# *Implicit*: An Agent-Based Recommendation System for Web Search

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As Internet contains more pages, it becomes harder to find relevant information. Search engines aim at facilitating search process. However, they have shortcomings such as the lack of personalization. Recommendation systems are intended to exploit the fact that sometimes different users expect different answers to the same query. A recommendation system accepts queries from a user and exploits knowledge about his/her needs, behavior patterns search profiles and content information in order to make personalized suggestions. Such systems implement either content-based approach (e.g. using TF-IDF vectors [1]), either collaborative filtering [2], or combination of the both approaches. Producing personalized recommendations, these systems overcome the drawback of search engines.

We present a multi-agent recommendation system *Implicit* for web search. Recommendation creation process is based on the concepts of Implicit Culture [3], namely on using implicit knowledge of the community members to help a newcomer to behave similarly to the other community members without the need of expressing explicitly their knowledge. *Implicit* is designed to be used within a small organizational community of people that have similar interests. The system is compliant with FIPA standards and is implemented using JADE. One of its advantages is that feedback is collected automatically, without requiring any extra effort from the user.

The architecture of the system is given in Figure 1. After a user logins, using an html/php user interface on the client side, he/she is assisted by a *personal agent*. Personal agent is a software agent running on the server side and communicating with the other agents by means of message exchange. Its main task is to process user's or other agents' queries and to create useful recommendations in response. Agent also interacts with other agents[1] to exchange links and agent IDs[2]. Agent IDs are used in order to contact the agents who are likely to produce a useful suggestion, while all the links obtained during the search are shown to the user as recommendations.

*SICS* (System for Implicit Culture Support) is a part of personal agent that analyzes observations concerning past behavior of agent's user and of the other users in order to produce recommendations. The general architecture of SICS consists of the following three basic components: *observer*, which stores in the

[1] *Directory Facilitator (DF)* helps to find other personal agents on the platform
[2] Hereafter by agent ID we mean unique identifier of an agent on the platform

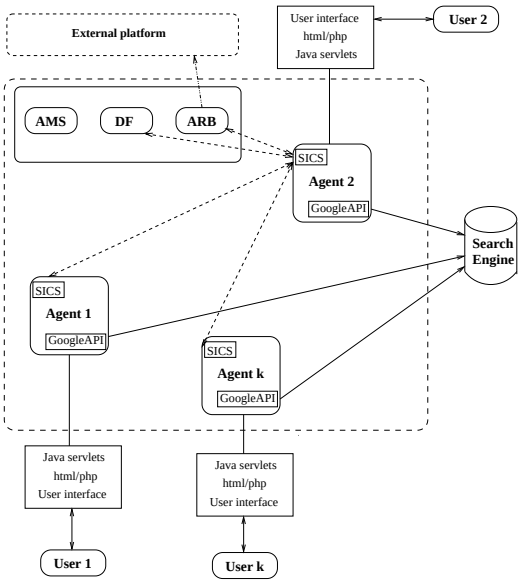


**Fig. 1.** The architecture of the system.

database information about actions executed by the user (query, accept/reject of the link); *inductive module*, which analyzes the stored observations and applies data mining techniques to discover patterns of user behavior; *composer*, which exploits the information collected by the observer and analyzed by the inductive module in order to produce better suggestions to the user or to the other agents. *GoogleAPI* allows agent to query Google search engine to produce the results apart from the recommendations. Using *Agent Resource Broker (ARB)*, agents are able to communicate with other platforms. *Agent Management System (AMS)* provides agent registration, deletion, etc.

This is a short version of the paper [4] that will be presented on AAMAS-05.

## References

1. Salton, G., McGill, M.J.: Introduction to Modern Information Retrieval. McGraw-Hill, Inc., New York, NY, USA (1986)
2. Resnick, P., Iacovou, N., Suchak, M., Bergstrom, P., Riedl, J.: Grouplens: an open architecture for collaborative filtering of netnews. In: CSCW '94: Proceedings of the 1994 ACM conference on Computer supported cooperative work, Chapel Hill, North Carolina, United States, ACM Press (1994) 175–186
3. Blanzieri, E., Giorgini, P.: From collaborative filtering to implicit culture: a general agent-based framework. In: Proceedings of the Workshop on Agents and Recommender Systems, Barcellona (2000)
4. Birukov, A., Blanzieri, E., Giorgini, P.: Implicit: An agent-based recommendation system for web search. In: Proceedings of the 4th International Conference on Autonomous Agents and Multi-Agent Systems. (2005)