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A Step towards Softbots: Easy2Shop, a Multi Agent based Shopping bot

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Abstract:

With the emergence and omnipresence of e-commerce on the internet, online purchasing assistants and applications have made their appearance. More commonly known as “shop bots” these intelligent agents facilitate the purchasing process, therefore saving time and money. Most shop bots provide you with a list of companies offering the best price and service for the product that you want. The first shop bot Bargain Finder was developed in 1995 by Andersen consulting and it was designed to help people find only musical CDs. Today, Shop bots are capable of finding a wide variety of products and services offered on the internet. These intelligent agents help you to make the best choice when looking for CDs, DVDs, books, computers, software, and cars.

Keywords: Intelligent agents, Shopping bots, E-Commerce, Multi agents, Robotics, Easy2Shop, Intelligent agent criteria, Soft bots.

1. Introduction

E-commerce has changed the way companies distribute their products and services to consumers. Traditional brick-and-mortar companies continue growing this segment of the economy by creating their own e-commerce presence. Some companies have created or reshaped their image by having their entire operations based strictly on e-commerce (Filipo 2002). An e-commerce strategy has many benefits for the company as well as the consumer. In the research presented here, we aim at improving the accessibility and expanding the benefits of e-commerce shopping to consumers and at aiding the move to a personalized and thus more efficient marketplace. Shopping bots are price comparison sites on the World Wide Web that automatically search the inventory of several different online merchants to find the lowest prices for consumers. Typically, these sites rank products by price and allow shoppers to link directly to an online

merchant's site to actually make a purchase. Many shopping bots also include links to product reviews from evaluation sites like Gomez.com and Bizrate.com. Initially Search Engines were early solution to the problem of finding information spread over many different websites. This task was difficult as type, cost and organization of information provided by sites varies from companies to companies. The second approach is through alert services. Several services allow shoppers to sign up the service that notify the prices when it go up or fall below a specified range (Pattie 1999). A third approach is voluntary rating reviews of the products through vendors and customers. The drawback of these above approaches is lack of autonomy, personalization and privacy. Our research overcomes these shortfalls in such a way that all the operations are performed autonomously by the agents, without user interaction. Personalization means that the Easy2Shop learns the behavior and preferences of the shoppers by observing his actions while shopping. Privacy means to conceal the identity and private information of the shopper.

1.1 Environment

1. Sensor
   - As it is a soft bot, so it senses the environment through encoded binary bits. Input is supplied through interface which interacts directly with merchant websites.
2. Processing
   - Learning
   - Knowledge
   - Experience
3. Effectors
   - Best possible price on the Internet, and also supports related search.

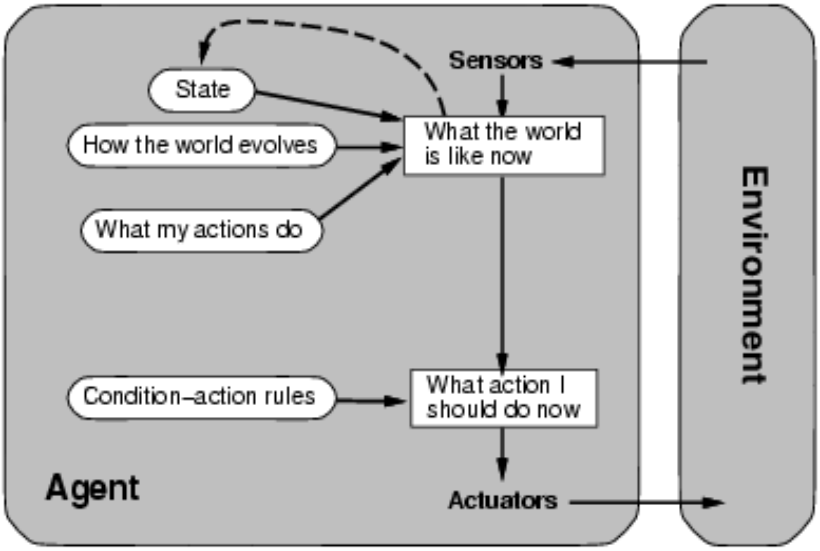

Figure 1.1: Schematic diagram of simple reflex agent (Stuart Russel, 1995)

2. Background

Research in the area of shopping agent's dates back to the early years of the Web. In 1995, Andersen Consulting developed Bargain Finder, the first of the shopping agents. It allowed users to compare prices of music CDs from stores selling over the Internet. At the time however, some of the retailers blocked access because they did not want to compete on price, and BargainFinder ceased operation. Since then, there have

been additional shopping agents that started providing unbiased comparison of products from different shopping sites. In PersonaLogic, users created preference profile so describe their tastes. The approach allowed for the identification of products with features important to the users, but the vendors had to provide an interface that explicitly disclosed the features of the products in a way that could be matched with user profiles. PersonaLogic was acquired by AOL in 1998 and the technology disappeared. Ringo was an agent that recommended entertainment products (music, movies) based on collaborative filtering, i.e., on opinions of like-minded users. This was one of the earliest software agent technologies to be commercialized, when it was incorporated into a company named FireFly. FireFly also addressed the issue of privacy by initiating and promoting the P3P standard. FireFly was acquired by Microsoft in 1998 and the FireFly agent ceased operation shortly there after. However the concept of collaborative filtering has become widely used, by large commercial vendors such as Amazon. The ShopBot was an agent that could learn how to submit queries to e-commerce sites and interpret the resulting hits to identify lowest-priced items (Christian 2002). ShopBot automated the process of building “wrappers” to parse semi structured (HTML) documents and extract features such as product descriptions and prices. Our goals are similar but we focus on learning the user preferences (with respect to many features) and we use a different approach for extracting those features from vendor sites. The ShopBot technology had a similar fate to those of PersonaLogic and FireFly; it was acquired and commercialized by Excite (under the name Jango), and soon replaced with a biased vendor-driven agent. Tete@Tete was an agent that integrated product brokering, merchant brokering, and negotiation. A start-up called Frictionless Commerce is applying the technology to B2B markets (e-sourcing) rather than to B2C markets. The only comparison shopping agents available to consumers that are surviving in the commercial realm are biased, presenting results only from companies with whom they collaborate. Examples include MySimon, DealTime, PriceScan, RoboShopper, and many others (Oen-Etzion 1994). Learning user behaviors and preferences by “looking over the user’s shoulders” is an example of an interface agent. These have been widely employed in information filtering and Internet recommendation systems. Two user interface agents that learned from the actions taken by a user are Letizia and WebWatcher. Similarly to these agents, IntelliShopper presents information to the user in a way that allows her interaction to be easily incorporated into the learning process. In the area of Web querying and monitoring, the most relevant work is WebCQ . In WebCQ, specific pages can be monitored for changes to their content. The system can track changes on arbitrary pages by computing the difference between the page at some given time and the same

3. Guidelines, Criteria’s and Properties of Intelligent Agents.

1. Agency-related Criteria	
1.1 Architecture Properties	
1.1.1 Organization	How good the methodology is in defining the organizational relationships between agents?
1.1.2 Mobility	How capable is the methodology in presenting and modeling agent’s migration?
1.2 Basic Properties	
1.2.1 Autonomy	To what extent the methodology can support and present the autonomous features of agents?
1.2.2 Reactivity	To what extent the methodology supports reactivity?
1.2.3 Reasoning	In this context, to what degree the methodology supports proactivity?
1.2.4 Temporal continuity	To what degree the methodology can present and model temporal continuity in agents?

1.3 Advanced (mental) Properties	
1.3.1 Beliefs	To what extent the methodology can present and model this cognitive property?
1.3.2 Desires (goals)	To what extent the methodology can present and model the intended 'goals' of agents?
1.3.3 Intentions (actions)	To what extent the methodology can present and model 'intentions'?
1.4 Learning ability	To what extend the methodology can present and support the 'learning ability' of agents?
2. Modeling-related Criteria	
2.1 Notation	To what degree the methodology is effective in manipulating the notational components (i.e., syntax and semantics) and presenting texts and symbols?
2.2 Ease of use and understanding	How easy the notation and models are to understand and use with this methodology?
2.3 Expressiveness	To what degree the methodology's models and notation are capable for representing the desired multi-agent system with all the necessary concepts in an easily perceptible manner?
3. Communication-related Criteria	
3.1 Local Communication (Basic Sociability)	
3.1.1 Cooperation	How do you rate the methodology's support to define and present this feature?
3.1.2 Coordination	How do you rate the methodology's support to define and present this feature?
3.1.3 Competition	How do you rate the methodology's support to define and present this feature?
3.1.4 Negotiation	How do you rate the methodology's support to define and present negotiation?
3.2 Wide Communication (Advanced Sociability)	
3.2.1 Interaction with the external environment	To what extent you think the methodology can support and present the interaction of agents with an external environment? Note that we assume an external environment as a remote environment, which is usually heterogeneous, and/or having different ontology.
3.2.2 Agent-based user interface	To what extent you think the methodology can provide effective description of interfacing with its MAS' users (e.g. human agents)?
3.2.3 Subsystems interaction	To what extent the methodology can provide a tool for presenting and modeling subsystems of agents that collaboratively interacting together?
3.2.4 Bio-induction	To what extent the methodology can present and model this feature that concerns such a higher level of communications?
4. Process-related Criteria	

4.1 Development Lifecycle	
4.1.1 Architectural design	To what degree the methodology is effective in supporting the process of gathering, analyzing, and modeling the requirements of a potential MAS?
4.1.2 Detailed design	To what degree the methodology is effective in supporting the tasks associated with the process of carrying out the detailed design of a potential MAS?
4.1.3 Verification and Validation	To what extent the methodology is capable in supporting verification and validation?
4.2 Refineability	To what extent the methodology is effective in supporting clear procedures for refining models gradually in order to accomplish implementation?
4.3 Managing complexity	To what extent the methodology can provide effective modeling tools that facilitate the decomposition, assignment, and management of tasks among agents?
4.4 Ease of use and understanding	To what extent the methodology supports the following features: - Standard notation - Standard modeling language - Ease to understand and follow process steps and phases
5. Upgrading-related Criteria	
5.1 Modifiability	How easy is the methodology in supporting changes to an MAS after implementing it?
5.2 Scalability	How good is the methodology in handling and integrating the requirements for a large number of agents?
5.3 Open systems support	To what extent the methodology can provide support for open systems to allow dynamic integration (or removal) of new agents and/or resources?
5.4 Adaptability – Dynamic Structure	To what extent the methodology is effective in supporting reconfiguration in dynamic systems (e.g. when agents are created or destroyed)?
5.5 Integrate ability	To what extent the methodology is capable to support integrating data acquired from several platforms with the knowledge possessed by the current active agents?
6. Application-related Criteria	
6.1 Applicability	To what extent this methodology is NOT limited to a specific type of software domain (e.g., component-based systems or real time systems)?
6.2 Maturity	To what extent the methodology is mature, in terms of the availability of the recourses that describe it (e.g., documentation, publications, manuals, and supporting case studies)? Is there any records/feedback from stakeholders to recommend/oppose this methodology? On a ten-point scale, how it was rated?

6.3 Field history	To what degree the methodology is applied in practice, used by non-creators and used in developing real applications?
6.4 Cost concerns	In terms of costs, to what extent the methodology is economically feasible?
7. Supporting Properties	
7.1 Ontology	To what extent the methodology provides support for the specifying and modeling ontology in MAS?
7.2 Security	To what extent the methodology provides support for designing security features in MAS?
7.3 Collaborative Services	To what degree the methodology can support, presenting and modeling services, such as 'yellow pages' and 'blackboards' in a potential MAS.
8. Perception-related Criteria	
8.1 Perceived ease of use	To what degree you believe that using this methodology would be easy enough and free of effort?
8.2 Perceived usefulness	To what degree you believe that applying this methodology will be significantly effective in achieving its objectives?
8.3 Intention to use	If you were asked to adopt an AOSE methodology in developing an agent-based system, to what degree you intend to use this methodology?
9. What Kinds of Activities Can your Intelligent Agent Perform?	
• Search for information automatically • Answer specific questions • Inform you when an event (e.g., an article has been published, your favorite book is on sale, the road you travel is under construction, your name has been mentioned on the web) has occurred • Provide custom news to you on a just-in-time format • Provide intelligent tutoring • Find you the best prices on nearly any item • Provide automatic services, such as checking web pages for changes or broken links	

4. SYSTEM ARCHITECTURE:

Easy2Shop bot consist of four agents namely Form Agent, History Agent, Privacy Agent and Learning Agent.

4.1 Form Agent:

The Form agent has the job to accept request from shopper in a secure manner and handover these requests to History Agent to check the information against shopper request.

4.2 History Agent:

The history agent check the information already stored in its knowledge base data and response the user with the required information.

4.3 Learning Agent:

The learning agent learns the behavior, new updates about the product, experiences and information about

new products directly from the vendor sites.

4.4 Privacy Agent:

The privacy agent conceals the private information about the customer, offer personalize services to customer.

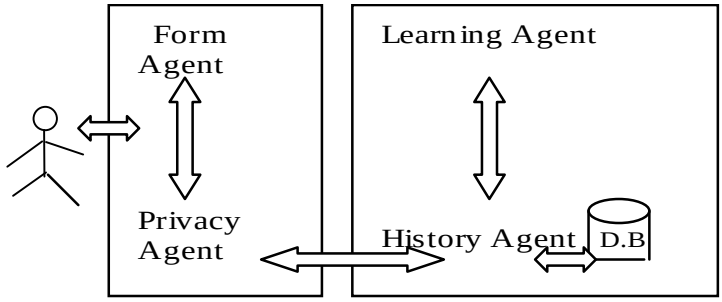

Figure: 4.1 Easy2Shop System Architecture

5. Eas

Prototype describes the implementation of the system.

5.1 User Interface

When a user logs in, Easy2Shop displays the profile inferred by the history agent based on the previous shopping activity of the current user. The history of the shopper is also displayed. The user can click to examine new or old hits, or remove requests he no longer wants to view. Alternatively, the user can submit a new shopping request via the query interface. Here the user can specify a query string (to be forwarded to vendors) and the type of request, i.e., whether the user is interested in shopping at online stores or auctions sites. Each of these options corresponds to a set of vendor modules.
Once the results have been received from the various vendors, collated, parsed and stored in the database, the learning agent presents them to the user, all these formats are converted to common data domains before the value of each feature is stored in the database.

5.2 Vendor Modules

The vendor modules allow Easy2Shop to interface with the various online store/auction sites. There are two aspects to vendor logic from the Easy2Shop's perspective: (a) submitting queries, and (b) parsing results. Task (a) is simpler; it consists of identifying an appropriate form, submission protocol, and input syntax on each vendor site. Task (b) is more difficult; it consists of identifying items and extracting feature values for all desired features (e.g., product description, price, etc.). While vendors could readily simplify this task, say by using XML-based output, the opposite trend seems to be taking place; many vendors are not interested in competing on price alone, and therefore use complex and changing HTML markup to make it difficult for shopping bots to extract information from their sites.

5.3 Database Design:

Easy2Shop must store much data about its shopper personal information, their profiles, queries, product hits, and their features. The prototype stores all this information in a relational database. The references table stores the profile of each personal; for each feature (e.g. price). My SQL is selected as DBMS to store data.

5.4 Implementation of Intelligent agent's criteria by Easy2Shop bot.

Intelligent Agent	**Shopping Bot**
1.Agency related Criteria:	Facilitate the user in shopping by providing best possible price on the web.
1.1 Architecture Properties:	
1.1.1 Organization	A user friendly interface allowing user to enter the item/product, which he/she wants to search. The shopping bot then answer the user by providing the best price on the web.
1.1.2 Mobility:	Easily implemented on any computer system.
1.2 Basic Properties	
1.2.1 Autonomous	The agent can independently/automatically handle/mange its operations.
1.2.2 Reactivity	The agent rationally behave to the user requests/queries
1.2.3 Reasoning	If the user misspells the word, then the agent provides suggestions to the user about the search. It also provides related search options to enhance/facilitate/improve user search criteria.
1.3 Advanced (mental) Properties	
1.3.1 Beliefs	Knowledge based, History & Experience
1.3.2 Desires (Goals)	Providing best available price on the web Also saving time of the user, net surfing/searching the desired product
1.3.3 Intentions	Time saving, facilitating user.
1.3.4 Learning ability	Remembering the search patterns, providing help in user shopping. Automatically updating the database.
2. Modeling related criteria	
2.1 Notations	Very easy to use.
2.2.2 Ease of use and understanding	Very easy to use, user friendly interface
2.2.3 Expressiveness	Very effectively handles the related search criteria and response immediately
3. Communication related Criteria	
3.1 Local Communication(Basic scalability)	
3.1.1 Cooperation	As it is a multi aided agent based software, so it sub agents cooperated with each other in solving problems.
3.1.2 Coordination	The sub agents coordinates with each other
3.1.3 Competition	By evaluating the other shopping bots

3.1.4 Negotiation	Effective negotiation b/w agents
3.2 Wide Communication	
3.2.1 Interaction with the external environment	Through Form Agent
3.2.2 Agent based user interface	Communication with user through web
3.2.3 Subsystem interaction	Through multi agent setup
4. Process related Criteria	
4.1 Development Lifecycle	Agile Development mythologies, like Extreme Programming(XP)
4.1.1 Architectural Design	analysis and modeling requirements
4.1.2 Detailed Design	Detailed design of MAS can be achieved by first designing each agent independently and then integrating the whole design.
4.1.3 Verification and Validation	Support for verification and validation
4.1.4 Refine ability	Through Learning process
4.1.5 Managing Complexity	Handle complex situation
4.1.6 Ease to use and understanding	UML will be used for modeling
5. Upgrading related criteria	
5.1 Modifiability	Support of Modifiability
5.2 Scalability	Highly scalable
5.3 Open System Support	N.A.
5.4 Adaptability Dynamic Structure	Through Learning based agent
5.5 Integrate ability	As it is MAS, so it has integrated structure
6. Application related criteria	
6.1 Applicability	Component based system
6.2 Maturity	Documentation, material is available
6.3 Field History	With the growth of internet, these agents based websites are most commonly used by customers
6.4 Cost concerns	Economical in cost
7. Supporting Properties	
7.1 Ontology	Based on objects
7.2 Security	System is highly secure
7.3 Collaborative Services	Can be implemented
8. Perception-related Criteria	
8.1 Perceived ease of use	Because the project is software based, and did not require any hardware, so it will be easy
8.2 Perceived usefulness	For making decisions
8.3 Interaction to use	Through easy user friendly interfaces

9. What kind of Activities can your Intelligent agent perform
Shopping bots are price comparison sites on the world wide web that automatically search the inventory of several different online merchants to find the lowest prices for consumers. Typically, these sites rank products by price and allow shoppers to link directly to an online merchant's site to actually make a purchase. Many shopping bots also include links to product reviews from evaluation sites like Gomez.com, exicet.com, kalkoo and Bizrate.com.

Pseudo Code: describing working functionality of Easy2hop Multi-aided Shopping bot

Step1. *Customer Logon to the website*
Step2. *Customer enters the search item/product information in a form.*
Step3. *Agent accept the search item request through its* ***Form agent***
Step4. *The program checks the user search entry through its* ***history agent*** *and gives suggestion in case of misspelling, and facilitates the user with related search suggestions.*
Step5. *Agent checks the price of item from its Knowledge base data through vendor module.*
Step6. *Agent updates its knowledge, to get the up to date information about product, information about new products and vendors, through learning agent.*
Step7. *The agent provides the best available price on the web.*
Step8. *The agent requests another search option.*
Step9. *Finish*

6. Conclusion:

Shopping bots on the internet facilitate the user in shopping process. While shop bot based on the artificial intelligence concepts not also facilitate the shopping process, as well as through their intelligent agent structure modify and reshape the business. Easy2Shop bot has a multi agent based architecture which utilizes internet resources, to provide lowest available prices of the products; they are searching for, saving their precious time and money. Through its multiple agents structure which coordinates each other in system execution and moreover though learning agent the easy2shop updates its knowledge database for future assistance.

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