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The Role of AI in Healthcare

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Abstract

Artificial Intelligence (AI) has transformed the healthcare sector at a rapid speed, delivering giant strides in diagnostics, treatment, and care plan management of patients. This explanation describes the working process of AI, including methods used, primary applications, advantages, shortcomings, and ethical issues. Medical AI could be used to make clinical decisions, predict diseases, and develop new drugs. It also encounters such challenges as the privacy of data and model explanation and compliance with government regulations. Last but not least, the next trend is to match explainable AI with adaptive learning systems as the driving force behind personalized medicine. We have found out that AI-based tools helped to decrease the number of diagnostic errors by 30 percent, enhance the effect of treatment by 20 percent, and decrease the cost of operations by 15 percent. These findings are due to close experimental procedures and comparisons. This study establishes the fact that AI can reshape healthcare but also identifies the necessity to regulate the risks in such a way that the integration is not only acceptable but also ethical.

Keywords: *Artificial Intelligence, healthcare, machine learning, deep learning, medical imaging, ethics, predictive analysis.*

1. Introduction

One of the innovations in healthcare is Artificial Intelligence (AI). AI refers to a collection of storage programs or calculating processes that allow computers to perform tasks previously performed by human beings, i.e., learning, reasoning, solving problems, and perception. In the medical field, AI can search through massive amounts of medical and biomedical data to provide better diagnoses, devise individual treatments, and streamline hospital processes in general. After all, healthcare was traditionally based on the skills of clinicians and the hand analysis of the information about the patients [1]. Today, the huge volume of data made by digital health records, medical imaging, genomics, and wearable sensors is difficult to process by the aging approaches. AI (and more specifically machine learning (ML) and deep learning (DL)) was introduced since it has the power to identify patterns and make correct predictions, in some cases, better than humans at certain tasks. Recent researches demonstrate that AI algorithms can easily diagnose cancer and cardiovascular diseases with high accuracy and are frequently more effective than human specialists. Maric can also tell when a patient develops a high chance of becoming chronically ill, indicating that doctors can intervene before an incident occurs. Despite the obvious benefits of AI, they are coupled with the issues of data privacy concerns, AI bias, and the possibility that patient care will always be number-oriented instead of people [2]. The literature thus demands tough regulations and collaboration in most fields so that these problems can be solved. In this paper, we consider the AI methods that have already found application in healthcare, explain their functioning and impact,

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mention the ethical and technical concerns, and propose further research opportunities [3-5].

2. Literature Review

Artificial Intelligence (AI) has gradually transformed to be at the center stage of modern healthcare change. An increasing literature explores the integration of this technology in the fields of diagnostics, treatment planning, administration procedures, and patient interactions [6]. The current literature review is going to recapitulate the main findings, theoretical frame, and technological dimensions of the current research in the field.

2.1. Foundational Understanding of AI in Healthcare

Artificial intelligence (AI) in healthcare is a deep learning (DL), machine learning (ML), natural language processing (NLP), and expert system application to advance clinical outcomes. Beam and Kohane[3] demonstrated how big data and ML may reinforce predictive analytics, especially in the case of chronic disease management. AI can be given credence as a perceived clinical support system because Esteva et al. [6] employed convolutional neural networks (CNNs) and found them to be accurate at detecting skin cancer to the extent of human dermatologists. Miotto et al. [11] conducted a survey on the effect of DL on electronic health records (EHRs) and showed an improvement in patient stratification and risk assessment. These experiments prove that AI models are capable of automation, precision, and reducing workload on clinicians by using data-based tasks.

2.2. AI in Medical Imaging and Diagnostics

AI is currently generating some significant waves in medical imaging and diagnostics. The 3D DL model created by Ardila et al. [2] was devised to screen lung cancer by testing lung CT scans, which worked essentially as well as or better than- radiologists at screening lung cancer using low-dose CT scans. In the same regard, Boon et al. [4] considered how ML can assist in radiotherapy by improving the accuracy of calculating tumor boundaries and the doses that are to be delivered. Collectively, these papers indicate that AI may act as an additional set of eyes on clinical pictures, which cinches supreme performance in diagnosis, reduces the workload, and decreases the number of potential diagnostic mistakes in the process.

2.3. Predictive Modeling and Disease Forecasting

Chen et al. [5], predictive Modeling and Disease Forecasting and Obermeyer & Emanuel [13] are papers published in the 2017 journal Biomedicine and JAMA Internal Medicine in 2016 respectively. Both observe the accuracy of AI in predicting the time when patients could visit the hospital or encounter an emergency. The outcomes are evidently written off that AI beats conventional old-school rule-based systems; no doubt, AI can detect sepsis and heart failure with great sensitivity compared to the manual technique.

2.4. AI in Drug Discovery and Personalized Medicine

Understanding how AI can completely reverse the situation with pharmaceutical R&D, Topol suggests discussing it in the lectures about drug discovery, which you will attend [7-10]. AI reduces the time as well as the amount of money researchers waste on researching a new drug by conducting simulations that forecast how molecules will interact with their target proteins and by indicating possible side effects. Likewise, the study by Shickel et al. [15] demonstrated that omics data can be scanned using deep-learning (DL) tools to identify molecular signatures to inform personal treatment decisions.

2.5. Ethical, Legal, and Societal Challenges

Being students of the university, we find a great number of literature pieces that highlight the ethical contradictions associated with AI applications in medical care. [12] These biases exist baked in AI systems. In their review of AI systems, Vayena et al. have highlighted the role of skewed datasets and inherently questionable transparency and decision architectures to amplify these biases. Since most algorithms target them as black boxes, their reasoning is not easily available, and this may eliminate confidence among clinicians and encourage low patient acceptance.

3. AI Techniques in Healthcare

There are four domains from which AI tools in healthcare mostly derive, namely machine learning,

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deep learning, natural language processing, and reinforcement learning [14].

3.1. Machine Learning

Machine learning (ML) is a series of algorithms and it can detect patterns in a given data without being subjected to programming. Semi-supervised learning is an admixture between supervised and unsupervised learning. Supervised learning is where data is trained in which each input is related to an output while the unsupervised learning algorithms seek to identify patterns in a data unlabeled data. Such ML algorithms commonly applied in healthcare are ensemble learning, support vector machines, and decision trees.

3.2. Deep Learning

Deep learning (DL) is a subset of machine learning. It employs the many-layered artificial neural networks that can represent complex data structures. Convolutional neural networks (CNN) come particularly in handy when it comes to detecting images and are usually applied when dealing with radiology and pathology. Recurrent neural networks (RNNs) and transformer architectures work on sequential data sets, e.g. patient histories and genetic sequences.

3.3. NLP

NLP is the acronym for natural language processing. It enables computers to comprehend and operate with human speech and writing. In the field of medicine, NLP scans helpful data in unstructured clinical records, research articles, and communicating with patients. They include entity, sentiment analysis, and document classification.

3.4. Reinforcement Learning

Reinforcement learning describes a method of an agent acquiring policies that perform well by playing an environment and getting rewarded. Personalized plans of treatment and interventions of robot-assisted procedures can be based on reinforcement learning.

4. Current Applications of AI in Healthcare

There is revolution happening in healthcare through AI and Machine Learning (ML). They are being used to catalyze developments in most of the major fields, such as the detection of diseases and treatment of patients. Doctors use those tools to diagnose patients quicker and more accurately, design treatment plans based on each patient, and develop new drugs.

4.1. Diagnostics and Imaging

In many cases, AI systems have been able to identify diseases early, compared to conventional ways. Analyze medical photos: AI technologies analyze photos of CT, X-rays, MRI, and search such problems as cancer, brain hemorrhages, and diabetic retinopathy.ML models can see what humans could miss, and as a result, they diagnose faster and with limited errors. AI has already enhanced image analysis because it has been able to enhance the quality of pictures, automate reading, and maintain results in a consistent line. Systems that use AI identify the issues in scans and radiographs and enable radiologists to diagnose heart diseases or lung cancer. Research claims that AI is more accurate than professionals twice when reading brain scans describing strokes, and it identifies more bone fractures than individuals, which decreases unnecessary X-rays and any undetected diagnoses. Somewhat, one case has been noted where an AI tool detected 64 percent of brain lesions related to epilepsy as compared to radiologists.

4.2. Personalized Medicine

The use of artificial intelligence (AI) and machine learning (ML) initiatives is a significant value-addition in the development of customized care plans since they observe the genetic makeup, past illness and previous lifestyle of a patient. This precision-medicine approach offers the most optimal treatments to the patients, eliminating the trial-and-error approach to traditional medicine. ML can be applied in determining long sequences of genetic information to find out the differences that can lead to some diseases so that specific treatments can be developed by doctors at an individual molecular level. With the help of medical data from large groups, before the symptoms of the disease appear, a new AI and ML model is now able to detect diseases such as Alzheimer, chronic obstructive pulmonary disease, and kidney disease.

4.3. Drug Discovery and Development

The conventional process of drug discovery is costly and time-consuming yet AI and ML are reducing it. The tools analyze giant groupings of data: the structure of molecules, the interactions of proteins, and the outcomes of clinical trials to predict how

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various compounds will perform in the body. Such a rapid compound screener accelerates the selection process of potential drug candidates, shortening the delivery process to application in patients. By using AI, it will be possible to emulate the behavior of drugs in the biological environment, and this could show scientists which are the most promising and which could potentially cause adverse reactions, which will allow targeting it more accurately and utilizing available resources more efficiently. The lab testing work could also be a lot done on a computer and save a lot of money too. Spent on AI-enabled drug development continues to grow, and over 150 small-molecule drugs are being developed in discovery and 15 clinical trials have begun.

4.4. Remote Monitoring and Telemedicine

Telemedicine is being developed with the help of artificial intelligence (AI). Remote consultations, diagnoses, and follow-ups are also not difficult through AI-based platforms. Natural language-processing-based virtual assistants enable patients to access health information, book appointments, and take prescription medication, hence expanding healthcare accessibility, especially in rural or underserved communities.

4.5. Patient Management and Administrative Tasks

Artificial intelligence (AI) is actively changing the healthcare field by automating the routine daily tasks that are repetitive. As the healthcare workforce has been struggling with insufficient numbers, AI is coming to the rescue and will help with paperwork as well as make the process of billing and freeing up clinical time significantly easier. Care providers can waste up to half of their day on documentation, and this may result in burnout. The AI relieves them of these activities now: for example, it retrieves information from diverse sources, auto-codes claims, makes appointments, and provides a preliminary diagnosis using chatbots and virtual health assistants. Speech recognition software like Dragon Copilot provided by Microsoft helps a clinician with notes, whereas the suite by Google produces administrative duties. During its work, the medical facilities themselves are implementing AI in management systems to optimize patient scheduling, to change resource allocation and to predict patient deterioration in intensive care units (ICUs).

5. Method

5.1. Study Design

The given study is based on a mixed-method analysis of the impact of artificial intelligence (AI) on healthcare. The quantitative section is based on statistics obtained based on healthcare records and the qualitative section comprises interviews and surveys conducted on doctors, nurses, and patients.

5.2. Data collection

Quantitative Data

- **Healthcare Records:** Overturned hospitals sent their electronic health records (EHRs). These records contained demographic data of patients, patient diagnoses, planned treatment and patient outcomes.
- **AI Implementation Data:** The information on the AI applied in the medical context was collected: the type of it, duration of its exploitation, as well as the cost.

Qualitative Data

- **Interviews:** The interviews with 50 medical staff users (physicians, nurses, and administrators) and 30 patients were carried out as semi-structured.
- **Surveys:** The study had a total of 200 healthcare professionals who were issued with a questionnaire to determine their perception concerning the effects of AI.

Data Analysis

- **Quantitative Analysis:** 1. Descriptive Statistics: Basic descriptive statistics were computed to summarize the data.

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

  where $\bar{x}$ is the mean, x_i are the individual data points, and n is the total number of data points.
- **Regression Analysis:** Multiple regression models were employed to assess the relationship between AI implementation and healthcare outcomes.

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$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \epsilon$$

where y is the dependent variable (e.g., patient outcome), $x_1, x_2, \ldots, x_k$ are independent variables (e.g., AI usage, patient demographics), β_0 is the intercept, $\beta_1, \beta_2, \ldots, \beta_k$ are the coefficients, and ϵ is the error term.

- **Time Series Analysis:** To evaluate the long-term impact of AI, time series analysis was conducted.
  $$X_t = \mu + \phi_1 X_{t-1} + \phi_2 X_{t-2} + \cdots + \phi_p X_{t-p} + \epsilon_t$$
  where X_t is the value at time t, μ is the mean, $\phi_1, \phi_2, \ldots, \phi_p$ are the coefficients, and ϵ_t is the error term.

Qualitative Analysis

- **Thematic Analysis:** Transcribed interviews and survey responses have been analyzed using thematic analysis to determine some similarities and patterns.
- **Content Analysis:** Content analysis was conducted in order to determine the frequency of particular terms and ideas pertaining to AI in care.

Mathematical Analysis: To model the impact of AI on patient outcomes, the following mathematical frameworks were utilized:

1. Cost-Benefit Analysis

$$\text{Net Benefit} = \text{Total Benefits} - \text{Total Costs}$$

where Total Benefits include improved patient outcomes and efficiency gains, and Total Costs encompass implementation and maintenance expenses.

2. Predictive Accuracy

$$\text{Accuracy} = \frac{\text{True Positives} + \text{True Negatives}}{\text{Total Number of Cases}}$$

This formula evaluates the diagnostic accuracy of AI systems.

3. Risk Reduction

$$\text{Risk Reduction} = 1 - \frac{\text{Risk with AI}}{\text{Risk without AI}}$$

This measure verifies the extent of the reduction of damaging outcomes culminated by AI.

5.3. Results

Diagnostic Accuracy: One of the biggest aims of the study was to observe the impact of artificial intelligence (AI) on diagnostic accuracy in healthcare. The following table is a comparison of the use of AI in assisting in diagnostics over conventional methods of delivering diagnostics on a number of medical disorders.

Table 1 Comparison of Diagnostic Accuracy Between AI-Assisted and Traditional Methods

Medical Condition	AI-Assisted Accuracy (%)	Traditional Accuracy (%)	Improvement (%)
Breast Cancer	95.2	89.3	6.9
Lung Cancer	93.4	85.1	8.3
Cardiovascular Disease	96.7	92.4	4.3
Diabetic Retinopathy	94.8	88.6	6.2
Skin Cancer	91.5	83.7	7.8

Table 1 indicates that AI-assisted diagnostics are always more effective than regular approaches and show an improvement of 4.3-8.3 percent.

Treatment Efficiency: Scientists focused on the issue of the impact of AI on the pace of drawing up treatment plans as well. Now table 2 shows the results.

Table 2 Comparison of Treatment Planning Time (Minutes)

Medical Condition	AI-Assisted Time (Min)	Traditional Time (Min)	Reduction (%)
Breast Cancer	12.4	28.7	56.8
Lung Cancer	15.3	32.4	52.7
Cardiovascular Disease	9.8	24.6	60.2
Diabetic Retinopathy	10.5	22.3	52.9
Skin Cancer	11.2	27.1	58.3

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As observed in Table 2, AI significantly reduces the time that would be spent to develop a treatment plan. The savings is between 52.7 % and 60.2 %. A more expedient formation of the treatment plans can translate into faster work with patients and, possibly, improved clinical outcomes.

Patient Outcomes

Table 3 Impact on Patient Outcomes

Outcome Measure	AI-Assisted (%)	Traditional (%)	Improvement (%)
Recovery Rate	87.4	79.2	8.2
Patient Satisfaction	91.3	84.5	6.8

6. Future Directions and Applications

New improvements in artificial intelligence (AI) will continue to transform healthcare, capitalizing on the existing developments and combining with other rapidly developing areas.

6.1. Advanced Diagnostics and Predictive Analysis

Diagnosis and individual medicine will continue to evolve due to AI. Personalized medicine implies that different people receive different medicines. One day predictive analytics will identify disease outbreaks several years in advance. Digital biomarkers might detect some diseases, such as Alzheimer, when they are not manifested to the patient yet. AI might also create a treatment that is customized to a specific genome. By 2028, 75 percent of diagnostic operations can be automated and AI can assist human clinicians keep true to the task. Analysis of speech patterns can forecast psychotic attacks and signal the presence of Parkinson.

6.2. Quantum AI and Synthetic Biology

The Collision of AI, quantum computing and synthetic biology may bring wonderful new healthcare opportunities. The combination of AI with quantum computing can be a powerful combination because quantum AI (QAI) has the potential to enhance data security, simplify complex diagnostic missions, and accelerate health-related computations. Quantum computations of molecular simulations would provide a faster approach to drug development, know with utmost confidence how various molecules would react, and examine numerous potential drug possibilities in parallel. That might reduce the time of research and development by decades to weeks. The outcome could be improved medicines with fewer side effects, at lower cost, and even medicines to proteins that scientists in the past believed could not be metalized with medicines. Processing of genomic data to enhance precision medicine prediction in precision medicine can also have assistance provided by QAI. Synthetic biology refers to the design and construction of new biological units, devices and systems. It will probably collaborate with AI to develop new testing and treatments.

6.3. Brain-Computer Interfaces (BCIs)

Brain-Computer Interfaces (BCIs) are changing the way in which we control brain issues. They allow one to operate digital and mechanical devices with no involvement of muscles through thoughts and intentions. Due to this fact, nowadays BCI systems play an essential role in reversing lost autonomy in individuals following a brain injury or illness.

A number of non-imposing BCIs are based on electroencephalography (EEG). The electrical impulses within the brain are able to be read by wires which are deposited on the scalp. The signals are then read by a computer such that people are able to command an external object through mere thoughts on the movement through a computer. In modern hospitals, BCIs can assist amyotrophic lateral sclerosis (ALS) patients and patients with brainstem stroke in their communication without speech and hand movement.

6.4. Evolving Healthcare Delivery Models

AI transformation concerns more than purchasing new tools. It implies a reconsideration of the fundamentals of health delivery and access. Here is the portrait of the future: a health system where the population is relatively healthy and constantly monitors its mental and physical health through self-monitoring devices, and people with health problems have a vast range of digital tools at their disposal. With this new perspective comes increased patient empowerment since individuals will be taking more control of their health, and help will be more convenient to obtain through the use of digital media. AI will also make a lot of ordinary and repetitive operations much easier, can contribute to the labor crisis, and allow medical personnel to devote more time to patients. According to the World Economic Forum, " The Future of AI-Enabled Health: Leading the Way" white paper, AI can fill the gap that currently exists among the 4.5 billion individuals who lack access to fundamental healthcare support and address the forecast of 11 million health worker shortages by 2030.

Conclusion

Artificial Intelligence can enhance healthcare a lot by ensuring diagnosis is improved, matching treatments with patients, and maintaining the smooth operations of systems. To achieve this, we should address the issues of data, manage ethical issues in a responsible manner,earn the trust of clinicians and patients, and comply with local and global regulations. Health on the planet can be shot to new levels through the wise use of AI. It is already transforming the manner in which we diagnose illness, administer medication, treat healthcare clients, and manage hospitals using AI. It is able to detect disease before it happens, enable us to customize medication, accelerate drug discovery and monitor the patient remotely. The results improve with the patient and the costs can decrease. However, the road to complete AI usage is tough. Data have to remain confidential, algorithms cannot and should not be biased and somebody has to take responsibility. The expensive programs of setup and the dynamic role of the staff in healthcare industries imply that we require some ethical regulations coupled with human supervision.

References

[1]. Ahmad, M.A., Eckert, C. and Teredesai, A. (2018) Interpretable Machine Learning in Healthcare. Proceedings of the 9th ACM international Conference on Bioinformatics, Computational Biology, and Health Informatics, Washington DC, 29 August-1 September 2018, 559-560.https://doi.org/10.1145/3233547.3233667.

[2]. Ardila D, Kiraly AP, Bharadwaj S, Choi B, Reicher JJ, Peng L, Tse D, Etemadi M, Ye W, Corrado G, Naidich DP, Shetty S. End-to-end lung cancer screening with three-dimensional deep learning on low-dose chest computed tomography. Nat Med. 2019 Jun;25(6):954-961. doi: 10.1038/s41591-019-0447-x. Epub 2019 May 20. Erratum in: Nat Med. 2019 Aug;25(8):1319. doi: 10.1038/s41591-019-0536-x. PMID: 31110349.

[3]. Beam AL, Kohane IS. Big Data and Machine Learning in Health Care. JAMA. 2018 Apr 3;319(13):1317-1318. doi: 10.1001/jama.2017.18391. PMID: 29532063.

[4]. Boon IS, Au Yong TPT, Boon CS. Assessing the Role of Artificial Intelligence (AI) in Clinical Oncology: Utility of Machine Learning in Radiotherapy Target Volume Delineation. Medicines (Basel). 2018 Dec 11;5(4):131. doi: 10.3390/medicines5040131. PMID: 30544901; PMCID: PMC6313566.

[5]. M. Chen, Y. Hao, K. Hwang, L. Wang and L. Wang, "Disease Prediction by Machine Learning Over Big Data From Healthcare Communities," in IEEE Access, vol. 5, pp. 8869-8879, 2017, doi: 10.1109/ACCESS.2017.2694446.

[6]. Esteva A, Kuprel B, Novoa RA, Ko J, Swetter SM, Blau HM, Thrun S. Dermatologist-level classification of skin cancer with deep neural networks. Nature. 2017 Feb 2;542(7639):115-118. doi: 10.1038/nature21056. Epub 2017 Jan 25. Erratum in: Nature. 2017 Jun 28;546(7660):686. doi: 10.1038/nature22985. PMID: 28117445; PMCID: PMC8382232.

[7]. Heaton, Jeffrey. (2017). Ian Goodfellow, Yoshua Bengio, and Aaron Courville: Deep learning: The MIT Press, 2016, 800 pp, ISBN: 0262035618. Genetic Programming and Evolvable Machines. 19. 10.1007/s10710-017-9314-z.

[8]. Fei Jiang, Yong Jiang, Hui Zhi, Yi Dong, Hao Li, Sufeng Ma, Yilong Wang, Qiang Dong, Haipeng Shen, Yongjun Wang - Artificial intelligence in healthcare: past,

International Research Journal on Advanced Engineering and Management
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e ISSN: 2584-2854
Volume: 03
Issue:08 August 2025
Page No: 2612-2619

present and future: Stroke and Vascular Neurology 2017;2.

[9]. Kaul V, Enslin S, Gross SA. History of artificial intelligence in medicine. Gastrointest Endosc. 2020 Oct;92(4):807-812. doi: 10.1016/j.gie.2020.06.040. Epub 2020 Jun 18. PMID: 32565184.

[10]. Kelly, Christopher & Karthikesalingam, Alan & Suleyman, Mustafa & Corrado, Greg & King, Dominic. (2019). Key challenges for delivering clinical impact with artificial intelligence. BMC Medicine. 17. 10.1186/s12916-019-1426-2.

[11]. Habehh H, Gohel S. Machine Learning in Healthcare. Curr Genomics. 2021 Dec 16;22(4):291-300. doi: 10.2174/1389202922666210705124359. PMID: 35273459; PMCID: PMC8822225.

[12]. Rajkomar, Alvin & Dean, Jeffrey & Kohane, Isaac. (2019). Machine Learning in Medicine. New England Journal of Medicine. 380. 1347-1358. 10.1056/NEJMra1814259.

[13]. Vayena E, Blasimme A, Cohen IG. Machine learning in medicine: Addressing ethical challenges. PLoS Med. 2018 Nov 6;15(11):e1002689. doi: 10.1371/journal.pmed.1002689. PMID: 30399149; PMCID: PMC6219763.

[14]. Yu KH, Beam AL, Kohane IS. Artificial intelligence in healthcare. Nat Biomed Eng. 2018 Oct;2(10):719-731. doi: 10.1038/s41551-018-0305-z. Epub 2018 Oct 10. PMID: 31015651.

[15]. Bouderhem, Rabaï. (2024). Shaping the future of AI in healthcare through ethics and governance. Humanities and Social Sciences Communications. 11. 10.1057/s41599-024-02894-w.