



Advancing Healthcare and Food Security: The Role of Artificial Intelligence and ChatGPT in Cybersecurity, Poultry Science, and Sustainable Food Production

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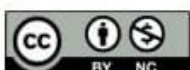
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ABSTRACT

Artificial intelligence (AI) is revolutionizing key industries, such as the healthcare, cyber security, poultry science, and food production. This review discusses how the innovations that are driven by AI converge across these areas with particular focus on their common challenges and synergies. Within a healthcare setting, AI is used to improve the diagnostic test, clinical decision-making, and cybersecurity, whereas ChatGPT and natural language processing contribute to communication and research. Through AI, the field of poultry science and the production of food allows accuracy in farming, disease detection, supply chain optimization, and sustainability. Cross-domain integration highlights the importance of predictive analytics, data security, and ethical frameworks. Being able to tackle transparency, equity, and accountability challenges, AI is a gateway to resilient, efficient, and sustainable systems needed to support global health and food security.

INTRODUCTION

It is a history of unprecedented growth of artificial intelligence (AI) usage in various industries that the 21st century has brought and changed the usual workflow to become data-driven, predictive, and automated. Medicine, cybersecurity, and food production are some of the most vital fields where AI has the potential to be applied and could be of great benefit, with poultry science being the foremost [1]. All these sectors have been historically struggling with the problems of efficiency, safety, and sustainability, yet the implementation of AI technologies has allowed coming up with creative





solutions to facilitate performance improvement, minimize risks, and deliver a real-time-based actionable insight [2].

Within the healthcare sector, AI has transformed itself in the form of simple data processing software to advanced systems that can analyze the intricate medical data, detect patterns and aid in clinical decision making. Diagnostic, patient monitoring, and disease outbreak predictive models are now supported by machine learning algorithms, deep learning models, and natural language processing (NLP) systems. The growing use of digital documentation and interconnected health technology, though, has also brought with it considerable cyber threats, such as unauthorized access, data breaches, and ransom ware attacks [3]. In that regard, AI is not just a clinical improvement tool, but a vital tool to enhance healthcare cybersecurity. Through anomaly detection, predictive threat modeling and automated response systems, AI can proactively find weaknesses, secure sensitive patient data as well as provide integrity to digital healthcare infrastructure [4].

The agricultural and food production industries are already undergoing a revolution by AI. Poultry science, which is one of the pillars of the food security in the world, has also been utilizing AI to take advantage of it in precision farming, disease forecasting, genetic selection, and environmental monitoring. Smart sensors and predictive algorithms could be used to allow farmers to trace their growth patterns, detect disease outbreaks at an earlier stage, and simplify their feeding programs, which makes their animals more productive and healthier [5]. On top of poultry, AI enables efficient food production, quality control and supply chain optimization. Predictive analytics can minimize food waste, track storage conditions, and adhere to food safety requirements to build a more sustainable, resilient food ecosystem [6].

One such most significant piece of AI-generated communication is the creation of ChatGPT and other large language models. Such systems are able to process, produce, and summarize textual information of complex nature and are useful in healthcare, research and agricultural advisory. ChatGPT may be useful in healthcare to help medical professionals synthesize patient information, write reports and deliver evidence-based guidance [7]. Equivalent NLP-based systems may provide advice in food production on best practice, risk control, optimization of operations to close the knowledge gap and improve decision-making in large scale.

The convergence of these domains—healthcare, cybersecurity, poultry science, and food production—highlights the multifaceted potential of AI. Although both areas have been regarded as separate disciplines, their amalgamation reveals a common dependence on data-driven knowledge, predictive analysis, and real-time surveillance. In addition, these crossroads present some critical ethical and regulatory, as well as operational concerns [8]. Such problems as the privacy of data, the





biases in the algorithms, and the accessibility of the most current technology, need to be addressed with care so that AI solutions would be not only fair but efficient [9].

This review will seek to examine these converging frontiers to offer a thorough analysis of AI use in healthcare cybersecurity, ChatGPT-enabling intervention, and AI-controlled poultry and food production systems. Integrating existing knowledge, technological discoveries and real-life examples, this article attempts to uncover the avenues by which AI could not only keep interconnected industries safe, efficient, and sustainable. The knowledge of these convergences is needed to build a future in which AI can not only contribute to the development of technology but also resilient, secure, and sustainable systems of human and environmental well-being [10].

AI-DRIVEN INNOVATIONS IN HEALTHCARE SECURITY

The medical field has received an unparalleled number of positive outcomes through the digital revolution of healthcare, which includes electronic health records (EHRs) or telemedicine and AI-based diagnostics. It has, however, also subjected the industry to a more than ever diverse range of cybersecurity risks [11]. Hospitals, clinics, and research centers are becoming more interdependent with each other, possessing large volumes of sensitive patient information that are the great attractors of cybercriminals. Incidences of breaches will lead to financial losses, reputation, and above all compromise patient safety. Here, artificial intelligence (AI) has come into play as one of the most critical tools to improve healthcare cybersecurity in the form of predictive, adaptive, and real-time solutions that surpass conventional defense systems [12].

The issue of cybersecurity in healthcare is multi-faceted. The vulnerability of healthcare infrastructure in ransom ware, phishing, and unauthorized access is caused by the complexity of the hospital networks, integration of Internet of Medical Things (IoMT) devices, and the popularity of cloud-based services [13]. Conventional security providers like firewalls and antivirus programs tend to be reactive, using known signature threats and involving human intervention. AI, on the contrary, makes proactive and predictive security possible. Machine learning software can be used to study traffic on the network, identify patterns that are considered anomalies, and forecast potential breaches before they can happen. To illustrate, the unsupervised learning methods could be used to detect irregular access to patient's records or abnormal data transmission patterns that could signal a cyber-attack in the process [14].



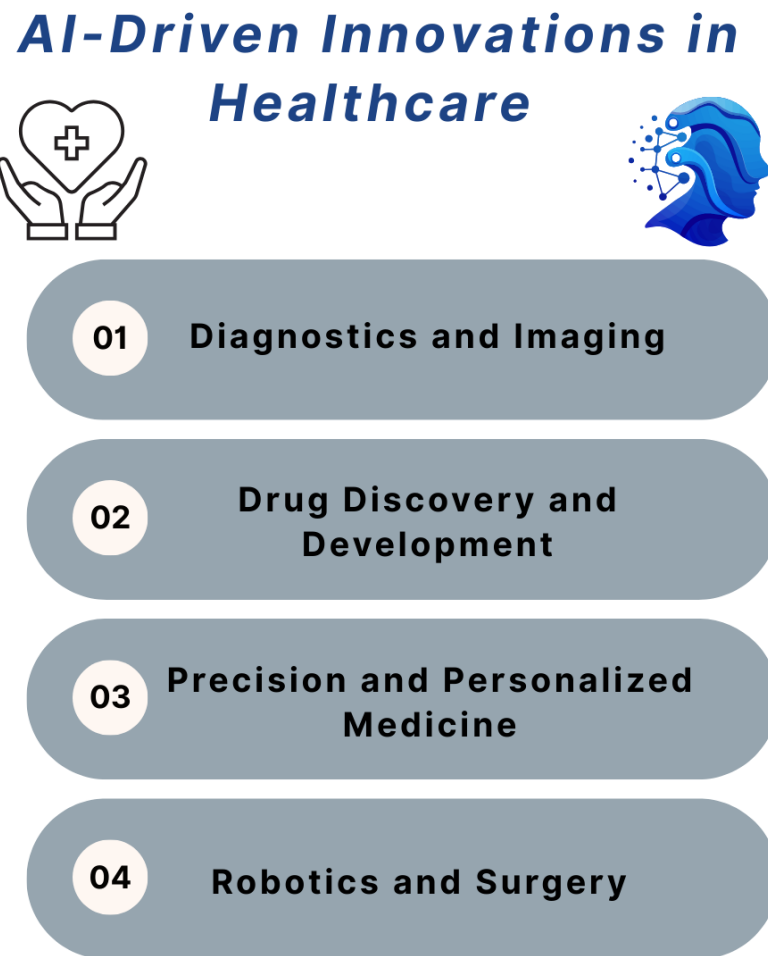


Figure: 1 showing AI driven innovations in healthcare

Deep learning models also increase cybersecurity because they detect subtle correlations between very large and intricate data sets. As an example, AI-based systems can track IoMT devices, including smart insulin pumps, pacemakers, or patient monitoring sensors, when they abnormally behave, indicating they may have been tampered with or have failed [15]. This is an ongoing and live-time approach, which is essential in a healthcare facility where a small security breach can prove to be a disaster. In addition, AI can be used to carry out threat reactions, i.e., isolate affected devices, notify security staff, or instigate defenses, thereby minimizing response time and reducing the possible harm [16].

AI is also applicable in ensuring that sensitive data in an electronic health record adheres to protection measures. Anomaly detection models/natural language processing (NLP) can identify attempts to gain unauthorized access to or abnormal patterns of modifications of patient records. In addition to reactive monitoring, it is possible to develop predictive models to analyze possible vulnerabilities within hospital networks and prioritize them by their risks and propose remedies [17]. This type of strategic



foresight enables healthcare organizations to prioritize resource allocation and the proactive enhancement of their cybersecurity stance.

Fraud detection is another important field of AI use in healthcare security. Medical billing fraud, insurance fraud, and identity theft issues are major problems that affect both medical practitioners and the patients. Machine learning models have the ability to process billing information and identify any irregularities and potentially fraudulent claims on-the-fly. This is the process that AI automatizes and enhances efficiency as well as minimizes financial losses or administrative burdens [18]. As much as these developments have been made, AI use in healthcare cybersecurity has not been without issues. HIPAA and GDPR are data privacy laws that restrict the use of patient data and thus AI systems have to be handled carefully to avoid violations. The fact that AI-generated security alerts should be understandable and explainable is also essential since healthcare professionals should be able to trust the system and trust the results obtained by AI [19]. Moreover, the so-called adversarial attacks on AI models, like the data poisoning or evasion attacks, are new threats that need constant inventions and monitoring.

Computational methods like mesh optimization in fluid mechanics which are commonly available in packages like OpenFOAM can be applied to healthcare to simulate blood flow in arteries, airflow in the lungs and drug movement in the human body with AI increasingly predicted and customized to patient-specific data [20]. The design of control systems such as the ones used in ball and beam balancing systems, offer a baseline to AI-controlled surgical robots and rehabilitation systems, which are necessary to ensure accuracy, stability, and flexibility during interaction with the patient [21]. Correspondingly, the exploration of elementary vibrations is related directly to the biomedical signal analysis where AI can read subtle changes in ECG, EEG, and other indicators of diagnosis, which will allow identifying cardiac and neurological disorders at an earlier stage [22].

Reduction of high BODs during sewage treatment is a sign of wider optimization efforts that are shared by AI implementation in hospital wastewater treatment and biomedical waste management, making the healthcare processes even safer and more sustainable [23]. Moreover, the model of two-link planar anthropomorphic manipulators reflects the progress of robotic limbs and exoskeletons in the health care sector, where AI algorithms allow adaptive bipolar movement, patient-specific rehabilitation, and minimally invasive operations. Combined, all these engineering subjects explain how computational modeling, control systems, environmental optimization, vibration analysis, and robotics can be combined with AI to revolutionize contemporary approaches to healthcare [24].

The healthcare security brought about by AI is of healthcare security, replacing reactive defenses with proactive and predictive and automated healthcare security. With the use of machine, deep, and





anomaly learning, AI makes healthcare systems resistant to cyber-attacks, protects patient information, and provides continuity in operations [25]. With the growing integration of healthcare with IoT and cloud-computing technologies, the importance of AI in the area of cybersecurity will persistently grow and form an essential layer of the safe, efficient, and secure healthcare services [26].

CHATGPT AND NLP CLINICAL AND PUBLIC HEALTH DOMAINS

The emergence of natural language processing (NLP) and conversational artificial intelligence (AI), in particular, chatbots, like ChatGPT, has provided a new opportunity in the field of healthcare communication, research, and the management of public health. In contrast to the traditional software, these AI systems have the benefit of being able to comprehend, process, and create human-like texts, which means that they can help clinicians, researchers, and healthcare administrators with the tasks that involve the complex interpretation of the data and its communication [27]. ChatGPT and other NLP models can change the clinical workflow, patient interaction, and evidence-based clinical decision-making by turning unstructured medical data into actionable learnings.

ChatGPT can be used as a decision support tool in the clinical environment. The medical staff and doctors are usually overwhelmed with huge amounts of patient information, electronic healthcare records (EHRs), and ever-changing health-related information. ChatGPT may be helpful as it is able to synthesize patient histories, summarize diagnostic reports, and even give potential treatment options that are supported by the evidence provided by peer-reviewed literature [28]. As an example, it may be able to pull out useful information based on lab results, imaging reports, and clinical notes and arrange it in a systematic and easy-to-read format. This has the potential to slow down the cognitive load on the healthcare provider as well as improve clinical decision-making accuracy and efficiency [29].

Another highly essential area that ChatGPT is helpful is patient communication. The chat systems based on AI can offer real-time and personalized answers to patient requests, help book an appointment, and offer educational information on health-related topics and easy to understand language. Such systems can quickly share correct information, dispel misinformation, and direct people on what to expect during pandemics or other public health emergencies, preventive actions, and treatment choices. Notably, the tools work 24/7 which is significant because of the problem of scarce human resources and because they can provide assistance to patients at any time [30].

Outside of clinical care, ChatGPT and NLP models have become central in epidemiology and research of public health. The big data on health, social media pages, scholarly articles might include important information, yet it is challenging to process them manually. NLP can extract trends, disease patterns and sentiment of the people in these sources of information and provide timely information to





policymakers and health authorities [31]. As an example, AI-based textual and social data analysis can be particularly useful in the context of monitoring the spread of infectious diseases or predicting possible outbreaks. This has the ability to intervene in time and achieve better population health [32]. In addition, AI-based applications such as ChatGPT will support medical education and research, helping students and researchers conduct literature reviews and summarize complex topics and generate drafts of scientific reports. They are able to fill the gaps in knowledge, make reference, and assist in organizing complex clinical or laboratory results into logical stories [33]. Similar NLP systems have been applied in agricultural and food producing sectors, where scientific knowledge of poultry science, disease control and nutrition can be converted into practical advice to farmers, positively affecting productivity, and food safety through the food supply chain [34].

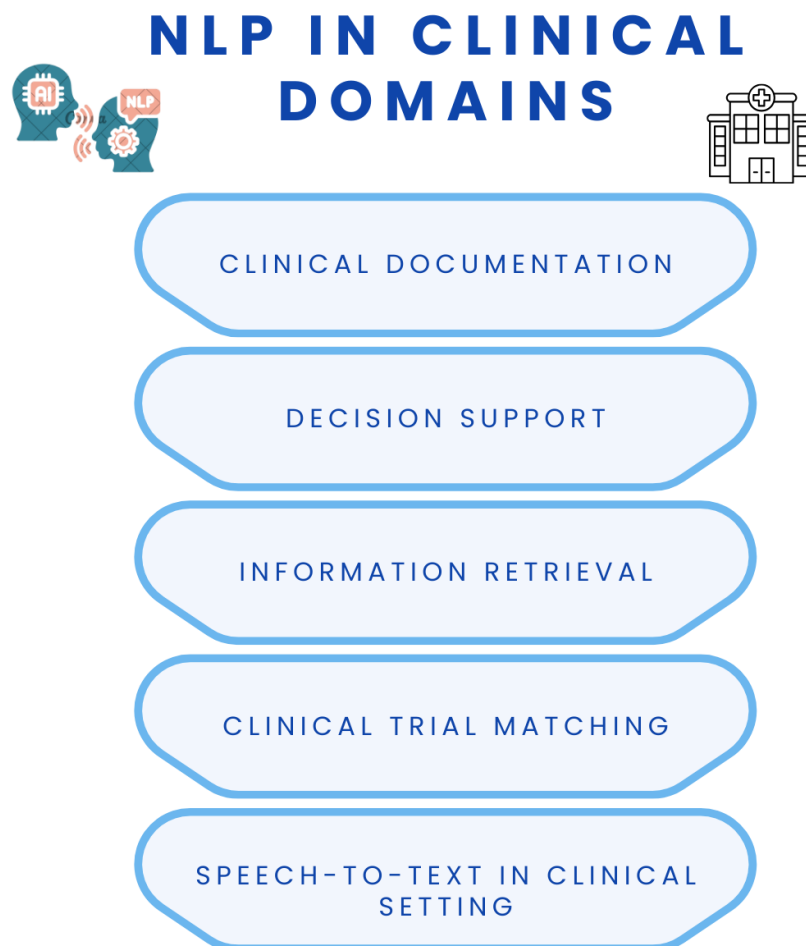


Figure: 2 showing NLP in clinical domains

There are significant challenges associated with the implementation of ChatGPT in healthcare and public health in spite of the transformative potential. The validity and reliability of AI-generated content should be carefully tested, because any mistakes or bias in the productions may be very harmful. Ethical issues, such as patient confidentiality, informed consent and adherence to law and



policies, such as the HIPAA, are of utmost importance [35]. Moreover, the models are quite dependent on quality and representativeness of training data and continuous updates, monitoring, and auditing are necessary to prevent the possibility of misinformation or unfair results [36].

The ChatGPT and NLP technologies are transforming the healthcare and general public health by providing solutions to data synthesis, communication with patients, research and education, and are scalable, intelligent, and context-aware. Being able to process unstructured written information, offer timely insights, and support evidence-based decision-making, they make them indispensable to the contemporary field of medicine [36]. These AI systems—when implemented through careful and ethically considerate methods—can promote clinical productivity, increase the responsiveness of healthcare to the general population, and make the healthcare environment more informed and resilient [37].

INTELLIGENT SYSTEMS IN POULTRY SCIENCE AND LIVESTOCK MANAGEMENT

Poultry science is of vital importance in food security in the world in that it offers affordable protein to billions of the world. The poultry industry is, however, afflicted with long term problems such as disease outbreaks, resource inefficiency, environmental issues and sustainable production systems. Conventional approaches to poultry management, though generally effective in limited situations, are becoming more and more ineffective to manage the size and challenges of contemporary systems of production [38]. Intelligent systems, in this regard, include artificial intelligence (AI) as a technology that has transformed poultry science and livestock management, which are now automated, precision-farmed, and predictive with intelligent systems [39].

Precision livestock farming (PLF) is one of the most important contributions of AI to the poultry science. Through intelligent sensors, cameras and real-time data analytics, AI systems are able to continuously monitor poultry environment. Temperature, humidity, feed intake, water intake, and behavior of the animal is monitored so that optimal living conditions are maintained [40]. This data is processed using machine learning algorithms to identify any variation in usual patterns, thus allowing farmers to initiate interventions in time. As an example, an abrupt alteration in feeding habits or locomotion may indicate the initial attack of a disease, and the problem can be treated and controlled in time before the outbreaks get out of control [41].

Another important sphere in which AI is having a significant influence is the disease management. Some of the diseases associated with poultry include avian influenza and Newcastle disease that can destroy the flocks and destabilize food supply chains. The use of imaging, audio and behavioral data helps to diagnose symptoms at the early stage using AI-driven diagnostic tools. As an illustration, AI-powered sound recognition devices can identify the presence of abnormal breathing or coughs in



chickens as an indicator of a respiratory disease [42]. Similarly, image recognition algorithms analyze physical symptoms such as changes in feather condition or posture. Such technologies are able to enhance the health and welfare of animals as well as minimize economic losses and dependence on broad-spectrum antibiotics [43].

Global Meat Production Distribution (2022)

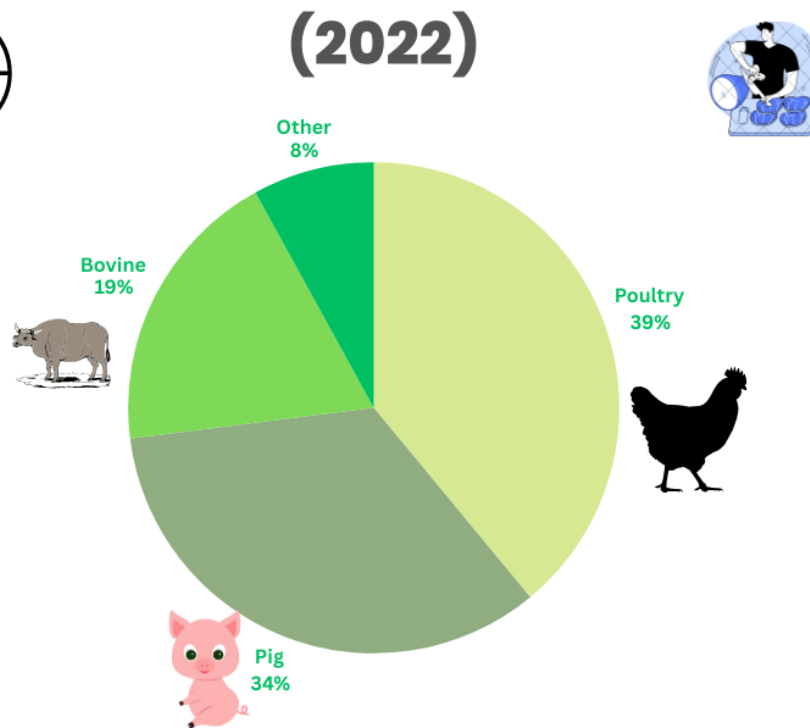


Figure: 3 showing global meat production distribution

Besides health surveillance, AI also optimizes the nutrition and feeding systems. Smart feeders incorporate AI and monitor feed consumption per bird and modify the rations according to the age, weight, and growth goals. Predictive models are designed in such a way that feed efficiency is maximized, minimizing wastes and low production cost [44]. These systems as well are conducive to sustainability because reduced nutrition decreases the environmental impact of poultry production since optimization of feeding minimizes the excessive release of nutrients into the environment that cause damage to the ecosystems [45].

Also AI is a contributor to genetic selection and to breeding programs. Complex algorithms are used to process large volumes of genetic data, growth rates, disease resistance and production outcomes in order to isolate better breeding lines. This speeds up the process of producing more resilient, more productive and sustainable breeds of the poultry [46]. Together with accuracy, AI-controlled breeding plans guarantee productivity of poultry and food security in the long run. The automation of large-scale poultry production is enhanced by AI, making the work of this industry more efficient. The AI-



enabled robotic systems have the ability to collect eggs, clean litter, and deliver feed to livestock, which will save labor expenses and boost farm biosecurity. Combining robotics and AI-driven monitoring will help the operations to be constant, effective, and with fewer chances of human error [47].

The future of animal management is being changed by intelligent systems and AI applications in the field of poultry science. AI helps to maximize food production, animal well-being, and sustainability by providing precision farming, early disease diagnostics, efficient feeding, and improved genetic selection. These innovations make sure that the production of poultry can satisfy the increasing demand of global protein requirement as well as counter resource efficiency and biosecurity challenges [48]. With the ongoing development of AI technologies, their application in poultry science has a promising future of data-based, more robust, and sustainable food systems.

AI-POWERED OPTIMIZATION IN FOOD PRODUCTION AND SUPPLY CHAINS

Food production and supply chains are complicated systems with a lot of stakeholders, including farmers and processors, distributors, and consumers. Demand in safe, nutritious and sustainable food is on the increase globally, yet the bottlenecks persist through climate variability, supply chain disruptors, food waste, and safety issues [49]. Artificial intelligence (AI) has become one of the trending tools that could enhance the operations of the whole food production and distribution chain. AI is a tool that can facilitate more efficiency, transparency, and resilience in food systems through predictive analytics, automation, and real-time monitoring [50].

Quality control and food safety assurance is one of the most noticeable AI uses in the field. Conventional food inspection procedures are manual and have human error. Imaging and imaging sensor technologies powered by AI can find contaminants, spoilage, and quality deviations in raw materials and processed food quickly [51]. As an example, machine vision algorithms can be applied to detect defects in poultry products, fruits and grains so that only high quality products are delivered to consumers. With machine learning, these systems can also determine the risk of microbial growth or chemical contamination and can be used to prevent foodborne diseases [52].

All these areas of research are united by the fact that they are driving more innovative drug delivery systems that enhance the stability, bioavailability and therapeutic efficacy of active compounds. Controlled release organogels, optimized by quality by design or used in oral preparations, have proven the sensitivity of the timing and dosage of drug release [53]. Phytosome systems provide emphasis on the potentials of bioactive compounds found in plants to improve absorption and use in cancer therapy [54]. Supersaturable self-microemulsifying drug delivery systems are also an example of how formulation science can address solubility issues in oral drug molecules such as itraconazole





[55]. At the same time, cubosomes are the state of the art in nanotechnology, which serves as a universal nanocarrier in focused and prolonged delivery in various therapeutic applications [56]. Collectively the practices represent a wider trend in pharmaceutical innovation, of customized, effective, and nanotechnology-based solutions to multifaceted health concerns [57].

Artificial intelligence also helps to increase the level of production and optimization of resources. Algorithms are able to utilize past and current data on crop production, feed intake, water usage, and energy demand to enhance allocation of resources. In livestock and poultry farming, as a case example, AI systems are used to optimize the ratio of the feed intake, decrease the waste, and decrease the environmental footprint of the farming activity [58]. AI-powered automation systems in food processing facilities automate routine functions by forecasting equipment maintenance requirements, minimize downtime and optimize throughput. Supply chain optimization is one more important contribution of AI. Pandemics, geopolitical conflicts, and climate-related events are subject to disruptions in food supply chains [59]. Based on AI algorithms, demand can be predicted, inventory is optimized, and transportation and storage is inefficient. To illustrate, machine learning models can accurately predict the trend in consumer demand, and therefore, assist distributors and retailers to match supply with demand with minimal leftovers and excess. Likewise, AI-based logistics platforms are used to optimize the transportation routes and schedules and minimize pricing and carbon emissions [60].

AI is also a central figure in minimizing food waste. In the world, an estimated one-third of all food generated goes to waste leading mainly to inefficiency in food handling, storage, and transportation. AI based monitoring devices are able to monitor the storage conditions like temperature and humidity, which guarantees maximum preservation of perishable goods. Predictive analytics allows to detect products on the verge of expiration and divert them to markets or donations, thus reducing the loss opportunities and enhancing food security [61]. AI fosters sustainability and consumer trust. Block chain combined with AI has made possible transparent supply chain tracking, which consumers can use to confirm the origin, safety and sustainability credentials of food products. This traceability does not only instill consumer confidence, but also assists in compliance with regulations and corporate responsibility in food industries [62].

AI-powered optimization in food production and supply chains offers innovative solutions to longstanding challenges of efficiency, safety, and sustainability. AI allows creating resiliency in food systems, which can support the nutritional needs of the increasing population of people all over the world, through smarter quality control, resource utilization, logistics, and waste management. Its adoption into the agricultural and food sectors is not solely the technological process but a move in a





very crucial direction in ensuring global food security [63].

CROSS-DOMAIN SYNERGIES: INTEGRATING AI ACROSS HEALTHCARE AND FOOD SYSTEMS

AI is no longer a concept that is limited to just one industry; the real power of the technology is its capacity to unite knowledge in various fields. Healthcare, cybersecurity, poultry science, and food production might seem to be separate spheres, yet they have such similar problems and issues as data management, risk prediction, sustainability, and resilience. The discussion of the cross-domain synergies points out the role of AI in developing integrated solutions that can respond to the interconnected issues and lead to the creation of innovations and efficiency in the human systems as well as the food systems [64].

Predictive analytics is one of the most obvious synergies. In the healthcare sector, AI forecasts disease outbreaks using data on patients and the environment. Likewise, in food systems and poultry production, predictive models observe disease threat, feed economy and production result. Integrating these strategies, AI can develop integrated One Health frameworks that monitor zoonotic diseases, which in many instances have livestock origins and can be transmitted to humans. Interconnected human and animal health surveillance systems early in the outbreak may be effective in preventing outbreaks, improving biosecurity, and protecting global health [65].

The other synergy is cybersecurity and data protection. Both healthcare and food production rely heavily on digital infrastructure and Internet of Things (IoT) devices. The hospitals are relying on the electronic health records, and modern farms and supply chains rely on the smart sensors and automated systems. These networks are at risk of cyberattacks that will interfere with patient safety or disorganize food supplies [66]. The model of the AI cybersecurity system can be developed to safeguard not only healthcare facilities but also farm activities, relying on anomaly detecting, foretelling threats, and automatic response to the threat. The joint reinvention on this front also enhances strength in areas that are crucial to life [67].

Sustainability and resource efficiency are also improved at the domains of AI. AI is useful in healthcare to streamline the hospital processes, lower energy usage, and refine resource allocation. In the food industry, AI guarantees that the feed, water, and energy are used optimally and hence less waste and environmental degradation. Through the use of generalized methodologies, e.g. machine learning models to predict resource optimization, the field of healthcare can assist in creating more holistic sustainability objectives, e.g. mitigate climate change, and manageable resource utilization [68]. Cross-sector AI-based communication systems such as ChatGPT have advantages. ChatGPT helps clinicians to make decisions in healthcare and enhance patient education. In the food systems





and agriculture, the same can be applied by providing real-time advice to farmers, processors, and distributors. The application of these NLP technologies in the sectors allows the flow of knowledge to occur more efficiently, closing gaps between scientific research, policy and on-the-ground applications [69].

AI in Food Systems



Agricultural Productivity

Food Safety & Quality Control

Supply Chain Optimization

Alternative Proteins & Food Innovation

Consumer Health & Nutrition

Figure: 4 showing AI role in food systems

These synergies emphasize the significance of ethical and regulatory frameworks that cross-sector. There has to be a consistent promotion of issues like data privacy, algorithm bias, fairness of access, and consistent response to the use of AI in patient care or food production. Sharing of governance can guarantee responsible innovation which is healthy to both human and food security. The combination of AI throughout healthcare and the food system highlights the potential of AI as a cohesive power [70]. AI enables resilience and efficiency in areas that are vital to human well-being through the integration of predictive analytics, cybersecurity, sustainability, and communication technologies. By adopting these synergies, we will be a step closer to the future where we no longer separate healthcare and food production as two silos, but rather we integrate them into the same mechanism striving to achieve global health and sustainability [71].





CHALLENGES, ETHICAL CONSIDERATIONS, AND FUTURE DIRECTIONS

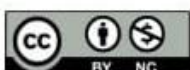
Artificial intelligence (AI) promises an amazing future in healthcare cybersecurity, ChatGPT-powered clinical support, and food production systems; however, its implementation in these areas is not significant and does not come without serious issues. A high level of ethical and technical impediments, regulatory ambiguities, etc. is something that is to be overcome in order to promote safe, fair, and sustainable adoption. Simultaneously, it is essential to determine the directions in the future to optimize the transformational AI potential in healthcare and food systems [72].

One of the major threats is information confidentiality. Both food and healthcare sectors are very dependent on sensitive information, patient medical records or production and supplies chain, etc. In the health sector, they may invade patient confidentiality and in the food sector, they may upset supply networks and consumer confidence [73]. AI models can be quite data-intensive, which leads to the issues of sharing data, data storage, and adherence to the regulations, including HIPAA and GDPR. Devoid of a strong level of safeguards, the extensive use of AI will only increase the level of vulnerabilities rather than address them [74].

The other urgent agenda is the topic of algorithmic bias and fairness. Historical data can be used to teach AI systems and thus, it can carry the inequalities that exist. Biased data in healthcare may contribute to the occurrence of inequity in diagnosis, treatment suggestions, or provision of resources among demographic groups. Biased models may prefer bigger farms or areas with more data in food production at the expense of smallholders and contribute to inequality. To deal with such biases, conscious actions are necessary to guarantee a variety of datasets, which are representative and clear processes of model development [75].

Transparency and explainability also are important hurdles. AI-driven recommendations are the ones that clinicians, farmers, and policymakers might be hesitant to implement because they do not comprehend the decision-making process. As an example, when an AI model raises a red flag on a potential cyber threat or the expected outbreak of a disease in poultry, users should have access to a reason why the model is prompting them to take action [76]. It is then important to develop explainable AI (XAI) tools that can give explicit rationales to build trust. Infrastructure and access problems exist. The modern AI systems demand high processing power and a fast internet connection and highly trained staff, which might not be possible in low- and middle-income areas. Unless access is equitable, AI has the potential to increase the digital divide, leaving the vulnerable populations behind in not only healthcare services but also food security [77].

Responsibility and accountability are also considered to be ethical. Should AI systems malfunction, e.g. by misdiagnosing a patient or failing to classify the risk of food safety, who is to be held





responsible? Developers, operators, or institutions? There must be clear directives on liability to avoid the misuse and to be ethically accountable. In the future, the future of AI infusion into healthcare and food systems lies in multi-pronged approaches. Jurisdictional structures that bring together technologists, medical providers, farmers, policymakers, and ethicists are required in order to coordinate AI development to meet practical demands [78]. Regulatory authorities need to revise systems in order to strike a balance between innovation and safety and ethics. Explainable and ethical AI research should be prioritized as an investment and infrastructure and access improvement in underserved areas should be pursued [79].

The future will be interdisciplinary. The cross-sector platforms developed based on AI can facilitate the timely identification of zoonotic diseases, safe digital systems, and eco-friendly production systems. These synergies echo the One health approach that acknowledges the fact that human health, animal health and environmental sustainability are interrelated. Although AI has the potential to transform the healthcare cybersecurity, clinical communication, and food production, it should be implemented with caution [80]. Critical aspects such as issues of data security, bias, transparency, accessibility, and accountability are to be addressed. Thoughtful policies and ethical standards will make sure that AI becomes a responsible partner, one that increases resilience, equity and sustainability in both the healthcare and food systems [81].

CONCLUSION

Artificial intelligence (AI) is no longer a new technology that is still in its experimental phase, it has become an inseparable element of modern society, which is changing the mode of functioning of industries and the way the global problems are solved. The exploration of AI across healthcare, cybersecurity, poultry science, and food production reveals both its transformative potential and the need for careful, ethical integration. This overview has pinpointed the role of AI systems, especially machine learning models, natural language processing applications such as ChatGPT, and intelligent automation systems in transforming two key industries the protection of human health and the guarantee of food security. When it comes to the final synthesis, one should contemplate the lessons that have been learned in general, what remains challenging, and what will bring a better future influenced by AI.

AI has a wide role in the medical field, including clinical decision support to cybersecurity. Telemedicine, connected devices, and electronic health records (EHRs) have become essential to hospitals and other medical facilities. Although these digital developments enhance efficiency, they also present cyber threats to healthcare systems, including ransom ware attacks and data breaches and malicious tampering. The role of AI in this case is two-fold prevention and protection. AI is more





resilient than the best cybersecurity systems through the detection of anomalies, predictive threat modeling, and automated responses.

Furthermore, within clinical care, ChatGPT and NLP systems provide new methods of unstructured medical data processing, synthesizing complex research results, and aiding patient-doctor communication. AI does not only empower the medical practice but it also improves the patient experience by decreasing the cognitive load on health providers and increasing the availability of information. Nevertheless, the matters of bias, transparency, and accountability should also be tackled so that AI could not make clinical workflows more complicated but complement them. Another AI application that is equally revolutionary is food production and livestock management. Poultry science, being one of the most rapidly developing industries in world agriculture, is struggling to satisfy the increased demand and sustainability as well as animal welfare. Smart technologies based on AI offer a solution in the forms of real-time monitoring, precision feeding, detection of diseases, and automated farm management. Such innovations minimize wastage, maximize use of resources and avoid disastrous outbreaks of diseases that endanger food.

Not only poultry, AI is applied to the whole food production/supply chain. AI optimizes efficiency and minimizes losses, whether it is automated quality control in the processing plants to predictive logistics and demand forecasts in the global distribution. Notably, one of the most urgent issues of the 21 st century, which AI solves, is food waste. AI also opens opportunities to more sustainable and fair food systems by observing storage environments, anticipating spoilage, and rerouting products that are nearing expiry. Among the greatest findings of this review is the fact that the healthcare and food systems are not two independent silos but are two closely related entities. The One Health approach highlights the fact that human health, animal health and environmental sustainability are reinforcing to each other. Zoonotic diseases such as avian influenza emerge from livestock populations but pose significant risks to human populations. By tracking the health data of both people and animals in real time, AI can be used as an integrated early warning system that will help to reduce the danger of pandemics.

On the same note, the two industries are largely dependent on digital infrastructure vulnerable to cyber-attacks. Similarly to hospitals that are vulnerable to electronic records systems, farms and food distribution networks of the current age are based on the IoT device as well as digital tracking, which can be targeted by cyber-attacks. The cross-domain implementation of AI-based cybersecurity solutions can guarantee that health and food systems can continue to stand and resist the increasing risks.

Although the AI promise is real, another major issue identified by this review is the need to address





major challenges. Privacy of data is of top priority, particularly in healthcare where confidential medical data has to be secured and in food supply chains where the transparency and consumer confidence largely rely on privacy of data. Discrimination in AI designs should also be handled cautiously to prevent the further increase of inequalities, be it health care inequalities or support to smallholder farmers. The other sensitive problem is transparency. The AI models should be explainable, so that the healthcare professionals, farmers, and policymakers can have the understanding of the ground of the recommendations. Unless it makes it interpretable, AI systems will not be trusted enough and adoption will be slowed down. Also important is accessibility, AI innovations should not be concentrated only in high-income areas and exclude low- and middle-income countries. Equity in AI implementation is a requirement to truly global health and food security results.

Going forward, interdisciplinary collaboration should inform the challenge of integrating AI in healthcare and food systems. Professionals in the field of research, technology, policy, and users should collaborate to make sure that AI applications are made practical and ethically protective. Explainable AI (XAI), fairness-oriented algorithms, and secure infrastructure will be critically important to invest in. These systems will be central to the creation of AI-driven global health surveillance systems that integrate hospital, farm, and supply chain data, which is one of the promising directions of the future. Such systems might forecast the disease outbreaks, track the cyber threat, and address the supply disruptions of food in real-time. The other boundary is the AI-based sustainability programs in which models of resource optimization could be used to minimize the environmental footprints in healthcare and agriculture.

Training and education will also be at centre stage. Digital literacy skills should be provided to healthcare workers, farmers, and the employees of the food industry to be able to utilize AI tools. Responsible AI usage policies along with cooperation on an international level will be required to develop standardized ethical guidelines that can cross boundaries. AI is not a panacea yet it is a facilitator of resilience, efficiency and innovation. It defends against sensitive systems and augment clinical intelligence in healthcare. It makes poultry science and production of food sustainable, safe, and productive. On the crossroads of these industries, AI creates bridges, which is the integration of data, enhancement of communication, and a holistic approach to the global problems.

The future of the AI would be a combination and not a separation. Through the cross-domain synergies and head-on-ethical approaches, societies can be able to use AI not only to enhance healthcare and food systems on individual bases, but also to enhance the overall interconnected web of human, animal, and environmental well-being. The future is going to require responsibility,





openness, and inclusiveness, yet the benefits are enormous: secure hospitals, sustainable farms, solid food systems, and healthier communities. AI is an effective instrument of creating a future that uses technology to the greatest need of humanity. It can turn out to be the foundation of a secure, effective, and sustainable world, one in which healthcare and food systems develop in tandem to address the demands of the future, with a careful and responsible stewardship.

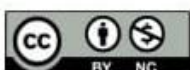
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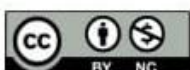


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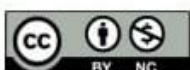


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