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Review

Using Multi-Agents for Intelligent Data Retrieval

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ABSTRACT

There is a need for innovative information search and retrieval strategies since retrieving information from the World Wide Web (WWW) using conventional search engines is still a challenging and time-consuming operation. In order to help users discover interesting content on the World Wide Web, an intelligent retrieval system model based on Multi-Agent is suggested. Using a combination of standard and specialized web search engines, this strategy narrows the results down to a manageable set of results that are very likely to be of interest to the user. The agent does this filtering by studying the user's online actions in relation to their preferences and search intent. Detailed are the model's architecture, design, functional components, and workflow. The methodology is useful for addressing the problems with generic search engines' poor accuracy and irrelevant content ranking.

Keywords
Multi-agent; Web search; Intelligent information retrieval.

INTRODUCTION

The quantity of data accessible online is expanding at a dizzying rate, thanks to the expansion of the Internet. Search engines like Yahoo!, Google, Excite, AltaVista, etc. have made it easy to access vast amounts of information online, but this convenience comes at the cost of potentially low-quality data. There are still numerous glaring issues, most prominently shown in the following areas, even if it does satisfy people's desire for searching for information to a certain degree.

First, there isn't a lot of coverage in the search. Search engines may have included vast amounts of data, but they pale in comparison to the Internet as a whole. Second, the accuracy of the search is low. Search engines like AltaVista and others that rely on Internet spiders or robots provide extensive coverage, but their quality is lacking, leading users to filter out much of the information they get. The third issue is that there is no customization. When two users use the same search engine and enter the same keywords, they will both get the same result. These search engines aren't flexible enough to meet the needs of each individual user. In the fourth place, an approach to a solitary quest. Standard search engines only provide a keyword-based search option. Because of this, the search request's expression ability is severely restricted. Consequently, how to precisely and rapidly find the information a user need on the network has emerged as a major area of study.

None of the aforementioned issues with the search engine will go away on their own. A popular area of study right now is how to apply agent technology from artificial intelligence (AI) to the domain of information retrieval. Our idea for the network information retrieval system came from the Agent technology [1-2]. A multi-agent system consisting of an analysis agent, a feedback agent, a filter agent, and a search agent was suggested as a means to do this kind of Internet search. From the user's perspective, this article examines our system's components and compares its performance to that of conventional search engines. When compared to ordinary search engines, our method is light years ahead of the curve.

2. Intelligent agent technology

An emerging area of focus in AI research in recent years is the idea of agents [3]. Information retrieval and service, electronic commerce, distributed computing, and other related domains have found extensive use of Agent recently.

There is no consensus on what an agent is in the academic and business communities. It is often assumed that an agent is a self-sufficient, continuously-running intelligent creature with the following traits, as it operates in an isomerism computing environment:

(1) Autonomy—An agent with autonomy can operate continuously, unaffected by external factors, and has complete control over its own actions and internal state.

(2) Adaptability — The agent is able to detect its surroundings and alter itself in response to changes in its environment; as a result, it may modify its behavior and the way its users interact with it.

Thirdly, learning allows the agent to modify its own behavior based on data collected from its surroundings.

Four, Agents may work together by exchanging messages using an Agent communication language [4] (such as
(such as KQML or the FIPA-ACL language), and work together to finish a large project.
Agents may migrate throughout the network, which brings us to point number five.

Generally, there are three most basic properties of Agent such as the autonomy, learning and the cooperation. A basic Agent system should has one of these properties, a advanced Agent system must have the autonomy and one of other two items, but an ideal Agent system must realize all of these properties and introduce other characteristics (for example mobility according to the actual demand, etc).
At present majority of Agent system only meet one or two items properties. This paper attempts to establish an ideal Agent system.

3. Intelligent information retrieval system based on multi-agent

The intelligent information retrieval system based on the Multi-Agent is developed through introduces the technology of intelligent Agent to the field of information retrieval. It provides intelligent the personal information retrieval service for the users with the help of the properties of the autonomy, learning and cooperation characteristic and so on.

3.1. The function of system

Intelligent Agent locates between the resource of network information and the user, plays a role of the proxy. It can search, filter, classify and collect the network information resource according to the user's choices, search intent and preferences and so on, finally provides to the user in terms of priority of information relevance.

3.2. The architecture of system

Because the duty of sole Agent system is too concentration so that the network-jam will happen easily, and it also is bad for the parallel execution of multi- tasks. Therefore it is an effective method to reduce the load of network, enhance the efficiency of intelligent search using the multi- Agent technology. In this paper, we decompose the intelligent search

Figure 2. The architecture of Multi-Agent system

3.3. The design of system

The whole system obviously has the level relation in the horizontal direction, may be divided into three parts such as the man-computer interaction module, the information processing module and the information search module. We will introduce separately the design thought and the realization method of each module.

3.3.1. The module of man-computer interaction. The module of man-computer interactive is composed with man- computer interaction Agents, completes the function of interaction between man and computer. On the hand it provides the good interaction surface of man- computer in view of the user's characters so that the user may produces the standard retrieval request. The user not only may use the inquiry based on the key word provided by the search engines, but also may retrieve homepage information such as the title, author and so on. On the other hand the man- computer interaction Agent provides the window of correlation feedback information for the user. The window records user's visit pattern, search intent and preferences, can provides causes for personal serve of the system. This module may be realized with the Java technique multi-platform in the browser.

3.3.2. The module of information processing. The module of information processing consists of analyzes Agent by the user, filters Agent and feedback Agent, is the core of the whole system. It must provide the user the search result filtered by the certain rule and finally ranked by the order of relevance. Therefore it is an expert system. The tradition search engines matching the inquiry in terms of the key word purely will bring the massive redundant information. The redundant
information must be filtered. This part of work will be completed by filters the Agent.
On the hand, the strategy of filter needs to consider the category of information, for instance information of the company stresses on the product introduction, the universities, colleges and institutes and the research organization stresses on the research information, therefore we may provide some inquiry templates (for example science research information class, product information class and so on) for the user, this may be realized by analyzing URL and the law of L. P. Bradford and G. K. Zipf. The filter algorithm topic-based is defined in equation (1). It computes the probability of text dx belong to Cy category.
Considered the change speed of the information of the different type and the characters of the user's demand, we may process separately. The change of the information of the foundation discipline is slow, the information may be updated monthly, but the change of the information of the application discipline (for example the IT technology and so on) and the product information is extreme rapid, we may enhance the renewal frequency to the week. On the other hand the intelligence search system must promptly tracks the change of user's interest according to the user's feedback information accepted.

3.4. Communication among multi-agents

The communication among Agents is one of core parts of the multi- Agent system. It is the foundation of the Agents completing the task mutually. Therefore the design of the mechanism of communication and the cooperation among
Agents is extreme important to the efficiency, the robustness and the compatibility of the whole system.
The communication of the entire multi- Agent system in the logic divide into three levels, from the top in turn are conversation level, expression level and transmission level. The transmission level refers to the protocol and the related mechanism of data transmitting on the physical circuit. In this paper we have selected the method of point-to-point. It establishes in the foundation of the protocol of TCP/IP, has the very good network compatibility. Because there is the massive news during Agents communication each other may lead the system to collapse. In order to guarantee the normal operation of the system, we must plan the process of the whole communication so that some main news among Agents can be transmitted normally. This kind of plan may be realized through give the differ-

ent priority to each Agent. In the system, man-computer interaction Agent, filter Agent and search Agent is the most frequent part of communication, we set the highest priority to them. The communication mechanism of the system has realized with the technique of WinSock. WinSock is a kind of standard of communication application program based on the Windows network. It is an object composed a group of components sealed. By it can cause the complex hardware realization detail to be transparent to the user.

The expression level is a kind of medium or the tool transmitting the communication the content to the conversation level, namely communication language. Agents may propose the request, inquire or make the response on some specific question. At present the international popular languages of Agent communication have two kinds such as KQML and the FIPA-ACL. They all are based on the theory of Speech-Act. They can complete some specific goal or the acts through transmitting news by Agents. They can support Agent cooperation and knowledge sharing, but at present there isn't still a relative standard. In this system, we have designed an extended protocol based on the KQML considering the concrete application. The information transmitted among Agents is divided into 3 parts such as the information head, act and behavior. The common acts include Ack, Ask, Act, Retrieve, Export, Inform, Order.

Finally, the conversation level realizes the related rule and strategy during the process of communication among Agents.

4. Conclusions and future works

This work presents a multi-agent based intelligent information retrieval method, describes the model's architecture, design philosophy, and implementation method in detail. The concept depicts an open ecosystem where agents with various responsibilities are used to distribute tasks. An improvement over generic search engines, this approach tailors results to each individual user by taking their purpose and preferences into account. Improving the clustering algorithm to mine the user's unique pattern and figuring out how various personalized patterns communicate and share data are the topics of the next research.

REFERENCES

[1] "Autonomous Interface Agents" by H. Lieberman was published in March 1997 in the Proceedings of the ACM Conference on Computer and Human Interface in Atlanta, Georgia..

Presented at the 2003 26th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval in Toronto, Canada, "Evaluating Different Methods of Estimating Retrieval Quality for Resource Selection" was written by Norbert Fuhr and Henrik Nottelmann.

In the 2003 edition of the Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI), edited by Georg Gottlob and Toby Walsh, J. Liu of Web Intelligence (WI) asked, "What Makes Wisdom Web?" on pages 1596–1601.

In Software Agents, published by AAAI Press in 1997, pages 291-316, Finin, Labrou, and Mayeld discuss KQML as a language for agent communication.