

IMPROVING THE CUSTOMER INTELLIGENCE WITH CUSTOMER ENTERPRISE CUSTOMER MODEL

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Abstract: Customer can be profitably considered as an enterprise strategic asset. So, it is very important to define a bi-directional communication channel between the customer and the enterprise itself. In this work we propose a model named Customer enterprise Customer (CeC), that continuously hears customer opinions about enterprise products/services and behaves accordingly. CeC exploits the inherent nature of the growing so-called web 2.0, where users spontaneously join and spend time in sharing their reviews. The CeC model first collects and analyses customer opinions, then reports dysfunctions about the product/service to competent offices for giving feedback to customers, either by making the necessary improvements or by answering customers. The proposed model crosses all internal business functions, from design to production, and it is placed on the top of a customer-centred Enterprise Information System. In this work an overview of CeC model is given.

1 INTRODUCTION

Customer opinions constitute a gold mine for generating high value added information for making strategic decisions (Hagel and Rayport, 1999; Fabris, 2007).

The gathering of opinions is classically performed by ad-hoc interviews (often by phone or by email), that are based on pre-structured questionnaires. This approach, besides to be expensive, is limited. In fact, a customer expresses her opinions by using natural language better than by answering to a structured question (Bolasco et al., 2005). In order to overcome this limit, an enterprise may take advantages of the huge amount of information available over the Internet in form of forum, blog, wiki, and other web 2.0 tools.

It is, in fact, evident as the coming of web 2.0 promoted the birth of a sharing business philosophy and stimulated conversations and exchange among people (Wenger and Snyder, 2000). Customers exploit web 2.0 tools for both expressing their opinions about a product and suggesting solutions for improving it. The enterprises often encourage exchange of opinions, by making available virtual communities, e.g. Italian Nikon's Camera forum, where people review Nikon products (<http://www.nital.it/forum/>), the blog on Benetton products (<http://benettontalk.com>),

and so on. Furthermore there are various web sites that collect and make free available customer reviews (Cho et al., 2002): epinions.com, cnet.com, complaints.com, planetfeedback.com, ecomplaints.com, ciao.it, dooyoo.it.

To capitalize customers opinions is very important for an enterprise, both for the improvement of products and for the reinforcement of the customer loyalty. The customer will be motivated to be loyal if the enterprise shows a strong attention to her needs and her identity.

It is estimated that for each customer which makes a complaint, there are 4 to 26 customers do not claim even if they are dissatisfied. Each dissatisfied customer, on average, expresses her mood to 10 people. So, in the best case, behind each complaint there are 40 potential skeptical customers. Nevertheless, it is interesting to note that if a customer who complained sees the enterprise accepting the review and solving the related problem, then her propensity to purchase from the same company increases of 3 times, while for the customer who has not claimed, the propensity to purchase increases by 6 times (Lombardi, 2006).

In the last years the enterprise informative system have been designed in a customer-centric way to gather more accurate and detailed information about customers. Enterprise information System (EIS) feels

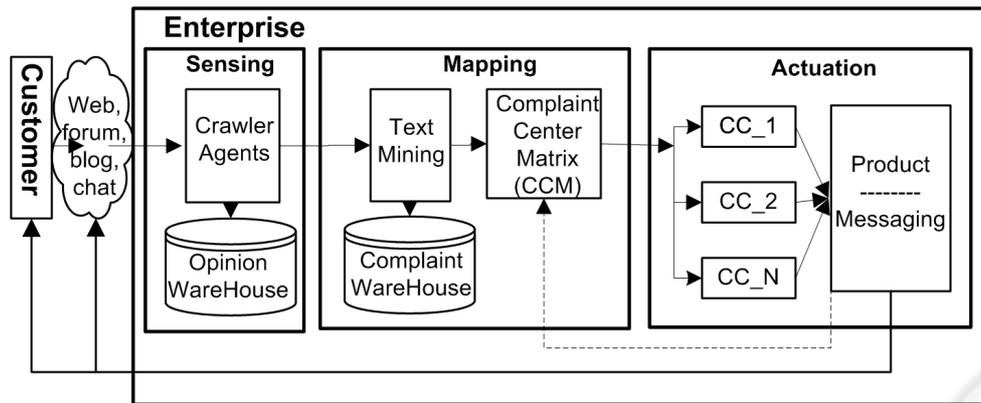


Figure 1: The Customer-enterprise-Customer model.

the necessity to have a model that gives, in real-time, the situation of the market and, in particular, that makes a continuous monitoring of the customer opinions.

In this paper a new model named *Customer enterprise Customer (CeC)* is proposed, that is aimed to continuously hears customer opinions about the product/service and behaves accordingly. To this end, CeC first collects and analyses customer opinions freely available over Web 2.0 tools, then reports dysfunctions about the product/service to competent offices for the necessary improvements or for answering customers.

Differing from classical operational CRM, CeC model is not limited to Customer Area (e.g. marketing, sales and post-sales), but it is introduced as a framework that crosses all internal business functions, from marketing to design and production. So, we placed our proposal on the top of the Enterprise Information System. Implementing a CRM model the enterprise is able to answer a customer only if her question is already in the CRM knowledge base. On the other hand, CeC addresses the customer opinions to competent offices analysing from time to time the unstructured texts containing opinions themselves. This, of course, introduces various issues to be considered, mainly regarding Natural Language Processing and Mining. In this work we briefly discuss these and other technical issues, concentrating on giving an overview of the proposed model.

The CeC model forms part of enterprise models introducing the concept of *prosumer* (Toffler, 1990), where it is emphasized the relationship between producer and customer. In this vision, the customer plays an active role in the enterprise, in particular he/she participates as a co-producer or as a consultant. Examples of co-producer are customers buying furniture at the IKEA and then finishing the productive process by assembling it at home. An example of consultant

prosumers is given in the Internet site of the "Fiat 500" (*500 Wants You - www.fiat500.com*), where each visitor expressed her/his creative contribution to the design of the new car.

The following Section is devoted to detail the CeC model, briefly discussing its main parts. Section 3 ends the work.

2 THE CeC MODEL

In Fig. 1, we show the Customer - enterprise - Customer model. The model is divided into three phases: *sensing*, *mapping* and *actuation*. Sensing consists of crawler agents that scan the web 2.0 tools (e.g. web site, forum, blog and so on) for finding and gathering opinions. Then, since customer expresses her opinions in unstructured text, we have to prepare and process opinions by text mining algorithms in order to extract useful complaints. In the mapping phase, complaints are mapped and routed to specific competence centers (CCs), that can be departments, internal experts, external consultants, and others groups of people that are competent in the problem expressed in the complaint. The mapping is described by the Complaint to Competence Matrix (CCM), e.g.:

- Complaints: unfocused photos, distorted images
→ CC: *Optic Department*;
- Complaints: LCD monitor does not shown photos
→ CC: *Electronic Department*.

Finally, the goal of the actuation phase is to react to stimuli, either by making changes to the product or by answering to customers (messaging). In this second case, the enterprise becomes, in a peer-to-peer web 2.0 vision, an actor as a customer.

2.1 Sensing

The sensing module is composed by a set of crawler agents specialized in different protocols (http, https, pop3, imap4, nntp), that are responsible to inspect and retrieve information, respectively, from web sites, blogs, chats, e-mails, newsgroups and so on. Each agent can be configured with policies to extract only texts (not structured, semi-structured or structured) with advanced techniques of NLP (Natural Language Processing). The various crawler agents are usually coordinated by a crawler manager which defines policies shared by all agents (Boldi et al., 2004). Crawlers could work in parallel exploiting the intrinsic nature of the network.

The customer reviews may be referred to positive or negative opinions. The CeC model has its principal focus on negative opinions. So, in order to reduce the searching space, intelligent agents can be exploited (Chan, 2008; Jansen et al., 2006). Such agents implement appropriate strategies and heuristics for analyzing only documents containing negative opinions. In order to distinguish between positive and negative opinions we can exploit techniques from the affective computing field (Grefenstette et al., 2004), for the individuation of emotions into a text.

In our model, collected reviews populate the Opinion Warehouse, that forms the corpus to be analysed by text mining algorithms in the next mapping phase.

Some examples of customer reviews are:

Review n.1: The edges of the photograph were faded;

Review n.2: The figures in the foreground aren't sharp.

2.2 Mapping of Complaints to Competence Centers

The main part of this phase is the Text Mining. The goal of the text mining part is the application of algorithms for pre-processing and for classification of customer opinions. Since opinions are written in Natural Language, we need specific pre-processing techniques: elimination of stop-words (articles, conjunctions, prepositions), division of the phrases into single words, identification of different parts of speech POS (nouns, verbs, adjectives), lemmatization, and numerical representation of text data (Berry and Castellanos, 2007). In the pre-processing phase it is important the use of the lexical ontology (e.g. WordNet). The ontology contains a set of explicit assumptions that concern the meaning of the words.

Table 1: An example of Complaint Competence Matrix.

	Complaints		
	distorted images	unfocused photos	LCD
Competence Centers			
Mechanic Dep.	0.15	0.35	0.00
Optic Dep.	0.75	0.05	0.00
Electronic Dep.	0.10	0.60	1.00

Classification model allows us to associate an opinion with one or more complaints on the basis of measures of semantic similarity. For instance, the opinions of the previous example can be classified as "The photos are unfocused". In order to design the classification model, information about both products/services and the internal organization of the enterprise has to be taken into account. To this end can be exploited a *Business Ontology* formed by two sub-ontologies: *Product Ontology* and *Enterprise Ontology*. The former defines in detail all products, their components, how they are produced and the related competence centers. The latter is a conceptualization of the whole enterprise: functions, business processes, competence centers, and so on.

The output of the data mining process are complaints, that are used in input to the Complaint Center Matrix (CCM), a model associating a complaint to one or more Competence Centers (CCs) (see example in tab. 1). In order to build the CCM, we can exploit information contained in the Business Ontology. The values of CCM elements represent the weight of a Department/CC in facing the complaint inherent problem.

At this point, a message containing the complaint and related reviews is automatically routed to individuated CCs. In the case of enterprise with a lot of CCs, we can improve the effectiveness of the routing by sending messages only to most competent centers, that is CCs with CCM values over a given threshold. In the example of Fig. 1, we see that the Optic Department is the most competent center for the problem regarding the "distorted images".

2.3 Actuation

The actuation phase is the less automatic one, cause the decision making process is mainly performed by people. In this phase CCs exploit the complaint messages for the improvement of products/services or for answering customers. In both cases, the enterprise give a (indirect or direct) feedback to the customer. As a matter of fact, the improvement of a product is an indirect message, communicating that the enterprise acknowledged the customer complaints. On the other hand, the enterprise may direct answer customer over

the same channel used by the customer for expressing her opinions. For instance, if opinions was found over a public forum, the enterprise participates in the forum itself as any other user.

The knowledge of the web sites dealing with enterprise products and services, can be also exploited for improving the effectiveness of communications towards the market. As a matter of fact, the message is addressed to interested people.

Furthermore, we introduce a feedback line from CCs and CCM, that allows managers to dynamically adjust the weights of the CCM, improving the effectiveness of the mapping and the routing (dotted line in Fig. 1).

3 CONCLUSIONS

In this work we propose the CeC model, a customer-centred enterprise information system model, aimed to exploit customer opinions for enriching the enterprise internal knowledge.

The main characteristics of this model is that the enterprise just limits itself to observe the web and, in particular, communities of customers discussing about enterprise products or services. Our model exploits the inherent nature of the growing so-called web 2.0 tools, where users spontaneously join and spend time in sharing their reviews. The CeC model is aimed to find, collect and analyse opinions, to react to stimuli and to send feedback to customers. So, while the enterprise plays a passive role in the discussions, it becomes participative when it send return messages to market, either by making changes to products (indirect messaging) or by direct answering customers by using the same web 2.0 tool.

The core of CeC is formed by the Sensing and the Mapping phases, where customer opinions are selected and analysed by tools derived from NLP and Text Mining areas. In these phases, after an appropriate pre-processing, unstructured opinions are classified as complaint classes, and then routed to centers most competent to respond to the complaint.

The CeC model is part of a more wide projet, that, at this moment, is at an embryonic state. We implemented only some crawler agents and designed the opinions warehouse for collect customer opinions about photo cameras and holiday villages domains. In next works we want to follow two main directions. In the former, we will use the collected warehouse for mapping phase, studying Text Mining algorithms and techniques most suitable for the specific problem. To this end, it will be needed to also design the business ontology.

In the latter direction, we will investigate techniques for design intelligent crawlers that are able to distinguish both useless from informative sources, and negative from positive customers reviews.

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