Artificial Intelligence: Its Uses, Advantages, Drawbacks, and Difficulties in Libraries—With Particular Reference to Rajiv Gandhi University Library, Arunachal Pradesh

Mridu Pavan Sarmah   **Rahul Sarma**   **Gayatri Dey**

Abstract

The world is now heavily reliant on science and technology as time goes on. In this occurrence, the development of artificial intelligence appears to be a blessing. The use of it facilitated quicker, easier, and more effective labour. Therefore, the purpose of this study is to examine the idea of artificial intelligence and its main applications. The paper's detailed investigation of the use of AI in libraries is another area of expertise. In this age of information explosion, libraries have transformed into information hubs. As such, implementing artificial intelligence greatly aids in meeting user needs in the most efficient manner at the appropriate moment. Additionally, libraries are a great place to learn on your own, and using artificial intelligence in libraries can be quite beneficial.

Keywords: Artificial Intelligence, Library, Rajiv Gandhi University

1. Introduction: Artificial Intelligence

Humans are curious beings. With the advent of science and technology, humans start striving for more comfort and solutions to their day to day problems, and Artificial Intelligence (AI) is the seed of that study that procures human-like solutions through the hands of machines. This sometimes entails taking traits from human intelligence and changing them into computer-friendly algorithms. It strategizes efficiently or in a flexible way to solve an issue by judging the requirement of the situation.

Artificial intelligence is mostly classified in the branches of engineering, but it is a versatile study that embraces different branches of knowledge such as arithmetic, psychology, cognition, biology, philosophy, and many others. Human beings' capacity to synthesize information from all these domains will help their quest to create an intelligent artificial being in the long run.

Artificial Intelligence is primarily concerned with the development of robotics. Along with that it also contributes to the field of software development, for instance, finance and economics, data mining, physical science and all such areas require computational understanding and modelling. In robotics, artificial intelligence refers to the creation of digital simulations of human mental processes. Making a programme

that behaves like a human isn't enough. One wants to create a programme that mimics human behaviour. Again, in computer science also, A.I. takes the role of computer to smoothen the work, otherwise a computer needs high level languages to solve the issues. The history of artificial intelligence can be traced back to 1951, and the University of Manchester can be said as its birth place, because in this year artificial intelligence programs are written on the machine of Ferranti Mark I in United Kingdom at the University of Manchester and they are the first working programs of A.I. They are developed with the combination of two programs such as - draught-playing program, and chess-playing program that are written by Christopher Strachery and Dietrich Prinz respectively. It is John McCarthy who finally names it as artificial intelligence and becomes the father of the same. In the 1990s, AI starts flourishing with the creation of intelligent agents. The first computer named Deep Blue becomes the chess champion in 1997 and beat a world chess champion. Again, VaMP, a driverless car completed a race of 158 km. without the help of any human in the year 1995. The year 1999 is even of more success as humanoid robots start working and walking freely.

Artificial Intelligence can be categorised in two ways - conventional, and computational intelligence. Machine learning can be typically said as conventional AI. It can be presented on the basis of formulas and mostly focuses on statistical calculations. Conventional AI is also known as logical AI, and symbolic AI. In the 90s the philosophical implications of AI was not there, therefore it was known as GOFR that stands for Good Old Fashioned Artificial Intelligence. It comprises various methods including an expert system, Bayesian networks, case based reasoning, and behaviour based AI. Expert system depicts a system with reasoning capabilities which can gather and analyse large amounts of information and also can draw conclusions from them. The Bayesian network is a combination of different variables. These variables are independent of expressions and can jointly work within one frame. Again, based on the memory of the past occurs, AI can solve the new issues and that is known as case-based reasoning AI method. The behaviour based AI method basically provides a human touch to work. It uses human perception to solve issues, for reasoning and overall to behave like a human. However, these are all about conventional AI. Computational intelligence or shortly CI is the design of computational paradigms that are biologically and linguistically motivated. There are three main methods of CI- Neural Networks, Evolutionary Networks, and Fuzzy Systems. The Neural Networks use the brain as a source of inspiration.

2. History of Artificial Intelligence

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3. Goals of Artificial Intelligence

Artificial Intelligence, though a late comer in the field of information technology, has transformed society beyond imagination at its very young age. The researchers of AI have set up some goals or traits to be fulfilled by the AI technology. Firstly, deduction, reasoning, and problem solving are some initial objectives to be seen in different such technologies. Unlike human beings who use to solve problems with quick, intuitive judgements, AI uses a step-by-step deduction process. Again, another goal of artificial intelligence is knowledge representation. AI, in problem solving, sometimes needs to know a lot about the world. This knowledge of objects, properties, relation between them, events, states, situations are needed to be earned by AI in order to solve problems. The existing knowledge of the system is ontology or what the machine knows about. Another goal of AI is to prepare intelligent agents in a way that they can plan for solving any matter. The agents should be able to set goals by visualizing the future regarding what has to be achieved. Natural language processing ability is another trait of AI which enables the machines to read and understand the human language. Semantic indexing is a common method of processing and extracting meaning from the natural language. Motion and manipulation are quite visible in AI, specifically in robotics. These are significant traits. To know the location, to know the surrounding, and in motion planning or planning in how to get somewhere from one point to the other – for all these robotics require intelligence.

Perception is another trait of AI or can be said as a goal which AI intends to reach through its different dimensions. Perception suggests ability to recognise through sensors such as – facial recognition, object recognition, speech recognition, etc. AI intends to interpret human emotions too. AI researchers set goals to inculcate the ability to simulate empathy and other social skills in Intelligent agents such as to predict the actions of individuals by understanding their emotional state, in fact the agents are intended to feel that though the display of emotion outwardly is not possible. Thus, these are some of the traits or goals that an AI researcher intends to see.

4. Areas of Artificial Intelligence

Artificial Intelligence has several components or areas such as expert system, pattern recognition, robotics, HAMLET, machine learning, Natural Language Processing, etc.

(i). Expert system: It is a knowledge-based computerized system that works as a gateway to retrieve relevant information from a stored database. Knowledge base, Inference Engine, and User Interface are three

components of an expert system. It is like advice giving, solutions recommending programs for a particular situation.

(ii). Natural Language Processing: It is the most desired need from computer science that suggests capability of understanding the human language by the computers. The fifth or ultimate generation of computer language uses natural language. Artificial Intelligence researchers get success to some extent in building the natural language interface. It possesses limited vocabulary and syntax. The procedure happens through the understanding of linguistic concepts through computers to solve questions. However, the components of natural language processing include- speech recognition, machine translation, linguistic approaches, speech synthesis, information extraction and information retrieval, etc.

(iii). Pattern recognition: It is a process of establishing a match between something already existed and a new stimulus. It can be performed in terms of all living beings. It can recognize the familiar patterns very quickly. In different studies, pattern recognition is used such as in computer science, psychology, and cognitive science. The major components of it includes – feature extraction, model selection and training, data acquisition, pre-processing, and evaluation. Generally, the origin of pattern recognition can be traced back to statistics, and engineering. It is gradually used in every sphere. In medical sciences for example, it is the basis for computer-aided diagnosis or the CAD system.

(iv). Robotics: Robotics is a prime area of artificial intelligence or to be said more precisely a sub-field. Either directly human control or through a pre-defined program, this robotics technology carries out automation tasks. Robotics is that branch which involves the manufacture and operation of robots that are some mechanical devices.

(v). Machine Learning: The term 'machine learning' was invented in 1959 by an American pioneer in computer gaming and artificial intelligence. He means it as an ability of a computer to learn without explicit programming. These algorithms use history as input in order to predict new output. It is basically divided into four categories, and they are- supervised learning, reinforcement learning, unsupervised learning, and semi-supervised learning.

(vi). HAMLET: The word HAMLET stands for How About Machine Learning Enhanced Theses. HAMLET is developed in Harvard at the Berkman Klein Centre for Internet and Society. The Doc2vec algorithm is used by HAMLET that searches the similarity of meaning between various documents and it is again based on another algorithm called word2vec which searches the similarity between words. The results are shown at the URL in a gray box. The prototype interfaces that HAMLET contains are- an uploaded file oracle, a recommendation engine, and a literature review buddy (Asemi&Asemi, 2018 &Mogali, 2015).

5. Four Foundations of Artificial Intelligence

As mentioned in McGraw-Hill Encyclopaedia of Science and Technology (2007), the four foundations of Artificial Intelligence are – (i) Representation, (ii) Search, (ii) Reasoning, and (iv) Learning. These can also be said as requirements of AI.

(i). Representation: It suggests representation of the facts about the world. Here, the internal description of a problem is denoted by the term representation. It is the knowledge base of the system to identify a problem. For example, when an expert system gives description and identifies symptoms of a person's disease in order to diagnose, then it would be called as representation.

(ii). Search: Search is basically used for problem solving methodology and is a significant aspect of artificial intelligence. In most of the cases, search is done in order to modify something or to give response to a problem. It creates possibilities for something.

(iii). Reasoning: Transfer of knowledge into solutions of problems can be said as reasoning. It is of two kinds- deductive, and inductive. Here, the knowledge regarding a problem is used to deduce some possible solutions or in order to develop a hypothesis that basically explains the existing knowledge and current problem as well. One example of reasoning is the expert system.

(iv). Learning: The learning feature of an intelligent system basically helps to gather intelligence by learning the history or the knowledge of the system. Programmers generally can learn only those things or facts which their formalisms can represent. Learning covers several aspects such as updating the knowledge and augmenting the reasoning, reconfiguring the representation, etc. Some examples of learning method generally used in artificial intelligence are- statistical learning, neural networks, reinforcement learning, etc. All these basically encompass the subject area of machine learning and deep learning as well.

6. Use of Artificial Intelligence in Library

Most interestingly, artificial intelligence is the newest technology that has emerged with enormous potential and promising applications in libraries. As a result, A.I. systems (robots) are predicted to be an important technology in this century by Corke (2013), and it is necessary to investigate this technology as well its benefits and drawbacks, in order to fully exploit its many advantages for innovative and optimal service delivery in libraries. In a nutshell, the main benefit of deploying artificial intelligence systems in libraries is that in comparison to humans, they are quick and less prone to errors. They can operate for 24 hours or 7 days a week without fatigue, allowing librarians to focus on other tasks. Finally, because computers can function at a size and pace much beyond human capabilities, they will improve library service delivery at all levels by increasing the speed, efficiency and effectiveness of processing library materials.

In the modern era, computers provide the ideal medium for the experimentation and application of Artificial Intelligence technology. Cognitive or intellectual tasks such as computer-based game playing theorem proving, are more successful for AI than perpetual tasks. These computer programmes are occasionally designed to encourage human behaviour and they are also technological applications such as computer-aided instruction (CAI). The key goal in many circumstances is to identify any strategy that can do the assignment swiftly and efficiently.

7. How the Expert Service is Applied in Library Activities?

The operations of the library are related to the reading materials, users, and employees. The employment of Expert Systems to facilitate communication between staff and users, as well as between users and database, promises to be highly promising. An Expert System can assist the librarian in recognising the need for increased productivity. Quality will also be improved by a well-programmed Expert System.

The Expert System can be used while providing various services of a library such as i) reference service, ii) cataloguing, iii) classification, iv) indexing and v) acquisition.

i). Application of Expert Systems in Reference Service

Reference service is one of the major services provided by a library and the use of an expert system will act as a substitute for a reference librarian. Some examples of expert system that are used in reference services are as follows-

a) REFSEARCH: REFSEARCH is an abbreviation for Reference Materials Searching System. It is a mechanism that provides clients with suggested sites to hunt up answers to specific questions. The system can be used to teach students how to use a reference library or as a computerised tool for practicing librarians and information professionals.

b) Online Reference Assistance (ORA): Using many technologies, including a videotext-like database, computer assisted training modules, and a knowledge-based system, this system aimed to stimulate the services of an academic reference librarian for low and medium-level queries. Directional transactions, such as library locations, services, and policies, make up ORA.

c) POINTER: It was the first successful use of a computer system in the field of reference work. It directs users to reference sources; it is not a knowledge based system, but rather a computer-aided reference programme.

d) PLEXUS: The word PLEXUS stands for Phillips Laboratory Expert System-Assisted User Software. This is a tool that is used in Public Libraries to make referrals. It covers information on the reference procedure, retrieving information on specific subject areas, reference sources, and library users. All of the methods shown above are advisory systems for locating reference books and factual information.

e) ANSWERMAN: It is an agricultural knowledge-based system to assist users with reference questions. It employs a number of choices to limit down the topic of the inquiries as well as the sort of tool required. It can be used as a consultation system or as a user interface for external databases and CD-ROM reference resources.

ii). Application of Expert System in Cataloguing

One of the oldest library crafts is cataloguing. As descriptive cataloguing is considered rule-based, recent attempts to automate cataloguing through Expert Systems have focused on it (AACR2). Artificial Intelligence techniques for cataloguing can be applied in two ways-

a)   a human-machine interaction in which the intermediate and the support system share the cognitive load, and

b)   An expert system with full catalogue capabilities coupled to an electronic publishing system, so that as text is written on-line, it may be transferred through knowledge-based systems and the cataloguing process can be completed without the need for any intellectual input from a middleman. Every attempt to transform AACR2 into the highly structured rules required to run the expert system has failed.

iii). Application of Expert System in Classification

The essential action in the arrangement of knowledge is classification. As a result, it is prominent in all knowledge organisation systems in libraries and information centres. The following are examples of Expert System applications in the field of library classifications:

a)   **Coal SORT:** It's a conceptual browser that may be used as a search engine or an indexer. Coal SORT principally consists of a frame-based semantic network and the software required to allow users to view pieces of it and navigate the conceptual structure. The semantic network houses practically all of the expert knowledge in the system. The system is devoid of procedural knowledge.

b)   **EP-X:** The Environmental Pollution Expert (EP-X) and coal SORT have a lot in common in terms of focusing on improving interfaces using a knowledge-based approach. EP-Knowledge X's base is made up of a hierarchical frame-based semantic network of concepts and a set of templates that define the pragmatic relationships between concepts. The term "conceptual information" refers to these patterns.

c)   **BIOSIS:** BIOSIS assigns documents to categories automatically using a knowledge base that includes a considerable amount of procedural knowledge. It's intended to help indexers. The information in the titles of biological documents is used by BIOSIS to allocate as many categories as possible, similar to what would be assigned by human indexers. The indexing languages provide an organised and realistic representation of data that can be utilised to benefit AI Systems.

iv). Application of Expert System in Indexing

Another area where expert systems are being developed is indexing of journals. The process of indexing a monthly article involves the identification of concepts, their translation into verbal descriptions, and the choice and assignment of restricted vocabulary terms that are conceptually comparable to verbal descriptions. To improve the consistency and quality of the indexing, the intellectual components of indexing are being automated. Based on the data provided by the indexer, the systems can automatically assign relevant subdivisions with the most applicable preferred terms. The system can form judgements and take appropriate action depending on such inferences. The best example of an indexing system used in library indexing is 'Med Index'.

Only a small percentage of library patrons have interacted with knowledge-based systems. The majority of these technologies are not perfect enough to be used by the average library visitor, therefore users have had minimal interaction with them.

v). Application of Expert System in Acquisition

Another important aspect of the library is the document collection. In this exercise, the librarian or information officer plays a crucial role. The library's users have an important role to play in the development of electronic collections, and their assistance and opinion should be sought. A number of systems have been integrated. Monograph Selection Advisor is a ground-breaking effort to apply this developing technology to another aspect of library science: library collection development. The job modelled is a subject bibliographer's item-by-item selection when picking monographic sources. The knowledge base must be large enough to possess vast amounts of materials and information, and similarly the interface must be user friendly, that means, simple enough for the library to extract the information it requires from the computer.

8. How the Natural Language Processing Applied in Library Activities?

When one thinks of NPL, it can be imagined as being able to speak or write an entire sentence and having a machine process and say it back to us. Many fields can benefit from NPL and the field of Library & Information Science is a perfect example. The most promising aspect in the field is searching databases such as Online Public Access Catalogues (OPAC).

The foundation for document retrieval is indexing. "Indexing's goal is to increase precision, or the proportion of relevant documents retrieved, and recall, or the fraction of relevant documents retrieved." Keywords that have been weighted by the indexer as being fundamental to human thinking on a particular subject will be fed into the electronic database in such a way that, when strung together in the proper sequence by the searcher, will trigger the citing of an article or book on the computer screen. The diversity in how a concept can be conveyed is the main restriction. (aaai.org/AITOPICS, 2014).This variation is largely due to semantics, such as the use of the terms "mobile home" and "trailers". In most regions of the country, the term trailer has been supplanted with the term mobile home.

Patrons of libraries may be unaware of the ambiguity in their search strategy. The use of natural language for dialog database searches would allow library users to search the database without the assistance of an information expert. A user utilising a library's electronic catalogue might desire the catalogue to understand a whole sentence, such as "Find all your sources that reference natural language processing for the use of library and information science." The human librarian has the advantage of being skilled in both search and query, as well as natural language, and may act as a go-between the machine and the library patron. There are some URLs that are also case-sensitive. It may be possible to visit the website using natural language in the future. To take advantage of this new technology, library visitors must become computer savvy.

9. How Robotics is Applied in Library Activities?

Libraries continue to buy enormous numbers of printed documents as they expand their digital library services and resources. Many libraries, particularly academic research libraries, are experiencing severe space constraints as a result of the demand to provide both online and offline resources and services. The All-inclusive Access to Printed Content (CAPM) project's purpose is to develop a robotic, on-demand, and batch scanning system that will enable real-time browsing of printed material via a web interface. The user will activate the CAPM system, which will then send a robot to retrieve the specified item. This item will be delivered to another robotic device, which will automatically open it and turn the pages. The CAPM system will not only permit for viewing of text pictures, but also for searching and analysing full-text created from the photos, thanks to existing scanners, Optical Character Recognition (OCR) Software, and indexing software developed by the Digital Knowledge Centre. The bookBot technology is another robotic book retrieval system. Though this technology has been used in the process of manufacturing, it is now immensely used the libraries. The bookBot is a service that delivers books to customers on demand by using the computerised catalogue of the library. In response to a request, one of the robotic cranes of book Bot locates and picks up the item from the shelves and brings it to the responsible unit and they deliver it to the needy user either inside or outside the library or by analysing whether the user wants to borrow it or not.

Radio Frequency Identification (RFID) tags are being included into the library collection. Which are basically some unique identifiers for each book in the library. These barcode-like tags can be scanned by the RFID scanners or readers. These scanners are easy to use as they are wireless. There are some RFID antennas that can be used for stock verification in the smart shelves. These antennas inform automatically when books are taken away from the shelves or when they are returned. In a similar vein, robots are being developed to scan and retrieve materials from the library shelves. Although they are more expensive to build and maintain, these intelligent systems are more accurate than people. The technicalities will include preparing a detailed map which shows the visual of the robots' movements in the entire library and along with that it controls the directions by predicting the obstacles such as users, books, furniture, etc.

From the above conversation, individual can see that AI is used or can be used in the following Library melodies: library housekeeping operations and user studies, library management, reference service, library customization and reclamation, research work and erudition, innovation, intelligent agents for information, study on implementation and existing technologies and solution.

10. Practice of AI In Rajiv Gandhi University Library

The Central Library of Rajiv Gandhi University has adopted AI services to revolutionizing the services of the library in several ways:

1. The Central Library has installed RFID technology in the year 2014 to minimise the time duration to complete a task and for security purposes.

2. The RFID gate helps to monitor the foot fall of the patrons of the library. The items available in the RGU library are tagged with a tag, hence, whenever a patron passes the gate without issuing the items from the library, the tagged has been detected by the gate and it produces a beeping sound to alert the library staff. Therefore, the RFID gate serves as a security checkpoint, ensuring that all materials leaving the library have been properly checked out.

3. The library also has a KIOSK machine, which minimises the workload of the circulation section to some extent by providing self-check in and check-out services. The patrons can use this system to borrow and return items independently without the assistance of library staff.

4. The RFID technology not only provides security but also allows the library staff to focus on other works and it also reduces wait times for patrons.

5. Moreover, the library housekeeping operations are managed with the help of Koha, which was installed in the year 2014.

6. Further, various documents like Phd thesis, newspapers, and rare books have been digitized and preserved for future use.

7. The Central Library is planning to add AI services like Frequently Ask Question (FAQ), RSS Feed, etc in the web OPAC (https://opac.rgu.ac.in).

11. Advantages of Artificial Intelligence (Libraries)

i)   24 hours accessibility to information resources and complete tasks or provide various services faster than a human can is possible with the help of AI,

ii) AI handle stressful and complex tasks that humans may find difficult or impossible to do,

iii) It find things that haven't been discovered before or can help faculty members uncover more research, resulting in increased research output,

iv) There are less errors and flaws and also increases the efficiency in different library operations,

v)   The function is limitless,

vi) In the delivery of library services, a more immersive and enhanced user experience will be there,

vii) The deployment of artificial intelligence systems in libraries can reduce the workload in different areas such as in circulation services, technical services, serial management, reference services, and many others.

12. Disadvantages of Artificial Intelligence (Libraries)

i)   Artificial Intelligence Systems can be a cause of raising unemployment as it has the capacity to not only reduce the human labour but to completely replace them in a particular job.

ii)   Artificial Intelligence Systems can malfunction and execute tasks for which they were not programmed to.

iii)   Artificial Intelligence Systems have the potential to be misused, resulting in mass disaster.

iv)   The basic and minute details of different house-keeping sections in a library such as cataloguing and classification can face ignorance in some cases as a result of the overreliance on artificial intelligence technologies

v)   The 'human touch' is lacking. Some users will choose to interact with humans and express their emotions directly rather than through a machine. It can affect the psychology of a user.

13.   Challenges in Implementing Artificial Intelligence in Central Library of Rajiv Gandhi University

Despite having lots of benefits, artificial intelligence systems are not highly applied in most of the libraries because of the following changes faced in its implementation:

i)   Lack of technical knowledge of the library staffs to operate A.I., and the cost of their training if these technologies are implemented.

ii)   Implementation of this technology needs suitable hardware and software and also an appropriate library building structure to some extent. The implementations of all such things are very costly in nature.

iii)   These systems also involve higher cost of maintenance.

iv)   Unreliable power supply in libraries, particularly in developing countries, to power artificial intelligence systems.

v)   The inherent complexities of developing expert/artificial intelligence systems.

vi)   Natural language skills are limited.

vii)   In some cases some functions in a library become limited to perform by the A.I. systems because they lack human knowledge in some factors.

viii)   To practice such a system in a library the library not only requires a large budget, but the effort, time, maintenance, and human power should also be high in the implementation process. The higher such elements the more powerful and versatile the system will be, and again it leads to more efforts of maintenance. So, it involves a cycle of cost, power, and maintenance. Currently, the essential experienced employees, as well as expensive development tools or methodologies, are either unavailable or prohibitively expensive, which results in the low rate of implementation of such systems in libraries.

ix)   The technology requires highly professional persons and they are scarce in today's time in the automation companies. Moreover, implementation of the A.I. systems are highly different from traditional library automation systems. Therefore, it requires hiring additional professional staff. These issues become hindrances in path of development of artificial intelligence.

14. Conclusion

Libraries must innovate their services and re-examine their procedures if they are to succeed in the new information economy, and artificial intelligence in libraries is a great way to do it. The development of artificial intelligence will no doubt bring efficiency in the work of different housekeeping operations in a library. The fear replacement of humans with the expert A.I. systems eventually increase the performance, dedication of the library employees. However, despite challenges and some of the disadvantages of the artificial intelligence systems, its benefits can never be ignored. Libraries have become knowledge hub, for knowledge recreation and recreation as well. It is embracing newer technologies at a higher rate day-by-day. Artificial Intelligence is a blessing in this case. No doubt, artificial intelligence will occupy every field in the near future, whether it is a library or some other organizations.

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About Authors

Mridu Pavan Sarmah, Assistant Librarian, Chaiduar College, Gohpur, Biswanath, Assam
Email: sharmamridu85@gmail.com
ORCID ID- 0009-0004-4970-8699

Rahul Sarma, Professional Assistant, Rajiv Gandhi University, Itanagar, Arunachal Pradesh
Email: rahulsarma85@gmail.com
ORCID ID: 0009-0004-5691-3375

Gayatri Dey, Library Assistant, Rajiv Gandhi University, Itanagar, Arunachal Pradesh
Email: gayatri.dey24@gmail.com
ORCID ID: 0009-0009-2688-2703