ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING USE AND CHALLENGES IN HEALTHCARE

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Abstract: The application of AI in healthcare presents a wide range of potential that aid in decision-making. This essay's goal is to provide an overview of the primary techniques and uses of artificial intelligence in the field of healthcare. as well as to go over its drawbacks and difficulties. The database of PubMed was searched. Outcomes for articles published during the previous five years were reviewed. Artificial intelligence, machine learning, and healthcare were among the search terms used.

The AI technique most frequently applied in healthcare was machine learning. It was used primarily for monitoring (9%), diagnosis (18%), and prediction (36.9%). The most popular machine learning algorithms were the neural network (27.8%), regression logistic (27.8%), and random forest (29.6%). In 15.6% of cases, machine learning was applied to enhance the management of the healthcare system. In 12.5% of the cases, it was utilized to characterize and make an attempt to comprehend the psychological behaviors of the community. It was primarily utilized in infect ology (15.6%) in clinical practice. In conclusion, AI holds great potential for the healthcare industry. The use of this technology in routine clinical practice must be accompanied by ethical concerns, though.

Keywords: Artificial intelligence, Machine learning, healthcare.

1 INTRODUCTION

In general, computer systems and algorithms that imitate a particular feature of human intelligence or behavior, such as learning, reasoning, and problem-solving, are referred to as artificial intelligence (AI) (Jiang et al. 2017). (Chen et Decary 2020). Following the accessibility of connected objects and open public databases, the development of computational models and algorithms, and the availability of powerful computers, there has been a tremendous advancement in AI in recent years. This advancement has improved human life in many ways and outperformed human performance in a number of fields.

Machine learning (ML), Natural Language Processing (NLP), AI voice technology, and robotics are just a few of the fields that have seen the development of numerous methods and techniques with the goal of extracting knowledge from massive amounts of data using automatic or semi-automatic methods (Chen et Decary 2020). (Jiang et al. 2017). One of the most popular types of AI is machine learning (ML). It refers to a system that develops a predictive model by recognizing patterns in data from input and then makes use of that model to predict usefully from fresh, previously undiscovered data (Chen et Decary 2020). (T. Davenport et Kalakota 2019). Supervised learning, unsupervised learning, semi-supervised

learning, and reinforcement learning are the most popular ML categories (Chen et Decary 2020).

A large amount of heterogeneous data is produced by the healthcare system (Abidi 2019). Many opportunities to support decision-making are presented by the application of AI in healthcare. It has shown that it has the potential to advance a variety of fields, including healthcare administration, biomedical research, medical diagnosis, treatment choices, management of chronic conditions, delivery of healthcare services, assessment of various aspects of healthcare, assisted operations, remote patient monitoring, personalized healthcare, intelligent prosthetics, drug discovery, and other domains.

The healthcare system generates a considerable amount of diverse data (Abidi 2019). The use of AI in healthcare opens up a lot of possibilities for supporting decision-making. It has demonstrated that it has the potential to advance a number of industries, including healthcare management, biomedical research, medical diagnosis, treatment options, chronic condition management, service delivery, assessment of various aspects of healthcare, assisted operations, remote patient monitoring, individualized healthcare, intelligent prosthetics, drug discovery, and other fields.

This essay's goal is to provide an overview of the primary techniques and uses of artificial intelligence in the field of healthcare. Moreover, to go over its drawbacks and difficulties
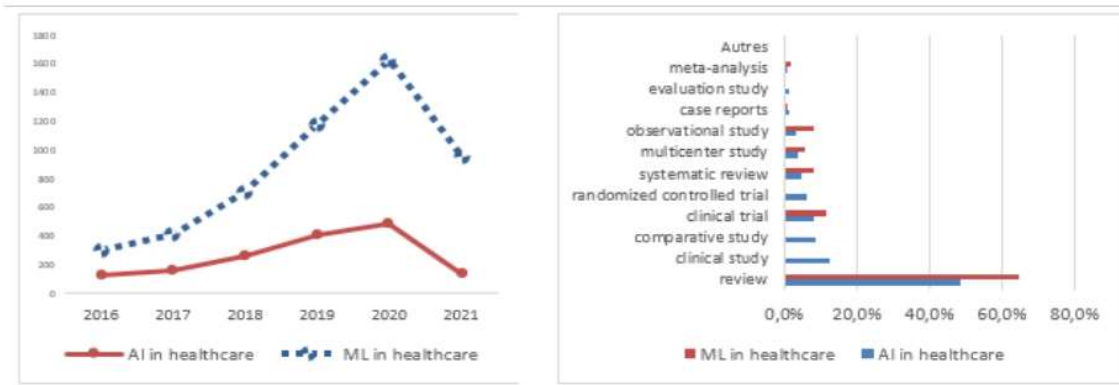
2 METHODS

A search was carried out in the PubMed database. Results for papers released between January 1, 2016, and June 30, 2021, were examined. "Artificial intelligence," "machine learning," "supervised machine learning," "unsupervised machine learning," "healthcare," and "delivery of health care" were among the search terms used. We took two steps forward.

- Using the search term "Artificial intelligence" AND "healthcare," we looked for the first articles about the application of any AI method in healthcare. All of the publications that were retrieved through this request were examined,
- Then, using the query ("Machine Learning"[Mesh]) OR "Unsupervised Machine Learning"[Mesh]) OR "Supervised Machine Learning"[Mesh]) AND "Delivery of Health Care"[Mesh]), research has been started specifically on the application of machine learning in healthcare. Only original publications that addressed the creation or validation of an ML model in the context of health were included in this stage of the search.

Otherwise, there were no additional exclusion criteria.

3 RESULTS

Our analysis revealed that there are ever more articles describing the use of AI techniques in the healthcare industry (figure 1.A). About half of the papers came from the USA (figure 1.C), and the majority of them were clinical trials and literature reviews (figure 1.B). A total of 4% of papers were devoted to discussing the ethical issues surrounding the use of AI in healthcare (figure 1.E).
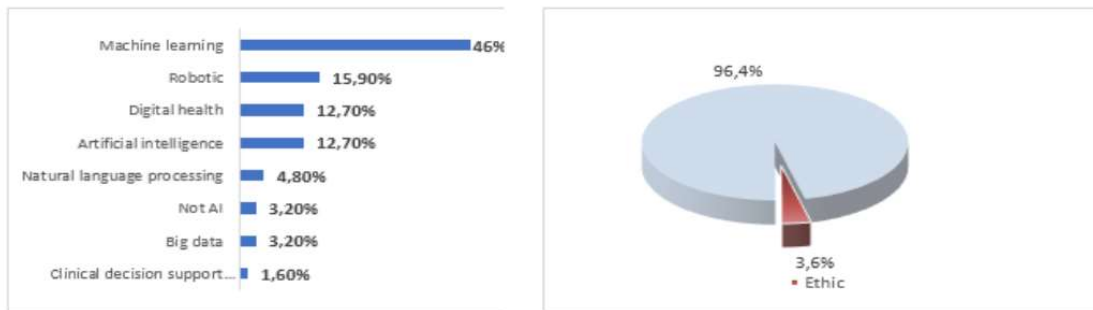
A: Number of publications about the use of the artificial intelligence and the machine learning in healthcare

B: Number of publications by type, responding to our two queries
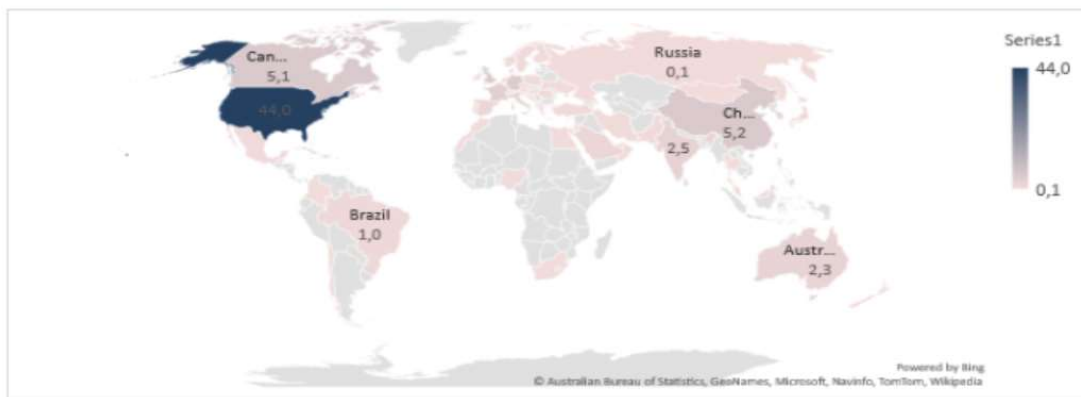
C: Number of publications of AI & ML in healthcare by country

D: Methods of AI frequently used in healthcare

E: The proportion of articles dedicated totally to ethics of AI use

**Figure 1: Distribution of publications on the application of AI in healthcare**

A little more than half of studies examined the application of machine learning in healthcare (figure 1.D), with prediction (36.9%), diagnosis (18%), and monitoring (9%) being the three main applications (figure 2.A). Random forest (29.6%), regression logistic (27.8%), neural network (27.8%), SVM (20.4%), deep learning (20.4%), gradient boosting (18.5%), and decision trees (18.5%) were the machine learning techniques that were most frequently employed (figure 2.C).

In 15.6% of cases, machine learning was applied to enhance the management of the healthcare system. In 12.5% of the cases, it was used to characterize and make an effort to comprehend
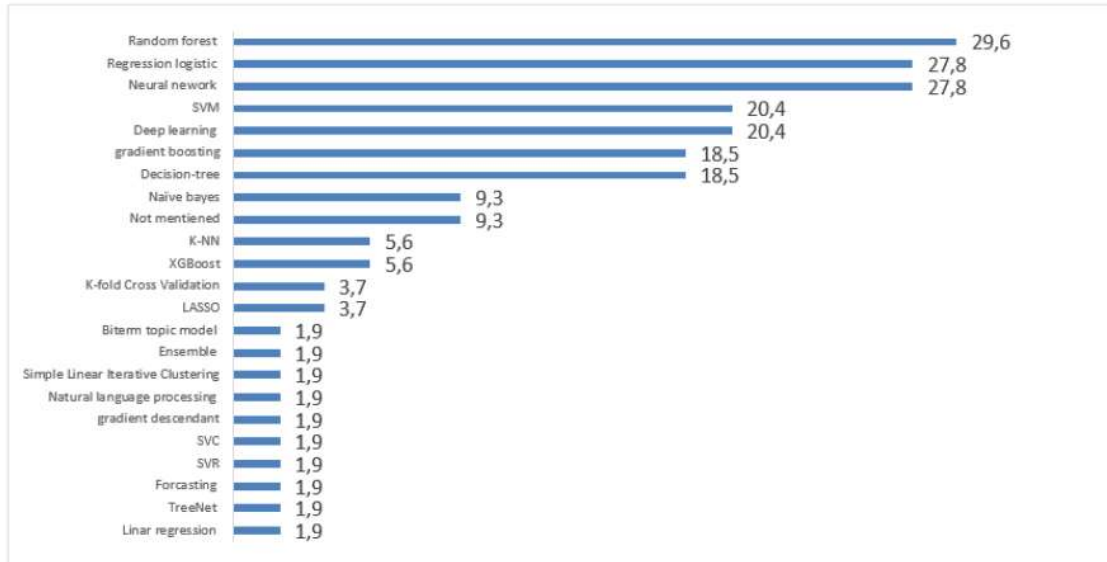
the psychological actions of the populace. It was primarily utilized in infect ology (15.6%) in clinical practice. (Fig. 2.B).
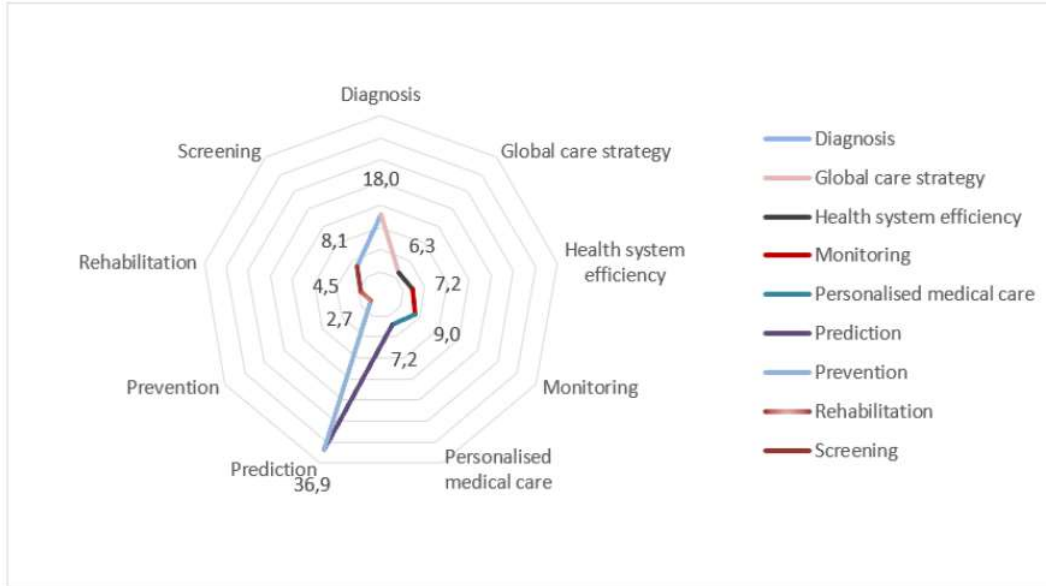
A: Domains of application of AI & ML in healthcare
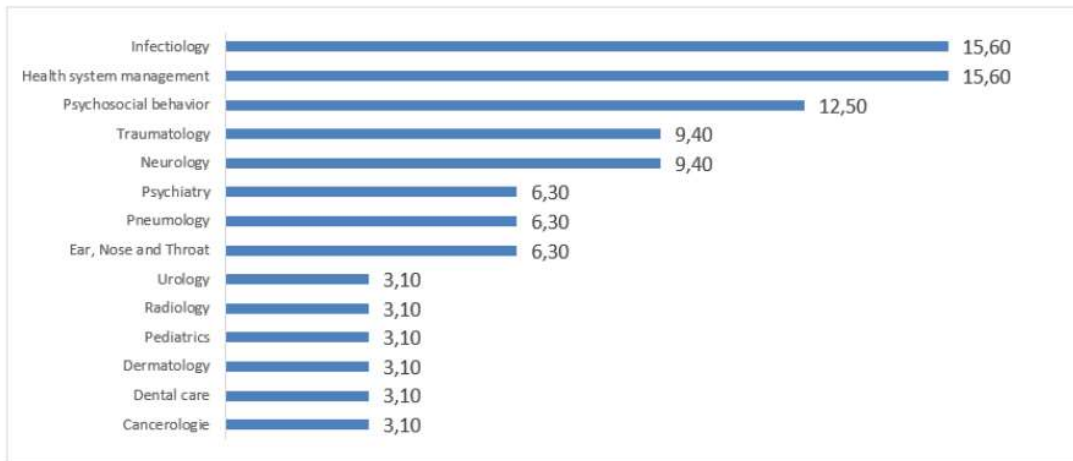
B: Publication in AI & ML in healthcare according to the specialty

C: Machine learning's algorithms used in healthcare

Figure 2: main AI's methods used in healthcare, and main areas of healthcare where AI is applicable

4 DISCUSSION

Our analysis of the literature revealed that AI is a rapidly expanding topic that inspires scholars to investigate it. The percentage of publications that are credited to the African continent, however, is small. Our research indicates that major disease fields that employ AI methods include infectious diseases, cancer, neurology, cardiology, and diabetes. (2018) Sivakumaran A common application of AI is prediction. It can be used to forecast a population's risk of developing certain diseases or accidents (Potash et al. 2020) (Reddy, Fox, and Purohit 2019), as well as the general public's opinion of an event (Eder et al. 2021). It is also used to forecast the cost of a health service, the requirement for equipment, and the risk in a hospital context (Spangler et al. 2019; Chen et Decary 2020). (Muremyi et al. 2020).

AI techniques are frequently employed in both disease diagnosis and treatment. While some of these studies also use other forms of pictures, such retinal scanning13 or genomic-based precision medicine, many of them are based on radiological image analysis. 14 (Chen et Decary 2020). (Chen et Decary 2020).

AI techniques may also be able to assist with more individualized therapy choices. Research demonstrated how an AI-based decision support could suggest alternative treatments and modify treatment regimens anytime new information was obtained 32. (Reddy, Fox, et Purohit 2019). The accuracy of the clinical diagnosis, as well as the uncertainty of paramedical diagnoses based on ultrasonography, tom densitometry, anatomopathological, or other investigations, are some of the obstacles that the individualized treatment encounters. Individual medical plans will be achievable thanks to the development of AI techniques to examine these various informations (L.-R. Li et al. 2020). Xie (Xie et al. 2020) has shown in his paper that deep learning is an effective, and least expensive as human in detecting diabetic retinopathy from fundus photographs.

AI has been proven to be an effective method for automating, improving, and supporting healthcare administration. By automating repetitive tasks, it contributes to lowering the administrative requirements 24 (Reddy, Fox, et al. 2019). Also, it can facilitate appointment scheduling, allowing for the better handling of urgent situations and the reduction of waiting times (Reddy, Fox, et al. 2019, Purohit) (Chong et al. 2020). By foreseeing length of stay and inpatient expenses, it can be utilised to enhance hospital management (Karnuta et al. 2020).

Robots have the potential to be used in the Covid 19 age to perform tasks including disinfection, medication and food delivery, vital sign monitoring, and border control assistance, all of which would increase the effectiveness of public health services (Yang et al. 2020). There is little doubt that AI will significantly alter the healthcare industry. Nonetheless, there has been much discussion about the ethical issues in the past (Noorbakhsh-Sabet et al. 2019). The issues that need to be brought up with regard to bias translation, interoperability, bias validation, security, and patient privacy protections (Safdar, Banja, et Meltzer 2020)

Algorithmic bias may exist in AI systems used in healthcare (T. Davenport et Kalakota 2019). when the variables in the prediction models selected by the designers and the biases in the training data. Hence, the algorithm has a tendency to repeat or perhaps strengthen these biases. (State 2018) (Keith J. Dreyer and T. H. Davenport 2018) (T. Davenport et al. 2019, Kalakota). Because of this, using those systems to make healthcare decisions raises issues with accountability for those judgements as well as with errors in patient diagnosis and treatment (T. Davenport et Kalakota 2019). Intelligent systems are like a "black box," incapable of explaining their choices. (State 2018)

The doctor-patient relationship can be altered in other ways. For instance, the elderly's assistant robot, which mimics and converses with people, raises several ethical issues, particularly those pertaining to the protection of private life and personal data (inserm 2018). Also, patients are more trusting of information they receive from a human than they are from an intelligent technology. 2019 (T. Davenport et Kalakota)

5 CHALLENGES AND CONCLUSION

It is irrelevant to debate the advancement and value of technology. The biggest obstacle is making sure they are used in routine clinical practice. To accomplish this, these systems must be connected with patient data into electronic health records (EHR) (T. Davenport et Kalakota, 2019). (Ahmed et al. 2020).

Additionally, scientists and researchers from a variety of disciplines, including biomedical science, psychology, ethics, economics, law, and policy, should be involved in the development of AI systems to establish protocols for monitoring technological advancements, define norms, and identify acceptable and safe behaviour for AI used in the healthcare domain. This will help to ensure that the impact of AI in the future will be more positive than negative. 2019 (Keskinbora) (Francesca 2016)

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