analyzed, an intelligent and interoperable customer complaint handling (i-CCH) system is proposed based on the case-retrieval mechanism.

2. Literature review

2.1. Web-ontology language

Building ontology on the web is the major effort pushing the development of the semantic web and to create representative languages and describe knowledge in a machine-understandable form (Berners-Lee et al., 2001). The functional architecture of the semantic web is defined in the metadata layer, the schema layer and the logical layer (McGuinness & Van Harmelen, 2004). XML Schema, RDF (Resource Description Framework) Schema and OWL can all be regarded as web-ontology languages with an increasing capability to express semantics, in order to meet the needs of knowledge processing and knowledge management in different stages of knowledge management (Maniraj & Sivakumar, 2010; Patel-Schneider et al., 2004).

In the metadata layer, a data model includes only resources and properties. In this layer, and RDF is regarded as the most popular data model. RDF is a programming language for representing information about resources on the World Wide Web. When using RDF, the information not only is delivered to people to read, but can also is provided to the applications as inputs. RDF can fully express the meaning of full context, so the information can be exchanged between applications in a common framework.

There are three major modules in RDF (Uschold & Gruninger, 1996; Yan & Zhang, 2006), i.e. (a) Resources, indicating an object itself, e.g. a hotel, (b) Properties, describing the relationships between the resources, and (c) Statements, linking an object with a component of the object, property and value. RDF can show the features which are of a restrictive nature. Within the domain, it can define the values that the properties of an object have. OWL is an extended application of RDF. It has downward compatibility with RDF. In other words, a legal OWL document must be a legal RDF document, but not the other way around.

2.2. Customer-complaint ontology

A customer complaint (CC) should be treated as a critical knowledge for an enterprise. Handling a compliant successfully not only avoids further accusation, but also helps maintain customer loyalty (Hoffman, Kelley, & Rotalsky, 1995). Hence, the customer complaint related knowledge, from the knowledge management perspective, is the valuable intelligence for an enterprise. Establishing a complete knowledge-ontology can benefit an enterprise when the company is responding to customers' complains in a full spectrum (Bitner, Booms, & Tetreault, 1990; Hoffman et al., 1995). Therefore, compared with traditional customer-complaint handling which is based only on experience, construction of a knowledge ontology is an informative first step to resolve customer complaints in a systematic way (Crié, 2003; Jarrar, Demy, & Meersman, 2003a). Jarrar et al. (2003a) introduced the idea of setting up an online CC Form system, to be able to retrieve, respond, and analyze customer complaints for retailers. He also introduced the idea of knowledge ontology. Crié (2003) introduced the mixed theoretical framework of customer-complaint behavior, which can be applied to the knowledge ontology of complaint handling. Bitner et al. (1990, 1994) defined four types of customer complaints on the basis of almost 1500 cases of service failures in airlines, restaurants and hotels. These four types are: staff's reactions to the delivery system, staff's responses to customers' needs and requests, and spontaneous behaviors and questionable customer behavior. Hoffman et al. (1995) researched 373 restaurant cases and produced the sub-categories of customer complaints, including: (a) service delivery system failures, such as product defects, slow/unrealized services, facility problems and unclear policies; (b) implicit/explicit customer requests, such as food that is not cooked as ordered and seating problems; (c) unprompted and unsolicited employee actions, such as misconduct, wrong orders, loss of orders and mischarges. Seven service compensations were developed, including free food (23.5%), a discount (4.3%), a coupon (1.3%), managerial intervention (2.7%), replacement (33.4%), correction (5.7%) and an apology (7.8%).

In the above literature, studies developed the basic typology of complaints based on airlines, restaurants and hotels. In this research, we focused on building generally applicable and upper-layer ontology for "face-to-face" customer-oriented service industries such as hospitality, catering, retail and tourism industries. Moreover, the specific and lower layers of ontology which can be easily extended to specific types of restaurant and catering industries, such as cafeteria, beverage, fast-food restaurants, food courts, and independent restaurants. Thus, a complete customer complaint ontology, from macro- to micro-levels, for a given service industry can be addressed.

2.3. Case-based reasoning

The concept of CBR was proposed by Schank and Abelson in the late 1970's (Schank & Abelson, 1977). It refers to a methodology of using the prior experiences to infer and deal with current problems of similar features. The prior experiences or cases are stored in a specific database. Since the system learns from its past experiences, this is called a dynamic memory-based learning system (Schank, 1982, 2002). The system adopts some specific principles or rules to solve the current problems in the same way that people do, to ensure consistency of response when solving similar problems (Schank, 2002). CBR takes advantages of similar, past cases and accumulated experiences to derive relevant knowledge for new issues. Thus, it can achieve the objective of knowledge reuse (Aha, 1998). The cases stored in the case database are treated as prior experiences. The principle of operation is to describe the problem statement first, and then, to retrieve similar cases from

Download English Version:

https://daneshyari.com/en/article/1133458

Download Persian Version:

https://daneshyari.com/article/1133458

Daneshyari.com