



APPLICATION OF SOFTWARE ROBOTS AND DEEP LEARNING IN REAL TIME PROCESSING OF E-COMMERCE ORDERS

WENBO NIU*, YIBO HU† AND WEI ZHANG‡

Abstract. The development of e-commerce faces many problems, among which the real-time information exchange between customers and websites is the most urgent. To study the application of software robots in the real-time processing of e-commerce orders. According to the working mechanism of ALICE, JAVAPROGRAMD, AIML technology, database technology, knowledge base principle, Rule of inference, and reasoning strategies are used to design the structure, workflow, knowledge processing flow, and Inference engine supporting human-computer automatic negotiation of the software robot. Establishing a rule base is the acquisition, induction, and organization of knowledge related to order processing. It requires learning and analyzing the problems and related materials to be solved, simulating the actual process of order processing, and extracting useful processing rules and processes from it. The rules in the system are not organized in a simple list form, but have a certain hierarchical structure. This way, when using these rules for reasoning, the hierarchy is clear and it is easy to modify and add rules. The hierarchical structure of the rules referred to here is to simulate the thinking activities of the human brain in the process of order processing, and organize them in a certain way. Based on the basic rules of order processing, the process of order processing, the rational performance of the order and the possibility of necessary events, so as to realize the structure of the reasoning machine. Expands the application of Chatbot ALICE, and provides a new tool for real-time online negotiation and negotiation of e-commerce order processing. The core part of the e-commerce order processing software robot is the human-machine automatic interaction module. Database module, knowledge base module and rule base module provide the necessary data, knowledge and rule basis for its realization, while the implementation of reasoning machine provides the possibility for the intelligence and dynamic interaction of human-machine automatic interaction module.

Key words: Software robots, E-commerce, Real time processing of orders, Online negotiation, Negotiate reasoning

1. Introduction. With the development of computer technology and network technology, the development of e-commerce advances rapidly. E-commerce can reduce costs, reduce inventory, save time, and so on, but it also faces many problems, among them, the order processing transaction in the high cost, low efficiency is especially obvious. The widespread market of e-commerce has led to increasing demands and expectations from people. At present, the problems faced by e-commerce websites in order processing transactions and the resulting defects of high cost and low efficiency are becoming increasingly apparent [1]. Currently, after consumers place orders through business websites, merchants will confirm the authenticity of the order and negotiate specific matters on the order through phone or email. In the face of fierce global market competition, every merchant should respond promptly and quickly. However, in the above-mentioned order processing process, several aspects are far from meeting the needs of rapidly developing information technology and increasingly competitive online commerce [2]. Therefore, it is extremely important to design man-machine dialogue software robot based on rules and reasoning mechanism, which can free people from order processing; increase the real-time, accuracy and dynamic interaction of order processing; reduce the operating cost of merchants; realize the characteristic service of merchants and the personalized needs of buyers. The research and implementation of this real-time and online man-machine negotiation platform is one of the challenging research topics in e-commerce order processing. Firstly, when a consumer places an order, they are faced with a pre designed business website by the merchant, which includes static information such as description information of various products, prices of products, and fixed delivery times in fixed areas. Consumers have only two choices: accept or not, and cannot make personalized special requirements based on their own situation. Moreover, consumers are not aware at the time whether the order can be fulfilled in a timely manner, that is, the order is fulfilled. Secondly, although

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online commerce based on phone and email can solve negotiation issues after placing an order, not all consumers are willing or have time to interact with merchants after placing an order. In addition, in order to improve online sales and market competitiveness, businesses need to provide online and offline services 24 hours a day, 7 days a week. This undoubtedly increases the operating costs of businesses, and due to the negligence of staff operations, timely and accurate services may not be possible. E-commerce is a further extension of human commodity buying and selling activities, which is changing the business operation mode of enterprises and people's economic lifestyle [3]. However, e-commerce, which is currently in its early stages of development, only provides functions such as information dissemination, the use of electronic currency, the sale and purchase of fixed price goods, and the fixed delivery capacity in fixed areas, lacking the intelligent negotiation part in traditional business activities. Secondly, the marketing philosophy has shifted from traditional 4P (Product, Price, Place, Promotion) to 4C (Customer, Convention, Cost, Communication), and this shift in marketing philosophy has put forward new demands for the operation of business websites [4]. The 4C theory needs to consider both consumer needs and corporate profits, so business websites should be customer-centric and constantly consider consumer needs while ensuring their own profits. Therefore, in order to solve the problems in the order processing process of e-commerce websites, providing efficient e-commerce transaction platforms with online negotiation mechanisms for merchants and customers can promote the further development of e-commerce, at the same time, it can realize personified real-time processing of orders. Therefore, it is necessary to design a human-computer dialogue software robot for e-commerce order processing based on rules and reasoning mechanism. Software robots are not fatigued and are based on a powerful real-time and dynamically updated database and rule base in the backend, enabling e-commerce websites to provide real-time, accurate, and error free online order processing services, which can promote the automation and intelligence of product buying and selling in e-commerce. Therefore, the implementation of human-machine dialogue software robots can free people from the process of order processing; Increase the real-time, accuracy, and dynamic interactivity of order processing; Reduce the operating costs of businesses: Achieve unique services for businesses and personalized customer needs, thereby increasing consumer satisfaction. The research and implementation of this real-time and online human-machine negotiation platform is one of the challenging research topics in e-commerce order processing [5,6]. At present, the research on negotiation reasoning mainly focuses on automatic negotiation model, interactive multi-objective negotiation model, negotiation support system, virtual reality technology, anthropomorphic human-computer interaction Agent, business auction system based on Agent technology, online bidding system based on XML technology, etc. The auction on Internet was so great success that some researchers believe that the auction is the only effective negotiation mechanism in e-commerce. The information integration in the real-time order processing system is also deeply concerned. The application of ALICE research is also very extensive.

This paper adopts JAVAPROGRAMD and AIML technology, using database technology, knowledge base principle, reasoning rules and reasoning strategy, and designs the structure, workflow, knowledge processing process of the software robot and the reasoning machine to support man-machine automatic negotiation. It has expanded the application of chatbot ALICE and provides a new tool for real-time online negotiation and negotiation of e-commerce order processing.

2. Literature Review. In order to solve the problems in the process of order processing of e-commerce websites, it is extremely important to provide efficient man-machine dialogue software robot with online negotiation mechanism to design man-machine dialogue software robot based on rules and reasoning mechanism.

At present, due to the research and implementation of internal and external e-commerce order processing, there is a research on the order processing process of the supply chain based on Finite-state machine. "Most of the order processing is mainly online, that is, not real-time online order processing. For example, the world's largest Chinese online book and video store, Dangdang.com, eGuo.com Mall, Gome Appliances, TOM Mall, Joyo Network, and so on, the shopping process of these websites generally includes: Logging in, selecting products, registering, logging in, filling out orders, and confirming payment methods, all these websites provide only the function of placing orders online through the network environment, without providing timely online negotiation and order confirmation when customers place orders, in this case, the so-called order processing is carried out manually offline, and the order processing personnel check the content of the order, including whether the goods ordered by the customer have sufficient supply and whether they can be delivered to the customer's designated receiving location on time, which is the effective fulfillment of the order [7]. In this case, whether

the order placed by the customer can be effectively fulfilled depends on whether the customer can provide the processing result of an order through email or phone on the order after the above processing is completed offline. At present, the real-time and online part of e-commerce online shopping includes the rationality verification of order content and the provision of online electronic payment function when placing orders. Among them, the rationality verification of order content does not refer to the verification of information that affects order fulfillment, but rather to the verification of the validity of the data by the business website according to certain rules when filling out the order, including the type of data, the number of digits of the ID number, whether the contact phone number and email address are correct, and so on. Online payment is based on financial electronic networks, using commercial electronic tools and various transaction cards as media, and using computer and communication technology as means to store electronic data in the computer system of banks, and it is a means of circulation and payment through electronic information transmission through computer network systems. Online payments circulate through electronic currency, which is a cash currency that exists in electronic digital form [8]. At present, research on online electronic payments mainly focuses on payment gateways, electronic banking, electronic wallets, electronic checks, and so on. The various online payment methods launched by the financial system are becoming increasingly perfect, which has invisibly played a role in promoting the rapid growth of online shopping. The C2it online payment service launched by Citibank in the United States can help customers establish an online account, and customers can easily complete payment procedures without entering their credit card number or bank account information each time they make a payment. Nevertheless, online electronic payment is also carried out when the order has not been confirmed to be fulfilled, adopting a mechanism of payment before delivery. The condition for its smooth execution is that both parties assume that the order will be fulfilled, but this process undoubtedly increases the uncertainty of order processing [9].

Electronic commerce order processing software robot is the core part of the man-machine automatic interaction module, database module, knowledge base module and the corresponding rule base module, provides the necessary data, knowledge and rules basis, and the implementation of the reasoning machine automatic interaction module provides the intelligence, dynamic interaction. The first step of establishing the rule base is to acquire, summarize and organize the knowledge of order processing. It is necessary to study and analyze the problems and relevant materials to be solved, simulate the actual processing process of the order, and extract useful processing rules and processes from it. The rules in the system are not organized in the form of a simple list, but in a certain way, based on the basic rules of order processing, with the process of order processing, the rational performance of orders and the possibility of necessary events as the reasoning mechanism, so as to realize the structure of the reasoning machine.

Software robots actually refer to a program that can simulate an operator's operation, and can automatically complete a certain operation without human participation, thus replacing some of the human work. The current research on software robots mainly focuses on search engine software robots (Ulika, Spider, CyBot, MetaCrawler), shopping software robots (AcscsBookfinder), and chat software robots (Eliza, ALICE). The shopping software robot applied in e-commerce is particularly eye-catching, as it not only helps buyers find the most cost-effective price, but also automatically orders this product when the best performance price ratio is found. This software robot has certain advantages when ordering goods, but when customers cannot determine whether their orders can be fulfilled in a timely manner in order to ensure that they can purchase the goods, they will place the same order on multiple websites. Therefore, orders that are not processed in a timely manner can cause false demand for businesses [10,11]. The real-time order processing software robot is mainly responsible for obtaining customer ordering information, logistics and distribution arrangement results of e-commerce websites, and providing customers with negotiation information about the positioning results of supply points and the selection results of third-party logistics and distribution centers.

With the development of computer technology and network technology, the development of e-commerce has made rapid progress. E-commerce can reduce costs, reduce inventory, and save time, but it also faces many problems, among them, the high cost and low efficiency in order processing transactions are particularly evident. Currently, after consumers place orders on the website, merchants will confirm the authenticity of the order and negotiate specific matters on the order through phone calls, text messages, and emails. In the face of fierce global market competition, every merchant should make timely and rapid responses, and in the above processing process, it is far from meeting the needs of online commerce. With the development of computer

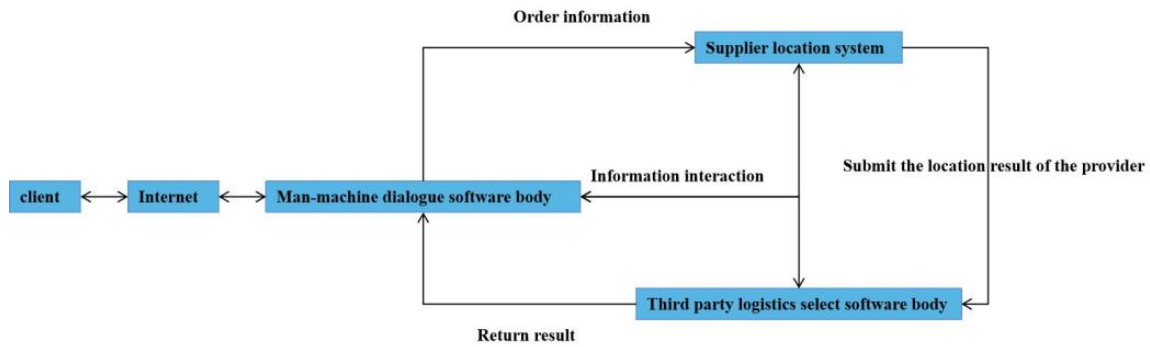


Fig. 3.1: Real time processing process of e-commerce orders

technology and network technology, the development of e-commerce has made rapid progress. E-commerce can reduce costs, reduce inventory, and save time, but there are also many problems, among which the high cost and low efficiency in order processing transactions are particularly evident. Currently, after consumers place orders on the website, merchants will confirm the authenticity of the order and negotiate specific matters on the order through phone calls, text messages, and emails. In the face of fierce global market competition, every merchant should make timely and rapid responses, and in the above processing process, it is far from meeting the needs of online commerce. Therefore, the structure of the human-machine dialogue software robot, inference rules and inference machines supporting human-machine automatic negotiation, have been designed, expanding the application scope of the chat robot ALICE, and providing new tools for real-time online negotiation and negotiation of e-commerce order processing [12].

3. Methods.

3.1. Determine system boundaries . Determining system boundaries means identifying what is inside and outside the system, and determining their relationships, but it is necessary to consider interface or information transfer issues within and outside the system. The location and information interaction relationship of this system in real-time processing of e-commerce orders are shown in Figure 3.1 [13].

This system is a man-machine dialogue system, in the running process of the Web application, from the customer login business website, to select goods with the server software robot after many negotiations, the system needs to remember to interact with it customers which one, what interaction behavior, namely the customer behavior, this requires business website web application ability to record and track the session. Even though the customer visits hundreds of web pages on the website and orders dozens of goods, after many negotiations with the software robot on the server side, the system can remember all the goods the customer wants to buy and the specific customers and relevant information they interact with. However, the construction and development of the website is based on HTTP protocol, and HTTP itself is a stateless protocol, namely there is no memory function, which means that it cannot each customer a request with another request, they use different ports at different times, so the server has no association about the request. In order to enable the system to remember that the customer who chose the product and the customer who negotiated with it are the same customer, and to record the relevant information in the negotiation process, the conversation tracking mechanism should be adopted to solve this problem.

Session tracking is the process of recording a customer logically associated with different access requests over a period of time. Sessions can be tracked through the customer's only-ID at each service request. Each session is identified by a unique session ID, used to track multiple requests sent from the same customer to the server, and to associate the customer with his session data.

3.2. System design of human-machine dialogue software robot. The system is divided into two parts for design and development, including web applications and EJBs. The system adopts Uml for system analysis, while applying a modular design concept, and adopts Java. Jsp for system implementation [14].

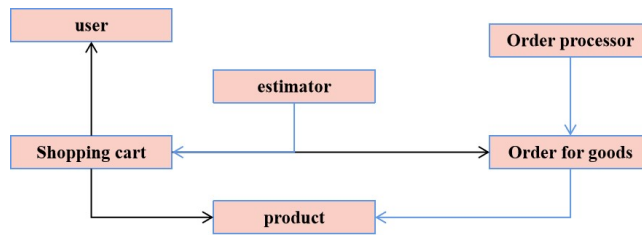


Fig. 3.2: Component Relationship Diagram

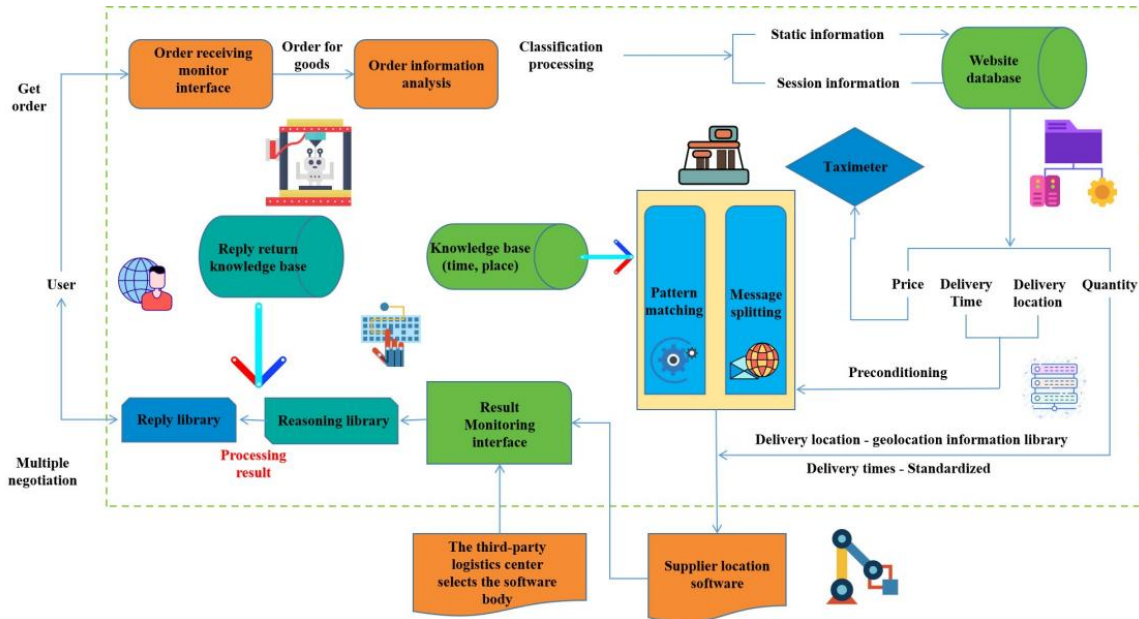


Fig. 3.3: Structure of human-machine dialogue software robot

(1) *Design of System EJBs Model.* The data objects involved in this system include User, Good, and Order, and three EntityBeans (UserEJBs, BookEJBs, and OrderEJBs, all of which are CMP types) were designed, each EntityBean has a table corresponding to it in the database, and each instance of EntityBean corresponds to a row of data in the Table.

The system accesses entity beans in the form of session beans. In this system, two types of session beans are used, stateful session beans representing shopping carts and stateless session beans representing evaluators. The component relationship is shown in Figure 3.2 [15].

(2) *The structure of human-machine dialogue software robot.* The main task of implementing human-machine dialogue software robots is to create a, when interested in purchasing goods, but unable to determine whether the merchant has sufficient supply of goods and can fulfill the order at the designated time and location, real-time online negotiation is conducted with the merchant to sign the order under mutually acceptable conditions. The structure of the human-machine dialogue software robot is shown in Figure 3.3 [16].

(3) *Design of Robot Analysis Mechanism for Human Machine Dialogue Software.* Information analysis is one of the most important parts of the personification real-time processing of e-commerce orders, mainly providing four functions: 1) Analyze the original information of orders received by the website, including the analysis of delivery time and location; 2) Analyze the processing results of the supply point positioning software body; 3) Analyze the processing results of selecting software entities for third-party logistics centers; 4) Combine the

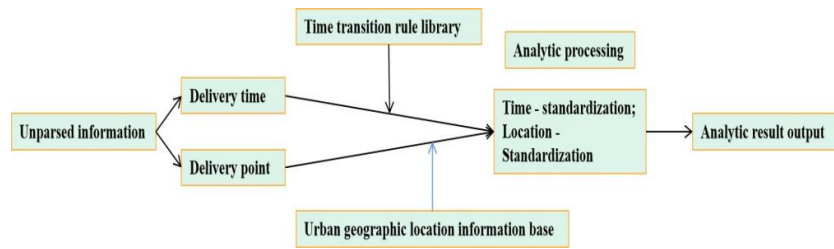


Fig. 3.4: Information Analysis Mechanism Structure of Original Orders

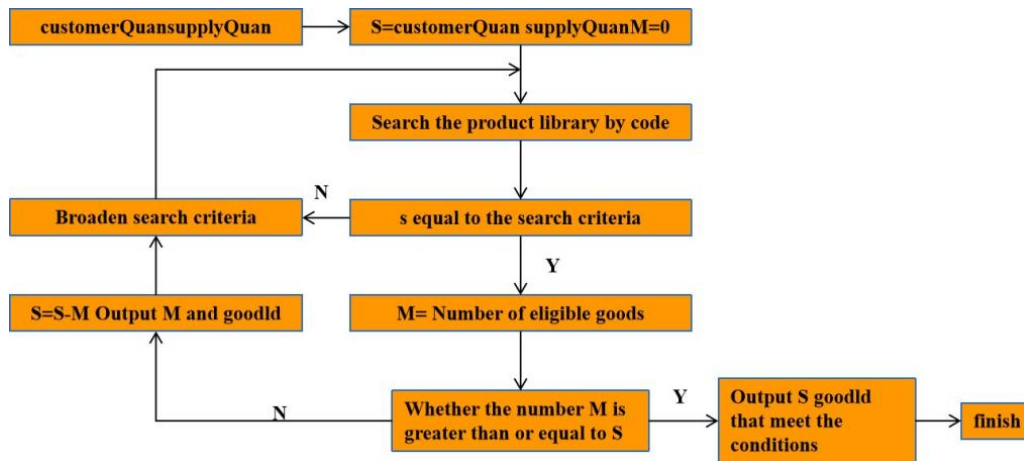


Fig. 3.5: Product Replacement Search Process

response and return to the knowledge base to perform secondary parsing on the processing results of 2) and 3), in order to obtain a humanized human-machine negotiation result. Therefore, in the information input interface section, it is necessary to implement the classification of received information, and input corresponding parsing rules based on the classified results for parsing, while providing the parsing results. When parsing the original order, the parsing mechanism structure is shown in Figure 3.4 [17].

(4) Reasoning Rule Design. If the user wants to buy 100JSP Introduction and Improvement), after the first human-machine negotiation, the feedback information shows that the customerQuan (quantity of goods ordered by the user) is greater than the supplyQuan (quantity of goods available in the supply point positioning software), and the ten digit code of "JSP Introduction and Improvement" is N002C1P1W310, then search for books that match or approximate N002C1P1W3 in the product library, as shown in Figure 3.5 [18].

In the process of product substitution, the substitution rules used are from precise matching to approximate matching. The rule execution process is as follows: When substitution behavior occurs, first search according to the taxi system code of the book that the user wants to purchase. For example, N002C1P1W3, if the quantity requirement is met, the search will be stopped. Otherwise, the matching conditions will be relaxed and similar matching rules will be implemented. Regarding the different importance of the four types of coding rules in the ten digit system, while ensuring that the category of the ordered book remains unchanged, perform similar matching in the following order, namely N002C1P1... - N002C1... - N002... During the search process, as long as the required quantity is met, exit the search and output the product ID and quantity that meet the conditions [19].

4. Implementation of inference engine in human-machine negotiation. The core part of the e-commerce order processing software robot is the human-machine automatic interaction module. The database

Table 4.1: Function Table of Java Class in Inference Machine

Java class	function
resSupply. java	Call the supply point positioning software body to select the supply point, and return the quantity and time of goods provided by the supply point
judgeSupply. java	Judge the processing results of the supply point positioning software, that is, judge the quantity and time. If the quantity is not enough, replace the product. If the time cannot be met, negotiate the time and call the corresponding user negotiation interface
goodReplace. java	The product substitution module mainly performs substitution queries based on the coding rules of the product, and the query process is dynamic, from precise matching to approximate matching as needed
timeReplace. java	Time change negotiation may occur after the supplier locates the software body, or after the third-party logistics center selects the software body
resTpl. java	Call the third-party logistics center software to perform logistics delivery and return the available logistics delivery time
judgeTpl. java	Judge the processing results of the third-party logistics center software body to determine whether there has been a time change negotiation. If necessary, call the corresponding negotiation interface
orderOk. java	Accept order, update order6 data table, delete temporary data table
orderEnd. java	Cancel the order, update the order6 data table, and delete the temporary data table

module, knowledge base module, and rule base module provide necessary data, knowledge, and rule basis for its implementation, while the implementation of the inference machine provides the possibility for the intelligence and dynamic interaction of the human-machine automatic interaction module.

Establishing a rule base is the acquisition, induction, and organization of knowledge related to order processing, it requires learning and analyzing the problems and related materials to be solved, simulating the actual process of order processing, and extracting useful processing rules and processes from it. The rules in the system are not organized in a simple list form, but have a certain hierarchical structure. This way, when using these rules for reasoning, the hierarchy is clear and it is easy to modify and add rules. When modifying, you only need to modify the rules at a specific level without modifying or changing the rules at other levels. The hierarchical structure of the rules referred to here simulates the thinking activities of the human brain during the order processing process, and organized in a certain way, based on the basic rules of order processing, the inference mechanism is based on the process of order processing, the reasonable fulfillment of orders, and the possibility of necessary events, to achieve the structure of the inference machine. When designing the inference engine structure, the inference process that handles the same problem is implemented as a class, and the processing situations with the same probability of occurrence are implemented as classes at the same level. The general form of rules in this system is: (IF_istate judgment) (THEN_joperation 1;ELSE_joperation 2). The inference engine of this system is written in Java language. The description of the Java classes inside the inference machine is shown in Table 4.1 [20].

5. Conclusion. With the development of computer technology and network technology, the development of e-commerce has made rapid progress. E-commerce can reduce costs, reduce inventory, and save time, but there are also many problems, among which the high cost and low efficiency in order processing transactions are particularly evident. Currently, after consumers place orders on the website, merchants will confirm the authenticity of the order and negotiate specific matters on the order through phone calls, text messages, and emails. In the face of fierce global market competition, every merchant should make timely and rapid responses, and in the above processing process, it is far from meeting the needs of online commerce. Therefore, the structure of the human-machine dialogue software robot, inference rules supporting human-machine automatic negotiation, and inference machine have been designed, expanding the application scope of the chat robot ALICE, provides new tools for real-time online negotiation and negotiation of e-commerce order processing. The core part of the e-commerce order processing software robot is the human-machine automatic interaction module. Database module, knowledge base module and rule base module provide the necessary data, knowledge and rule basis for its realization, while the implementation of reasoning machine provides the possibility for the intelligence and dynamic interaction of human-machine automatic interaction module. How to use natural language to negotiate with human-machine dialogue software robots for order processing in e-commerce is a challenging research direction with broad application prospects, and further in-depth research is needed.

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