Use of Intelligent Agent Technology / Artificial Intelligence in Libraries

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Abstract: *This paper highlights the different applications of artificial Intelligence in library systems. The various aspects of AI such as Expert system, intelligent technologies etc and their application to the libraries have been discussed in the paper. Merits and drawbacks of AI system are also discussed here.*

Keywords: Intelligent Technology, Expert System, Artificial Intelligence

Definitions of Artificial Intelligence (AI)

Artificial Intelligence is truly a universal field. It is very broad and complex area of study and very difficult for common man to understand. Experts in the field of AI debate what exactly AI is? AI technology has not yet been developed to the stage where robots or computer systems are capable of thinking wisely like human beings.

The definitions of AI vary widely. Some definitions focus on human thought process and some address human behaviour. (1)

"Artificial Intelligence is the workhorse of Intelligent Technology". (2)

Artificial Intelligence is incorporating intelligence in artificial devices like robots, machines etc. It is a combination of computer technology, philosophy and psychology. It is mainly concerned with understanding and performing intelligent tasks such as reasoning, adopting new situations and problems and learning new skills (3)

Artificial Intelligence is the ability of a digital computer or robot, which is computer controlled, to perform the jobs which are commonly associated with intelligence. This term is generally applied to the projects entrusted with human intellect such as ability to reason, discover meaning, generalize or learn from past experience. (4)

A study of rational agents is also called as Artificial Intelligence. A rational agent is that which makes decisions just as a person, firm, software or machine. It performs the actions with the best outcome. *(5)*

A common thinking about AI is a ROBOT that thinks like a human being and interacts smoothly with people by understanding their needs and also by learning through the previous experiences. Artificial intelligence can also be described as a "digital sister-in-law". For ex. If I want to go for the movie, instead of reading reviews, I will ask my sister-in-law. *(6)*

When such model of AI does not exist, Agent Technology, a subfield of Artificial Intelligence has been used in a variety of settings. "Agent Technology "is a Software which autonomously and continuously work in a particular environment and many times inhibited by intelligent agents and processes. Agent Technology with the help of intelligent agents is used in online shopping to assist product search and selection. (7) Similarly, these intelligent agents have also assisted the digital library users to locate the books and streamlining the search process. *(8)*

Few academic and public libraries have explored the use of intelligent agents in reference and information literacy instruction.
The intelligent agent based computer technology most often act to achieve the best results when there is uncertainty of the expected outcome. *(9)*

An intelligent agent is that program which can make decisions or perform tasks based on its environment, user input and experiences. Intelligent agents may also be called as a bot, which is short form of robot. *(10)*

Recent Developments in AI

Research scholars have made continuous efforts to improve the functionality of AI. In the mid 1990s. Apple i-phone's Siri is also one of the examples of AI with natural language technology. (*11*)

Self driving cars, google personal assistants shows the incredible development in the intelligent technology which may also revolutionize the lives of many people. (*12*) Google Brain, Carnegie Mellon's NELL deep learning research project have also advanced the field of AI *(13)*

Companies like Apple, Google are serious about developing AI and spends millions of dollars on research. (14) Experts are uncertain about when AI will reach its full potential and think like human beings. However optimists predicts for cognitive thinking like a human being, AI will take 5 to 80 yrs . However, doubters believe that it may take 200-400 years to develop artificial intelligence to its fullest capacity (15)

Use of Intelligent Agents in Libraries
In the library context, Librarians and scholars have been known to use the terms Intelligent Agents, Artificial Intelligence and Agent Technology interchangeably. (16) In fact, many of the current systems of libraries are an actually agent system which uses components of artificial intelligence i.e. logical and automated searching for assistance of library patrons. *(17)*

Additional few number of academic and public libraries have developed chatbots that use natural language processing *(18). Chatbot is a piece of software which makes*

a conversation experienced through hearing or relating to texts methods. (19)

The agent systems will definitely develop beyond our imagination in the era of advanced artificial intelligence. Thus, AI can provide increasingly important functions in law libraries as well as in any other library in future including appealing patrons in circulation, solving reference questions, increasing to information and information literacy programmes. *(20)*

Intelligent agents systems can be developed in-house or by vendors. Pandorabots, Inc. Company has developed fully customizable virtual chatbot assistant specifically for libraries. These intelligent agentsvirtual assistants are able to answer simple queries about library hours, the location of a particular books, upcoming library events etc. In future, the company intends to expand its features by providing microblogging platforms, instant messaging platforms, internet, branded entertainment and custom solutions. (*21*)

The Cybrarians or Reference Librarians are able to answer continuously asked enquiries, some of which can be answered easily while others require more research. An intelligent chatbot namely 'Cybersphyinx' is fully capable of giving answers and supporting to their customers for easy enquiries. It sends the harder questions to its supervisor. Thus, cybersphyinx is an virtual assistant of librarian or cybrarian who works under the guidance of its supervisor, gets trained very easily, also learns new answers and questions rapidly. Cybersphyinx observes carefully that, that what kind of questions were asked and answered. It smoothly connects with the library database.

Many libraries while adopting Cybersphyinx, first choose the name of virtual assistant librarian, then teach specific information about the library. Through mobile devices, patrons interact with the new virtual assistant either by talking or typing enquiries and gets their needed information. Libraries are open to personalize their virtual assistant librarian. They can create specific features for the specific classes of users such as 'story telling' for small children. It took 3 years the developers to develop the brain of Cybersphyinx. David Newyear and Michele McNeal have published the contents of their work as open source.

So, when any library is having virtual assistant librarian, it means it gets connected with books and author catalogues and hence, if patron asks any question about specific author or book to it, it can easily answer . According to David Newyear, these virtual assistant librarians can be easily connected to the collections as well as catalogues of the library. Library professionals can create a reference chatbot at their own with the help of Pandarabots and infotabby who are the hosts for bots written in Artificial Intelligence Markup Language (AIML). (22)

Some of the remarkable Chatbots are as follows:-
1) ELIZA (1966) :- Joseph Weizenbaum's ELIZA, created in 1966 is one of the earliest chatbots. It was developed to make a role of Rogerian therapist. Eliza was able to make the users to feel that they are conversing with a real human being.

2) Parry (1972) : It was the more advanced programme than Eliza. This programme is written in 1972 by Kenneth. You can download the programme of Parrry and also read more about it on www.chatbots.org/chatbot/parry
3) Jabberwacky (1988)
4) A.L.I.C.E. (1995)
5) Ultra Hal (1997)
6) Suzette/Rosette (2010)

Chatbots in European Libraries :-
1) *Stella* :- www.sub.uni-hamburg.de/bibliotheken/projekte/chatbot-stella.html
2) *Askademicus* :- www.ub.uni-dortmund.de/chatterbot
3) *INA :-* www.buecherhallen.de/ca/x/bws#
4) *Kornelia* :- www.kornhausbibliotheken.ch/Service/ChatbotKornelia.aspx

Chatbots in US Libraries
1) Lillian (2006)
2) Emma the Chatbot (2009–2012) :- www.infoTabby.org
3) Pixel (2010) :- http://pixel.unl.edu

Now, number of companies are competing to create virtual assistants. Personal Assistant Agents such as Ultra Hal for windows computer (2012), Siri for Apple's i-phone (2012) and Evi for android devices are working on full swing and successfully. In libraries also virtual agents are gaining popularity. These assistants are providing their assistance very cost effectively. For ex. Emma answered 4,774 questions related to the library during the period 2011. The cost for providing this service was $0.14 per use. Thus, we can say it is easy and cost effective for libraries to take this opportunity and swell their information services. (23)

Academic libraries can identify various ways to use intelligent technology for improving patron services by studying how these technologies are getting useful in other types of academic disciplines. For ex. In teaching and learning process how intelligent technology is adopted? (24)

Intelligent agents were responded positively by the undergraduate students in learning environment. When intelligent agents are used to support, guide and extend the thinking process, learning is more likely to occur. (25). Rather students become emotionally attached to agents by enjoying their learning process. (26)

Evidence suggests that the use of intelligent agents helps to improve student's engagement in learning process. (27) An example of agent based digital tutor system used in undergraduate education is IDEAL (Intelligent Distributed Environment for Active Learning) developed with the goal of encouraging students for their active participation in the learning process. (28). This technology is used in medical and dental schools when students interact with virtual patients. (29)

Library Science students, Law students may be benefited by the use of these digital tutors for increased student environment and active learning experience.

Use of Agent Technology in Digital Libraries
The use of digital technology has been started in digital libraries. (30) The example may be given of the use of agents to assist the searching and retrieving information across digital library collections and helping in query solving as like in advanced google search process. (31)

University of Michigan Digital Library Project is one of the first digital library project to include the agents. The main aim of the university behind this project was to design the agents that will retrieve only relevant search results for the user's query. (32).

University of Mexico digital library has also explored the agent based virtual reference system namely Vref that allows library patrons to inquire about how to locate information from digital library of the university. A relatively very small number of academic and public libraries have proposed the use of agents in circulation, reference and teaching.

What will happen when machine read all the books?
The most frequently voiced concern about Ai is that AI will accelerate the way of information search at the expense of librarians. Its true that machines can read the books/literature more faster and more comprehensively than any human beings can provide a much better fitted service by using AI.

Steven Bell in an article in the library journal in April 2016 asks that, really could artificially intelligent machines eliminate library jobs?. But, people argue that AI will not replace library or other jobs because machines can not replace the human skills of interaction and creativity. Another fear in the minds of people is that AI will eliminate the relation between books and people and also between librarians and their people. For this, firstly we need to accept that AI and machine learning are becoming more prevalent in our daily lives, particularly in learning and research activities. Secondly, we might also imagine AI for recommendation system for cataloguing purposes, for managing our collections, for solving simple queries of our users etc.

As per Catherine Nicole Coleman, AI can make libraries and librarians more valuable rather than less (33).

Today, AI is already capable of writing novels, newspaper articles and research papers hence question as to the copyright of these works arises. In the Monkey Selfie case, (34) the trial judge dismissed the suit and held that, even if Naruto (monkey) had taken the picture by independent and autonomous action, suit could not continue as animals do not have standing in a court of law.

Use of Artificial Intelligence in Academic Law Libraries
In academic libraries, the use of intelligent technology was first suggested by Roy Balleste. He stated that with the use of this technology, library hours would get extended, as it would help in answering the simple questions about the library, such as how to make use of the library? how to make use of the library catalogue? etc. It will help to assist in distance education and in cataloguing and circulation operations smoothly.

Agent technology helps to provide more effective reference services to academic library patrons at present and in the future as it continues to develop.

In libraries many reference queries are such that don't require expertise of a reference librarian. Near about 70% of queries are location based inquiries. These questions are related to availability of resources, printing, computer problem, circulation assistance. Approximately only 15% of the reference questions are those which require their expertise. (35). Thus a very small % of reference questions actually require librarian's expertise. Hence, now the question arises whether academic law librarian should eliminate the traditional reference desk. For this, the answer is, rather than giving up reference desk, better to incorporate agent technology in academic libraries so that librarians along with reference assistants can answer patron's reference questions effectively and efficiently. (36)

Use of Intelligent Agents in Circulation Process
Intelligent Agents can be used in smooth circulation functions. Thus, Agent technology can also be used for checking in and checking out the books to the users and it can also recommend the users other material of their interest. (37) In the era of information technology, by automating some of these functions librarians may give free time to the staff to give answer to the user's queries and also for working on more and more library projects.

Demerits/drawbacks of using Intelligent Agents and Artificial Intelligence in Academic Law Libraries
Despite the thing that Artificial Intelligence and Intelligent Technology have many benefits, certain drawbacks cannot be ignored. About AI some argue that it may lead to unemployment. (38) Many also states that "thinking computers" may harm human and society. The cost of AI is too high, hence, may be another significant concern for Academic libraries. When the libraries are already suffer the problem of tight budgets, where the budget for the books is getting slashed and money spent for each and every thing is being scrutinized, using this technology may be cost prohibitive. It is not easy to say the actual cost of AI in libraries, but companies like Google, Apple are spending millions of dollars on AI development. (39)

Despite the valid drawbacks, the AI has been proved to be very beneficial to students and patron services. Integration of agent technology now and more advanced Artificial Intelligence in the future will help the academic law librarians and library staff to provide the highest level of service to the whole law school community.

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