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Review Article

APPLICATION OF ARTIFICIAL INTELLIGENCE IN PUBLIC HEALTH: A SYSTEMATIC REVIEW

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ABSTRACT

Advances in artificial intelligence (AI) have proven useful in many research domains and have been applied successfully in various health-related fields however in field of Public Health it is still behind the curve in comparison to others. In Scientific disciplines AI may be incorporated in health care for improving medical care especially in handling big data, exponential computing power and ever increasing demand on health care system. The major issue is to ensure that techniques which are being developed should be potential enough to benefit all equally, balance risk and rewards as well as minimize dependence. AI can serve the broader objective of public health only through cross disciplinary expansion including collaboration which entails development of computer science by incorporating advancement in fields like epidemiology, biology medicine as well as public health. AI holds tremendous promise for transforming the provision of health care in countries like India by ensuring universal health coverage.

Keywords: Artificial Intelligence, Big Data, Public Health

1. ARTIFICIAL INTELLIGENCE : AN INTRODUCTION

In 1956 a group of Researchers coined the term "Artificial Intelligence" (AI) [1]. Artificial Intelligence also referred as AI is usually defined as "the science and engineering of making intelligent machines, particularly intelligent computer programs. In this we use computer to develop understanding related to human intelligence. AI does not have to confine itself to methods that are biologically observable" [2].

Since then a great advances have been achieved in the field of AI which have proven to be useful in many research domains and its application have proved to be successful in various health related fields. Thus Artificial Intelligence involves creation of intelligent systems which assist in performance of complex data. Artificial intelligence employee's use of coded computer software routines with set of specific tasks for which human brain is required for example understanding as well as processing of language identified sounds as well as objects and learning patterns for designing problem solving strategies. Such coded soft ware rules are called algorithms [3].

2. TYPES OF ARTIFICIAL INTELLIGENCE

The early AI researches were focused on Artificial General Intelligence and predominant representation of AI in culture. Artificial General Intelligence is basically ability of a machine to represent the human brain and perform intellectual tasks that human can perform. However, considering the challenges as well as complexity related with designing of AI several researchers got attracted towards artificial narrow intelligence: ie the ability of machine to perform a single task well. All AI health applications are considered artificial narrow intelligence [4]. Another AI knowledge based system is an expert system, which possess competence in solving problems. Through knowledge engineering we can build an expert system which includes a knowledge base as well as reasoning engine which is further based on series of complex rules for example if- then kind of statements. It includes application of fuzzy logics which help in decision support application thus facilitating in better approximation of the way human will approach complex problems [5-7].

Machine Learning is another application of AI it is a method of automatic data analysis using algorithms which help in identifying patterns in data and further help in learning from them. Machine learning can be further categorised into three broad categories ie supervised learning, unsupervised learning and reinforcement learning. Type of Artificial Intelligence which focuses on bridging the divide between languages that humans and computers use to operate is termed as Natural Language

Processing. In this main focus is on use of algorithms which further allows machines to identify key words as well as phrases such application helps in determining the meaning of text. Another branch of Artificial Intelligence with future potential is automated planning and scheduling with focus on organising and prioritising the activities required to achieve goals. Such types of applications are also applicable in improving the efficiency of human procedures too. Artificial Intelligence also has application in Image and Signal processing, certain common examples of signals are data produced by motion and sound. It includes steps related to signal feature analysis and data classification using tools such as artificial neural networks (ANNs). These are basically computing systems based on networks which consist of animal brains.

3. ARTIFICIAL INTELLIGENCE AS A BOON IN PUBLIC HEALTH

Application of Artificial Intelligence have been successful in several research domains as well as health related fields like genetic engineering, medical diagnostics, drug related interventions as well as personalized medicines. Artificial Intelligence as a wider application in Public as it is art or science of preventing disease , prolonging life and promoting health and efficiency through organized community effort [8]. Area of Public Health provides a wider opportunity of applying Artificial Intelligence for example: Artificial Intelligence has an application as a tool to promote healthy behaviors we can use it as predictive analytical application to identify population at risk and thus can help in better programme planning by targeting them. Such tools can be used at multiple levels at various health systems particularly for Public health decision making. By practical application of AI tools available in mobiles or online technologies we can target individuals who are at risk and share information with them, provide them social support as well as empower them through proper communication strategies. Hence smart phones along with mobile applications are tools which facilitates in healthy decision making besides monitoring behaviors.

Tools of artificial intelligence also helps in developing better understanding about interventional pathways implemented in improving public health. It facilitates in cross sectoral analysis of datasets which are related to broader social determinant of health like social services and education such information help in better decision making by these sectors and even helps in identifying at risk cases. An application of Artificial intelligence *i.e.* Natural Language Processing also facilitates in finding patterns and make connections along with linkages which acts as informative tools for policy makers as well as public health organisation. By integrating AI with research we can ensure cross discipline learning and thus refine our research process. Hence, such an approach serves as a model in policy decisions . Application of MI and AI helps institutions in enhancing data accessibility by providing detailed information on why and when the data was collected thus we can link certain data like food purchase data can be linked with existing health datasets.

Besides all this National Institute of Health in United States has number of ongoing researches with target of using Artificial Intelligence for improving surveillance of both communicable as well as non communicable diseases [9]. In order to reduce reliance on humans present disease surveillance system use AI and has automated the entire process this has facilitated more expedited and predictive surveillance and allowed usage of data from variety of sources like traditional systems such technological application has facilitated the public health officials to use such data to further improve the public health surveillance system [10]. This field of Artificial Intelligence have been enriched with several methodological developments which further enabled multilevel modelling to combine data at individual level with other social markers which include social conditions and this further ensures better disease surveillance, disease prediction, and implementation including evaluation of population health intervention.

Technological advancement, improved mobile connectivity and the popularity of wearable devices have provided opportunities to the clinicians and public health researchers for developing better understanding about physiological variability at individual level as well as population level and this aspect will further facilitate in diagnosis, better care delivery and to plan better for implementing preventive and therapeutic measures for the same. All such advances has led to emergence of new type of surveillance system termed as 'digital surveillance' which attempts to provide knowledge of issues in field of public health by analysing the health information which is stored digitally [11]. Thus Internet based health surveillance system helps in keeping track of both communicable and non communicable diseases this further helps in prediction of future health issues hence this modern system has an edge over traditional disease surveillance system wherein the data was typically fed by

the public health officials working in hospitals or certain agencies [12].

In Recent years the popularity of internet has increased manifolds among youth and they spent significant time on Internet and this can also be considered as primary source of health information [13]. The internet facility has helped in expansion of Public Health research [14]. Public Health practitioners are also assisted by web based application, online smart devices also social media platforms which particularly prove to be beneficial in disease surveillance, epidemic detection, behaviour monitoring and public health communication and education. Latest application of Artificial Intelligence is in processing of personalized data used to elicit patients preferences help patients to involve himself in care process by personalizing generic therapy plans. This helps to connect patients with required information beyond which available in their care settings [15]. But in order to attain this target efficiently it is essential to evolve and improve communication, collaboration and encourage team work between patients, their families and health care communities.

4. ARTIFICIAL INTELLIGENCE: CHALLENGES AND UNANSWERED QUESTIONS

AI approaches although facilitate existing processing power challenges applied to public health data but implementation of such approaches is still un clear. Substantial data are necessary to build and implement automated planning and scheduling applications [16]. Particularly in developing country like India compiling such data becomes difficult and time consuming. High Quality health systems data are presently difficult to collect in various resources poor settings although internet connectivity is improving all around the world but still in case of developing countries the accessibility to appropriate bandwidth required to upload is not available. However in spite of advanced web delivery the usage of internet in underdeveloped countries is quiet low besides this there are some usual privacy concerns related to usage of data in the systems. Hence it is advisable that the application of Artificial Intelligence should be considered just as an extension rather than replacement of traditional system [12].

Besides this application of Artificial Intelligence in countries like India also requires a strong and in depth knowledge of local social contexts, infrastructure requirements as well as additional related infrastructural needs which include IT, communication networks and platform for delivering primary health services. Moreover AI applications will have limited impact if they are not effectively integrated with languages and scripts used in electronic health records of developing countries. On the contrary in case of High income countries AI normally focuses on privacy, confidentiality, data security, informed consent as well as data ownership. Certain AI applications in view of experts can potentially exacerbate inequalities particularly related to ethnic, socioeconomic and gender.

5. CONCLUSION

The above stated reviews sensitize us regarding the importance of enhancing awareness particularly among Public Health professionals including policy makers regarding the use of advanced technologies. The practical application of such technologies will improve their widespread implementation with increased support and funding. Thus AI ensures tremendous promise with regards to health care services in developing country however there may be certain obstacles but they could be addressed and overcome using the AI support as well as other technological advancements. Public health outcomes can be improved by using several AI applications for example ubiquitous use of smart phones, cloud computing etc. Although along with all these features there is a need to develop human centred design while implementing use of AI *i.e.* we should consider all legal and ethical questions through human right this includes privacy, confidentiality, data security, ownership as well as informed consent.

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