사용자 선호도와 지능형 다중에이전트 기반의 전자상거래 시스템의 설계

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요   약

정보기술과 e-비지니스 산업의 발전은 전자상거래의 중요성을 증가시켰다. 전자상거래를 지원하는 시스템은 편리한 인터페이스와, 편하고 빠른 검색 기능, 고객이 만족할 수 있는 정보를 제공할 수 있어야한다. 이를 위해서 추론 기법과 에이전트 기술을 사용한 시스템에 대한 연구가 필요하다. 본 논문에서는 고객의 선호도와 사례기반의 추론과 규칙 기반의 추론을 혼합적으로 사용한 세일즈 에이전트를 사용한 전자상거래 시스템을 설계하였고 실험을 통해 그 효용성을 보였다.

A Design of the E-Commerce System based on Customer Preference and Multi-Agent

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ABSTRACT

The importance of electronic commerce system has been growing rapidly due to development of information technology and acceleration of enterprise e-business. Electronic commerce system must provide convenient interface, easy and fast searching function, and product information satisfied customer's. A study about the system that used a reasoning technique and an Agent technology for this is required. In this paper, we designs electronic commerce system with customer preference and sales agent which is composed of case-based reasoning and rule-based reasoning for high customer satisfaction. Also, we were shown on an appropriateness of a proposal system by an experiment.

1. Introduction

Electronic commerce has been growing rapidly due to the development of the internet and information technology such as high speed telecommunication network and visual reality technology [1, 2]. But many kinds of electronic commerce system don't satisfy customer's requirements or needs because the system don't give customer's suitable product-related information. To solve these problems, many researchers have studied intelligent agent and agent-related electronic commerce system [4-6].

In this paper, we suggest electronic commerce system with sales agent using intelligent multi-agent and customer preference. This paper aims to develop an electronic commerce system that reflects customer preference for high customer satisfaction as well as customer's or user's feedback. The presented system can find suitable product information according to customer's age, occupation, attainment in scholarship, sex, interest field, and customer preference according to price, sales quantity and production year. Also, we were shown on an appropriateness of a proposal system by an experiment.

2.Related Researches

Until the widespread deployment of internet technologies in the early 1990s. Enterprise that conducted e-commerce used almost exclusively a closed and standardized of computer-to-computer communication known as EDI. In fact, the term electronic commerce was virtually synonymous with EDI [2]. E-commerce as such, however, has come to attract the interest of many following the commercialization of the Internet and especially the advancement of the WWW and its business applications. Hence, in the evolution of e-commerce, it is possible to differentiate between traditional e-commerce and internet based e-commerce [3]. Various e-commerce definitions and conceptualizations covering issu-

es, applications, and business models are existed. Leem [7] defines that electronic commerce is transaction which processes all or part kinds of information through computer network to help enterprise, organization and persons task.

An agent is a computer program can assist user's by performing intelligent tasks [8, 13]. And Intelligent agent is software that achieve various works that user must achieve directly instead of. Work that user wants needs complex process sometimes or process one task simply. Therefore, intelligent agent needs plan function to understand work that user requires and achieve this effectively and structure that a several agent solves problem by cooperation is required to achieve complicated work efficiently. Intelligent agent can establish and realize planning that can satisfy user's requirements effectively by cooperating multiplex agent each other. It can be embodied by method that agent in electronic commerce system is various according to each function special quality, In implementation, openness and mutual operation, and proper correspondence about change must be considered. Intelligent agent does information gathering, data processing, knowledge abstraction, decision-making, decision-making achievement and reasoning, for state grasping of relevant condition and is divided to watching, learning, shopping, information abstraction agent according to the function that perform. Many researchers also have developed an electronic commerce framework using multi-agent technologies [10-12]. BargainFinder and Kasbah are examples for these electronic commerce systems. BargainFinder provides valuable information for the buyers through price comparison in online store. Kasbah is the marketplace architecture for buying and selling goods [5, 12].

Case-based reasoning is a problem solving technique that reuses past cases and experiences to find a solution to the problems [9, 14]. The main tasks that case-based reasoning methods have to deal with are to identify the current problem situation, find a past case similar to the new one, use that case to suggest a solution the current problem, evaluate the proposed solution and update the system by learning from the experience. Case-based reasoning is intelligent agent programmed by these methods. Case which expresses particular situation in problem of some domain in case-based reasoning is come to pattern in artificial neural network. And case base that do database with gathering particular cases corresponds to knowledge base in rule-based expert system.

Rule-based reasoning refers to that speak that express knowledge that is found by specialist's experience in form of production rule and arrange it after abstracting rules of problem area from specialist and embody rule base and reason this. Knowledge representation expresses by If-Then

rule here. These rule-based reasoning is ceilinged on problem explaining because is no problem when specialist's knowledge is arranged well systematically but must acquire specialist's knowledge as much as necessary part when is not so.

In this paper we use hybrid system that use strength and weakness of such two ways-case-based reasoning and rule-based reasoning properly, we can solve the problem by making rules by specialists in rule-based reasoning when similarity degree in case-based reasoning is same or case is not suitable or case is not in the case base. Also, there is advantage that can minimize the number of rules by applying necessary rule because our system makes use of case base system together.

3. Design of System

3.1 Structure of System

Usually, agent of electronic commerce system is divided to catalog agent, search agent, comparison shopping agent, advertisement agent, tradeoff agent [13]. Electronic commerce system in this paper is consisted of information gathering agent (Robot Agent) that collects goods and customer's information, Sales Agent to analyze customer's query and use customer's basis information and requirement and supply correct goods information in customer each inclination, Index abstraction agent (Index Agent) that compose index from collected information, Comparison search agent that find and compare relevant data according to goods sale agent's request and customer preference input system which can input customer's preference.
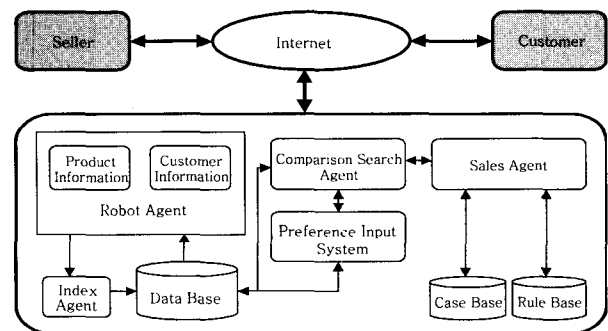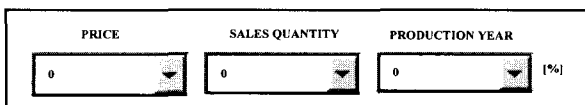

(Figure 1) System Structure

● Robot agent : It can do detailed processing for goods information or alteration of customer information, draw index by the information and index agent and store keyword information when is not stored comparing with information in data base.

● Index agent : It can draw index from goods information

to subject, item, kind, and size.

● Search agent : Search engine greatly can divide to key-word search engine, subject search engine, meta search engine etc. User can input factors such as price, sales quantity, production year by different input reflection ratio. Because this system supplies new goods information considering user's requirements in case customer does not satisfy to goods information that is supplied because similarity degree is so low or case is not in the case base. This system can supply the most suitable product information to customer.

● Customer preference input : Customer using customer preference input system can input customer preference degree directly when do not satisfy about goods recommended by selecting one among factors such as price, sales quantity, and production year or input according to the ratio. When there is no case in case base, in case customer satisfies to goods information that appear through customer preference degree, this information can be registered as new case. Scale range is from 100%~0% by 10% unit. Sum of value of three elements must become 100% always.

(Figure 2) Customer Preference Input

3.2 Sales Agent System

The structure of electronic commerce agent for sales is illustrated in (Figure 3). It supplies together information that is learned through case-based reasoning and information that is based on rule-based reasoning.
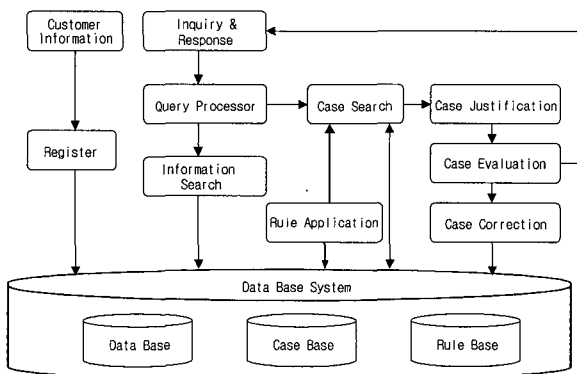
(Figure 3) Sales Agent System Structure

● Registering : In case of new customer, it adds customer's body information to customer information database.

● Customer query process : It discriminates customer and analyzes customer's query and draw keyword from inquiry.

● Case search : The system searches related case from case base by using customer's information and keyword. If customer's information and information that is abstracted from questions agree case in the searched cases, it chooses the case in case base. And it chooses the most appropriate case by calculation similarity degree if there is no relevant case and information that agree.

● Product Search : In case similarity degree of searched case is so low, at search step that search correct information suitable for customer's requirement, offer correct goods to customer through search engine. If case that similarity degree is high or similarity degree is same does not happen, supply the most appropriate information for the goods by searching goods information that corresponds to keyword that draw from customer's requirements in data base system.

● Case Evaluation : At the case evaluation step, in case searched case is impertinent case of customer's inclination, because customer inputs factors such as price, sales quantity, production year directly, the system supplies information for suitable goods for customer's needs.

● Case Correction : In equal case that bought recommended goods is in case base, increase case and add case in case base if case is new case. That is, in case customer did not buy goods, contents of case base are no change and in case customer bought product, correct information of case base. If there is no case in case base, rule base or customer preference input makes new case by selecting product information.

In sales agent system, internal process of hybrid-reasoning model using together case base reasoning and rule base reasoning is illustrated in (Figure 4).
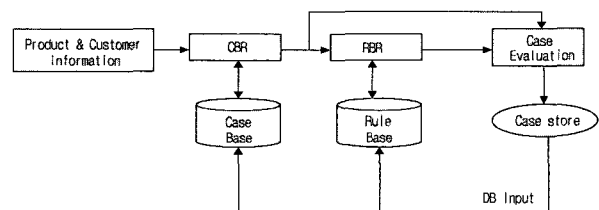
(Figure 4) Internal Process of Hybrid reasoning Model

3.3 Similarity Degree

To evaluate whether searched case fits in customer's inclination or not must calculate similarity degree by searching the best suitable case according to customer's requirements. R_i is the following. he calculation method of similarity degree

$$R_i = CUS_i(Customer\_Special\_Quality) \quad (1)$$
$$+ SEL_i(Case\_Choice)$$

$CUS_i(Customer\_Special\_Quality)$: Similarity Degree of Customer Special Quality

$SEL_i(Case\_Choice)$: Similarity Degree of Case Selection(Choice), $i = 1, 2, \cdots, n$

$$CUS_i(Customer\_Special\_Quality)$$
$$= CUS_i(Age) + CUS_i(Sex) + CUS_i(Scholarship) \quad (2)$$
$$+ CUS_i(Occupation) + CUS_i(Interest\_Field)$$

$$SEL_i(Case\_Choice) \quad (3)$$
$$= \left[\frac{SUC_i(Nmber\_of\_Success)}{Maximum\_Nmber\_of\_Success} \right] \times C$$

Customer's special quality is various kinds condition, and can be applied differently according to goods. In this paper abstracted information in question is limited to contents of distinction of age, sex, attainments in scholarship(scholarship), occupation, interest field.

3.3.1 Similarity Degree of Age

$$CUS_i(Age) \quad (4)$$
$$= W_{Age} - \frac{|Customer's\_Age - CB_i(Age)|}{C_{Age}}$$

$CB_i(Age)$: Age in case base

W_{Age} : Weight about age of main target customer of product

C_{Age} : Constant for age

3.3.2 Similarity Degree of Attainments in scholarship.

Attainments in scholarship is divided by graduate school 1, college or university 2, high school 3, middle school 4, and 2 in case do not know.

$$CUS_i(Scholarship) = W_{Scholarship} \quad (5)$$
$$\times \left[1 - \frac{|Customer's\_Scholarship - CB_i(Scholarship)|}{C_{Scholarship}} \right]$$

$CB_i(scholarship)$: Scholarship of case base

$W_{Scholarship}$: Weight about in scholarship

$C_{Scholarship}$: Constant for in scholarship

3.3.3 Similarity Degree of Sex. Customer's distinction of sex by goods does by man 1, woman 2, unknown 3.

$$CUS_i(Sex) = W_{Sex} \quad (6)$$
$$\times \left[1 - \frac{|Customer's\_Sex - CB_i(Sex)|}{C_{Sex}} \right]$$

$CB_i(Sex)$: Sex of case base

W_{Sex} : Weight for sex

C_{Sex} : Constant for sex

3.3.4 Similarity Degree of Occupation. According to connection degree about goods and profession, give weight.

$$CUS_i(Occupation) = W_{Occupation} \quad (7)$$

$W_{Occupation}$: Weight for occupation

3.3.5 Similarity Degree of Interest Field. Give weight if goods and interest field agree, and if not, can apply weight according to relating degree differently.

$$CUS_i(Interest\_Field) = W_{Interest\_Field} \quad (8)$$

$W_{Interest\_Field}$: Weight for interest field

3.3.6 Similarity Degree of Case Selection(Choice). Case choice appears by ratio of success number

$$SEL_i(Case\_Choice) \quad (9)$$
$$= \left[\frac{SUC_i(Nmber\_of\_Success)}{Maximum\_Nmber\_of\_Success} \right] \times C$$

$SUC_i(Nmber\_of\_Success)$: Total numbers which customer bought goods

C : Basic constant by product

4. Experiment and Results

4.1 Data Structure and Variables

To make prototype of system, we used Windows 2000 Server environment, IIS5.0 as web server, ASP3 and SQL2000 as DBMS. We designed prototype system for books sale. Data structure is followings.

• Product Information

Books Code	Title	Writer	Publishing Company	Price	Publication year	Sales Quantity

• Customer Information

Customer Code	Name	Address	Telephone Number	Birthday
Scholarship	Age	Occupation	Interest Field	Secret Number

• Sale Information

Books Code	Customer Code	Sale Date	Payment Method	Sale Number

• Index Information

Keyword	Books Code

Values given for calculation of Similarity Degree for conveniences is followings.

Maximum number of Success = 1000, *C* = 10,

$W_{Age}= C_{Age} = 5,10,$

$W_{Scholarship}= C_{Scholarship} = 3,10,$

$W_{Sex}= C_{Sex}= 3,10,$

$W_{Occupation} = 5,$

$W_{Interest\_Field} = 5$

4.2 Results

● *Abstraction of customer's information and keyword.* If customer inputs keyword of goods that customer wants, it draws customer's body information and keyword of goods information.

● *Case base search.* Search customer's information from customer's registration information, compose index from searched customer's personal information.

<Tables 1> shows example of composed index. And <Table 2> shows example of case base and <Table 3> shows calculated similarity degree.

<Table 1> Table of Index

Age	Scholarship	Sex	Occupation	Interest Field
30	Graduate School	Man	Student	IT

<Table 2> Example of Case Base

Key-word	Field	Age	Scholar-ship	Sex	Occup-ation	Books Code	Success Number
IT	e-Business	25	High school	Man	Student	IT123	400
IT	e-Business	25	University	Woman	Student	IT560	300
IT	e-Business	26	Graduate School	Man	Unkonwn	IT230	200
IT	e-Business	28	Graduate School	Woman	Unkonwn	IT002	380
IT	e-Business	30	Graduate School	Man	Stuedent	IB123	600

<Table 3> Calculated Similarity Degree

Books Code	Field	Age	Scholar-ship	Sex	Occupation	Case Selection	Success Number
IT123	5.00	9.00	3.33	10.00	5.00	4.00	36.33
IT560	5.00	9.00	6.67	6.67	5.00	3.00	35.33
IT230	5.00	9.20	10.10	10.00	5.00	2.00	41.20
IT002	5.00	9.60	10.10	6.67	5.00	3.80	40.07
IB123	5.00	10.00	10.10	10.00	5.00	6.00	46.00

● *Case Evaluation.* Product information for the highest similarity degree among case-base is presented. In case customer does not satisfy about product that is presented, case

for index is not in case, or similarity degree is so low. It shows search result that is consider user's requirements and fit most on customer need by making customer input benevolent persons' reflection ratio such as price, sales quantity, production year differently.

<Table 4> Example of Case Selection

IT	e-Business	30	Graduate School	Man	Student	IB123	600

● *Customer Preference Input.* Customer can select product by preference input. (Figure 5) and (Figure 6) shows the result of product information in case customer input own preference when he or she didn't satisfy to given product information.

Preference Condition	Books Code	Title	Writer	Publishing Company	Price [Won]	Publication Year	Sales Quantity
PRICE 100% SALES QUANTITY 0% PUBLICATION YEAR 0 %	IT123	eBiz World	AAB	Press One	8000	200010	5800
	IT560	Web Infor mation	SCS	Case World	8500	199905	5200
	IT230	IT World	DDF	Sam Book	8800	200103	4700
	IT002	IT Archi tecture	DFG	Basic Books	9000	200101	7700
	IB123	Infor mation Mana gement	SFS	Tritent	11000	199612	6400

(Figure 5) Product information list in case of price is 100%, Sales Quantity is 0%, Publication year is 0%

Preference Condition	Books Code	Title	Writer	Publishing Company	Price [Won]	Publication Year	Sales Quantity
PRICE 100% SALES QUANTITY 0% PUBLICATION YEAR 0%	IB123	IT Archi tecture	DFG	Basic Books	9000	200101	7700
	IT002	Infor mation Mana gement	SFS	Tritent	11000	199612	6400
	IT123	eBiz World	AAB	Press One	8000	200010	5800
	IT230	Web Infor mation	SCS	Case World	8500	199905	5200
	IT560	IT World	DDF	Sam Book	8800	200103	4700

(Figure 6) Product information list in case price is 0%, Sales Quantity is 100%, Publication year is 0%

• *Case Correction.* It shows goods information about selected case in case base to customer. In case of customer bought goods or took answer of affirmative that information for goods was profitable, increase success number in case base. In case of did not use case, It can register as new case about selected product and make success number 1.

5. Conclusion

In this paper, we proposed electronic commerce system for sales that can enhance corporation's profit in electronic commerce that is accelerated along with development of internet, that can heighten customer's satisfaction accommodating complicated customer requirements and that can use various kinds information about customer in corporation dimension.

We presented solution in case of customer does not want information given because similarity degree is same or so low through system that can do case-based reasoning and rule-based and system with search agent function. Presented system could satisfy more customer requirement condition through customer's preference input and agent can study oneself by learning and adapting

And we reflected enough customer requirement through customer preference input in case of product that is not reasoned in case base and used recommended product information to new case. The system could search more intelligent information by doing so. Therefore we can know that the system can offer much more customer satisfaction to customer by giving customer more efficient information. This research needs to make corporation use data actually by applying web application in real enterprise. Corporation or enterprise can supply more information to customer thereby and corporation can accomplish marketing or better administration result by using various information that get from customer.
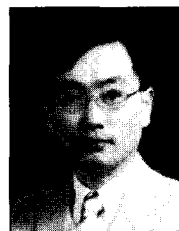
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