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AI in Healthcare and Food Systems: Exploring Machine Learning, ChatGPT, and Emerging Applications

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ABSTRACT

The scope of the review is discussing the potential impacts of artificial intelligence (AI) in terms of transforming the healthcare and food systems industries touching upon the machine learning systems and natural language processing technologies. The reality that AI is reshaping new domains in healthcare may rewrite the process of diagnosis, personalized medicine, and revolutionize the sector of patient care to make the process of diagnosis more correct and treatment of patients more efficient. The machine learning algorithms are also enhancing drug discovery and predictive analytics. With AI, the food system is being simplified, precision farming, better supply chain, and less wastage. It is also involved in the stimulation of sustainable food production and customized nutrition. Nonetheless, the development that contains the AI is connected with some ethical issues, among which we could notice the data privacy, bias of algorithms, and unequitable access, to be more specific. This is another impact of the AI on the health system and food systems that cannot be measured as long as this technology keeps advancing and it must be done with caution, ethics and fairness to reap the best out of it to the better benefit of mankind.

INTRODUCTION

Owing to Artificial Intelligence (AI), industries are evolving at a quick rate, and the food system and healthcare were no exception to this. Utilization of AI technologies is a new trend and efficiency with the advent of application of machine learning (ML) and natural language processing (NLP) [1]. It is bringing radical transformations in the way healthcare is being prepared to deliver the services and the modes under which food producing, distributing and consumption functions are being pursued. Both ChatGPT and machine learning are not only transformative, but it is even more so since it presents opportunities as well as challenges in other AI technologies [2].

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Artificial intelligence is bringing significant changes in the sphere of healthcare sector up to the diagnostics, treatment planning, individual medicine and treatment, and patient care. Application of machine learning algorithms provided a chance to know to an even larger degree the evolution of the disease and the outcome of the patient. Specifically, medical pictures can be confirmed with better accuracy using the help of AI than with the support of traditional methods and vast amounts of data pertaining to patients can be analyzed to detect patterns and predict potential fall risks to health [3]. The industry of AI-based personalized medicine is among the most promising, and the algorithms of machine learning that can be used to match the therapy with the genetics of a patient will lead to the increased effectiveness and fewer side effects [4].

The other NLP (created by OpenAI) called ChatGPT is also doing an excellent job of improving patient-provider interactions in the entire healthcare industry. It is one such assistant and I could become one of the virtual aides among the medical workers, answering the questions of the patients, telling them about the medication, the disease or giving their psychological help by conversing with a patient in a therapeutic way with him. Such a virtual assistant can become crucial especially in the areas where the concentration of health care workers is relatively low, and they can be replaced by the fundamental assistance and advice by the AI-based systems [5].

In the meantime, the significance of the role of AI in food systems is also more significant on the other hand. Using AI in order to revolutionize food production is enhancing efficiency and sustainability of food production, the smart agriculture methods, the supply chains and the interaction with consumers. The information that can be available to the farmer through AI based on its farms includes the situation, timing of sowing and crops situation and potential harvest [6]. The full potential of AI in minimizing food wastage may include the possibility to obtain real-time data about the food supply chains to be capable of making more accurate estimations of demand and, hence, alter and modify the production. The developments are, not only, making the food more secure but also more sustainable in preventing the over production and making a reduction in an impact to the environment [7].

ChatGPT is also staking its grounds on the food systems considering helping them with their reasonable food choices. It is able to give individual dietary suggestions, recommend a meal according to contents in the fridge, and even become a virtual dietician assisting one in achieving his/her dieting objectives. Besides that, it may also be used to promote the argument of food sustainability and raise the awareness of the population regarding the consequences of food consumption on the environment and human health [8].

Although the prospect of AI utilized in the two fields is promising, there are major issues that should

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be resolved, which relates to ethical implications and safety and availability of the technologies. The extent of control and safe use of AI is the most important thing in preventing the situation when benefits can be achieved, and devastation is excluded [9].

Finally, AI and healthcare/food system is a part of technological and human welfare relationship. The domains are already experiencing the implementation of Machine learning and ChatGPT which are about to change all these since they will learn to do things smarter and more productive. There are however some core considerations that should be put into consideration just like any other form of technological invention to ensure that it reaps the best out of AI and that the interest of the multitude is well taken care of [10].

USE OF ARTIFICIAL INTELLIGENCE IN HEALTH CARE

AI is disrupting the healthcare industry as it provides a quantum change to the industry and introduces the necessary transformation in the healthcare dispensation system in place. The prospects of those AI technologies are so favorable that their use in care can increase the outcomes of any clinical practice and herewith reorganize the system of medical care in the country [11]. The simplest technologies behind the change are a combination of machine learning (ML) processes, deep learning, and a natural language processing (NLP). The technologies will help the members of the healthcare personnel make better decisions and provide personalized care to the patients, thus improving the performance and quality of healthcare [{12}].

Diagnostic enhancement is one of the aspects which have been mentioned as making the most apparent change in the healthcare sector as far as AI is mentioned. Using the tool of AIs systems, the interpretation of medical images, including ones of the X-rays, CT scans, and MRIs, can occur to identify such diseases as cancers, fractures, and nervous disorders. Deep learning algorithms will be capable of detecting these images with much precision and also with speed as far as the human brain is concerned to recognize patterns as it should be the case. As evidence of its personal effects, AI models were found to be effective in early diagnosing of lung cancer and breast cancer based on radiological scans and an early detection and improved diagnosis of the disease is worth enough to prevent morbidity and mortality rate of the patient [13].

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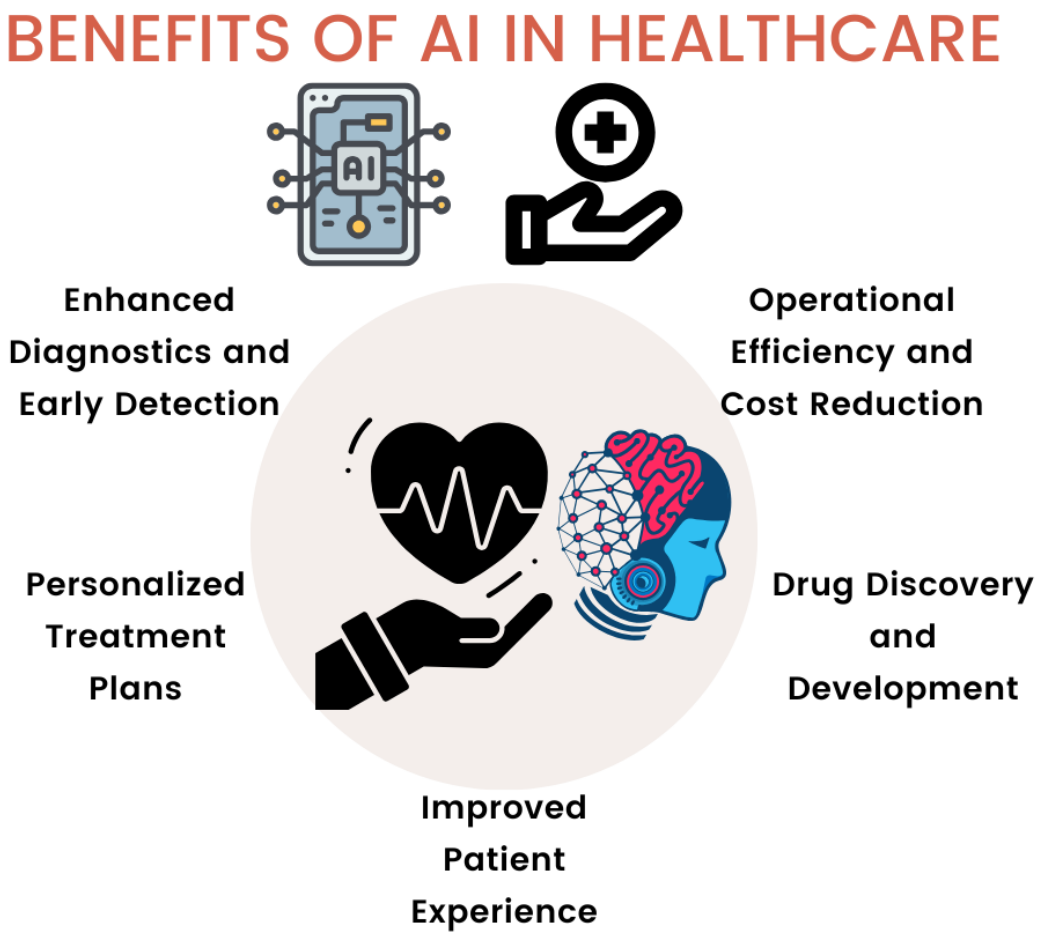

Figure: 1 showing benefits of AI in healthcare

AI and diagnostics development are among the most important parts of personalized medicine. The data of such immense quality of the patient including the genetic data, lifestyle data and medical history can be worked upon by use of machine learning algorithms so as to develop personal treatment regime. This strategy will also go a long way in enabling a more effective treatment and consideration of individual needs of the patient compared to the one size fits all method of treatments [14]. The other reason why predictive analytics is said to be the ability to make proactive decisions towards tour patients in relation to the direction of care on the part of the healthcare provider is the fact that big data analysis can be used to achieve a change of care [15].

Moreover, the AI chatbots, such as ChatGPT, are allowing the more pleasant experience and access to healthcare by the patients. ChatGPT (an example) is an electronic assistant that can be helpful in determining the answers to popular issues related to health, present the information on symptoms, and even give mental issues assistance. Patients in not so privileged areas or with minimal access to healthcare specialists will also have many advantages in terms of having such AI-driven tools as connectors with the availability of the variety of healthcare services they can use to obtain so-called

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quick solutions and refer to proper medical care in a proper manner at a given moment [16].

All these developments come with the problems. The AI healthcare adoption needs to surpass the concerns of the data privacy, black box algorithm and moral behavior of letting the algorithm to dictate decisions regarding the healthcare decisions. The safety of the data of any patient, avoidance of prejudices stored in the algorithms of AI, and presence of the human control that has to be done during the making of serious decision can be the necessary things to help in the cases when AI in healthcare can do all its possibilities [17].

APPLIED MEDICAL MACHINE LEARNING

The process of machine learning (ML) may be interpreted as an appearance of artificial intelligence (AI) technology that occupies the centerline among the contemporary trends in the area of healthcare. ML is coming to be significant in transforming the way the medical staff diagnoses, treats and makes prognoses of patients because machines can learn when presented with certain information and can infer or make an inference without carrying special programming [18]. It is being used in a variety of areas of the medical industry, which among others are medical imaging, drug discovery, patient monitoring, and clinical decision-making. ML involvement in the health industry has opened new grounds where the treatment is more centric, effective and accurate [19].

The use of machine learning in healthcare is also embodied in a highly powerful application, which is medical imaging. The analysis of large volumes of medical imaging such as X-rays, MRIs, CT scans and ultrasonography is the most and most likely powerful tool that can be deployed using ML algorithms and more specifically the deep learning models. This kind of algorithms is able to discover the trends in the pictures that may be not visible even to the naked eye [20]. As an example, Ml models have been evocative in as far as determination of the onset of disease such as cancer, heart diseases and the nerve diseases among others at an early age. It is shown that machine learning algorithms after training on a vast amount of information about medical imageries can detect anomalies as effectively as human radiologists in most of the cases at the early stages that are far simpler to work on [21].

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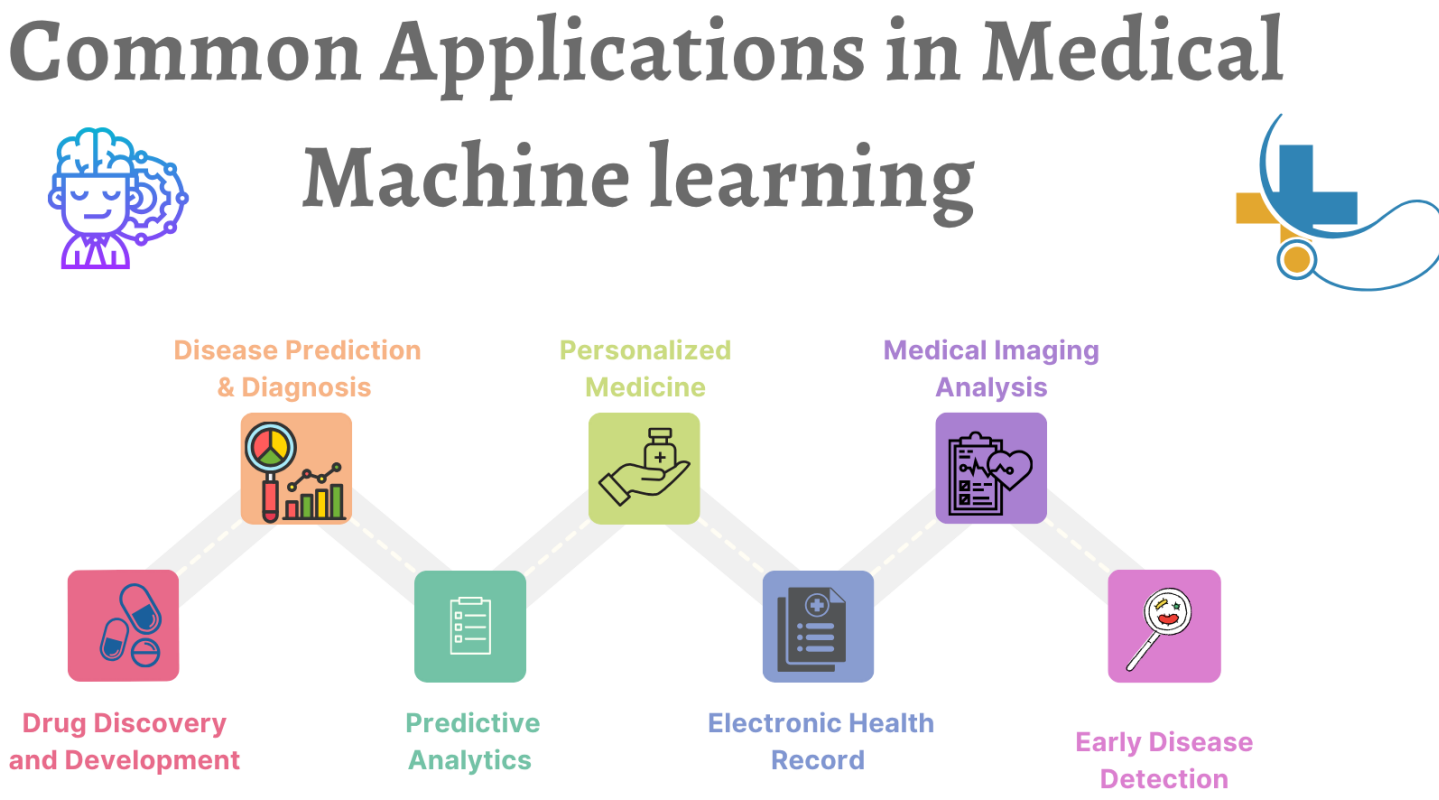

Figure: 2 showing applications in medical machine learning

The next sphere, that machine learning is approaching (and that in a significant way), is drug discovery and clinical trials. The conventional Drug development process could cost years and it is really expensive, however, ML is accelerating the process. Machine learning models can screen drug candidates faster, as it involves the use of huge amounts of biomedical data, such as structures and biological activity as well as patient responses of the molecules [22]. ML is also being utilized to help in the design of the clinical trials: it could as well be employed to predict the reaction of different groups of people to a drug treatment. The duration that is used on research and development is saved when using the evidence based approach and the patients can obtain the new treatment options earlier [23].

Clinicians will be able to make more accurate decisions as far as monitoring their patients and predictive analytics is concerned due to machine learning since it serves as an ideal real-time data tool. The wearable technology and the sensors will keep receiving the data transmitted to it by the patients continuously (the heart rate, blood sugar, and the level of activity). The ML algorithms can work with such data and help us predict the possible health-related hazard, including heart attack or diabetic crisis, before our time [24]. Using an example of a case where one has a patient who has surgically been treated or was hospitalized, then machine learning can be used to identify a patient

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who is at risk of readmission, and on this note, the concerned medical professionals would take precautions to prevent this and would improve the efficiency of the same [25].

Finally, machine learning will also improve clinical decision-making, during which the medical practitioners will get evidence-based information that they may be capable of making their decision. History of patient, history of treatment outcome and treatment guideline; ML can advise the best treatment or intervention given to a certain patient based on his poor medical history. This assists the physicians in being better enlightened and this is the probability of erring is less, and the general treatment of the patients becomes better [26].

The strength and diversity of the data, the ethical issues linked to the potentials of the algorithms, and the potential to combine the ML technologies with the current system of medical care are all the opportunities and challenges of Machine learning in healthcare. But, seeing that continuous optimization of the machine learning technology takes place the fact that the healthcare system is becoming more developed, streamlined, and individualized is reasonable [27].

ROLE OF AI IN FOOD SYSTEMS

AI is transforming the food systems on the earth and is impacting on all elements of the food systems that are the agriculture and food production to food distribution, food consumption, and food sustainability. It is even emerging that food production should be sustainable, efficient and may be able to produce more as the number of population is estimated to grow to approximately 10 billion by the year 2050. Advanced answers to overcome such challenges offered by artificial intelligence and machine learning (ML) and other related technologies are finding groundbreaking solutions with the aim of developing a smarter and robust food system [28].

The precision agriculture is one of the largest approaches to the enhancement of the food systems that the artificial intelligence is improving. The conventional agriculture may not be efficient and taxing in terms of the environment, water surplus, pesticide, and fertilizers. Nevertheless, the agricultural techniques are becoming more is sustainable introduced by such things as AI powered tools. Through a combination of rich information and multiple sources of machine learning algorithms, farmers would make the best out of irrigation, keep track of the condition of crops, and foresee their harvesting [29]. As an example, AI models will also be superior to blank applications, as they will be capable of showing those areas of field that require more attention or action. This enhances the output of the crops and lessens an environmental impact of agricultural activities, which ensures saving of the water and minimizing the number of the chemical run offs to the nature [30].

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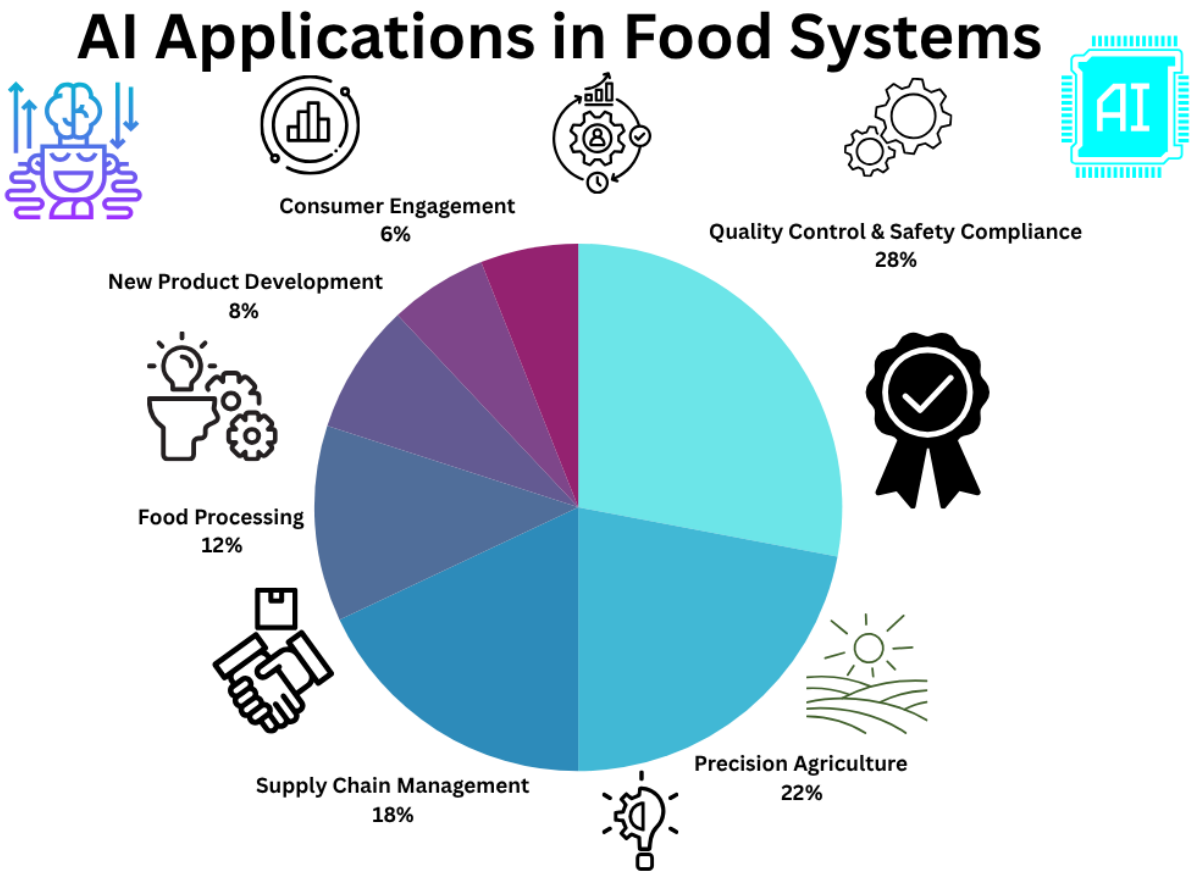

Figure: 2 showing AI applications in food systems

Other than facilitating agricultural activities, food supply chains are restructuring to employ AI. The AI-based tools allow the businesses to get a clearer picture of their demand and to streamline the chains of supply, and the tools can even lead to the minimization of the food wastes and the emergence of the food safety. The demands of a particular food product can be forecasted based on the trend of consumption and weather forecasts and the trend in the market thanks to the use of algorithms in machine learning [31]. It gives both the supplier and distributors a day to discuss on the production plans and delivery patterns and ensure that the food gets to the consumers before it gets bad and also reduces the percentage of all the good food that goes to waste at the end of the high transport. Besides, AI will also assist in improving the supply chain with its tracing, and individuals will be able to know where their food was being shipped [32].

Artificial intelligence is another thing which plays an important role in the food processing and quality control. Using the machine learning models in this case, consistency and quality of food products during the production process can be monitored in respect to, detecting flaws of the packaging of the food company product to distinguishing between taste and texture. The risk of a human factor becoming one of the guarantees of food products quality and safety also can be minimized with the

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help of AI-based technologies [33]. The AI application also covers food processing to augment the recipes, nutritional content and invent food products based on the need of the people who like it when the products are better or vegetal, or eco-friendly [34].

Moreover, the field of individual nutrition in AI is gaining pace and people would want to practice nutrition, which is scientifically beneficial to fir them, as individuals. One of such AI-based platforms which have been introduced to offer personal dietary plans is ChatGPT. Through the health profile, personal preferences and the objectives of a person, they will be able to post meal plans along with the recipes that will fulfill the nutritional requirements of a person on these platforms like, weight management and gut micro biome, or food allergies [35]. Besides, through AI, the consumers will be educated on sustenance of food choices, and thus pushed towards sustainable and healthier diet.

Some of the difficulties that need to be overcome along with these developments include the following. The ethical issues of privacy of information, digital divide in use of AI as well as the risks of creating imbalance in food supply due to AI are to be addressed reasonably. Provided that it is used with caution, AI can flip food systems, in the light of their sustainability in terms of environmental coverage, use of resources, and responsiveness to demands and needs of the global community, together [36].

ETHICAL CONSIDERATION AND DILEMMA

Along with the perpetual shift of artificial intelligence (AI), which is changing the purpose of the healthcare and food systems dramatically, there also comes a bulky baggage of ethics and needs, which should be thoroughly observed and kept in mind. Indeed, although the efficiency of AI improvement and accessibility and sustainability are high, the introduction of such sensitive areas as healthcare and food production generates an issue of privacy, equity, bias, and accountability. These are the problems, which should be solved in order that the positive effects of AI and the negative side effects could be achieved with the minimal influence on people and the society as a whole [37].

Data privacy is one of the most obvious issues which can be applied to healthcare and food chain. To be successful, AI systems have to be provided with sufficient data and work with the latter around the most personal information about a person, i.e., his/her health history, genetic background, and treatment program. Some of the data that the AI in the food systems might be using may include the eating habits and buying patterns of consumers. That is far more important to secure privacy, as well as safety of this information to exclude the possibility of breaking of confidences [38]. The risk of personal health information is that it might be hacked or one wrongly uses the profile regarding a consumer with aim of making a sale through marketing to a specific individual. Moreover, it will be against both the law and ethics to gather and employ such information to the extent that such practices

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go against the privacy regulation (like the General Data Protection Regulation (GDPR) in Europe) [39].

The other is the problem of biasness in algorithms. Machine learning models promote most of the available AI systems and since they are trained to reflect historical data as accurate information, they will more likely reflect and even add the biases in it. Examples of discriminatory out come in regards to healthcare include impeded access to treatment of a particular group of people or incorrect diagnosis in a particular group of people namely the minority or underserved social groups [40]. One of the examples that can be placed here is that facial recognition programmers in medical imaging have been discovered to be inefficient in individuals whose skins are relatively darker, and this presents the possibility of a misdiagnosis.

Among the potential negative consequences, there is also the existence of biased algorithms that could potentially influence the ways of how the supply chains of food could be prevented [41] or how such individual recommendations regarding nutrition could be offered at the price, which those groups or individuals would be capable of covering. Algorithm bias solution Algorithm bias ought to be solved majorly by diversity and representativeness of train data that have been supplied to the training of the AIs in the programs and further written to be monitored by the monitoring systems so they can be able to identify, detect, and correct the erroneous results.

Another burning issue is the problem of the fairness and the availability. Among the most crucial, it is that AI democratizes the field of healthcare, food system, and may cause new inequalities, consequently enhancing the disparity in the fields of interest even more. Entry of AI into the healthcare industry might worsen the already-present differences between the high-resource and the low-resource environment. The provided AI in less economically developed areas may not have the same effect on the residents, whereas in more expensive ones, such technology can present cost-efficient activities [42]. By analogy, in the food industry, one of the solutions may be AI-based environments when precision agriculture or exclusive nutrition can be sold to large-scale commercial farms or well-to-do people, and the production of farming or people with low-income levels will become stragglers. Their AI version must be all encompassing and planned ideally to fit the need of the vulnerable populations, and hence be affordable by the vulnerable too [43].

RESPONSIBILITY AND HONESTY ARE BECOMING ONE OF THE ETHICAL ISSUES

Machine learning which mostly utilizes deep learning may be referred to as a black box since a human being can barely know how they come to their own output. This confidentiality may be hard to think of a specific conclusion or the suggestion given by the AI systems [44]. In healthcare, it may give rise to the requirement of a situation where persons are not inclined to use the system of diagnosis or

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prescription of the treatment which is based on AI, as the patients and the people who are providing diagnosis or prescription of the treatment will be unable to comprehend the rationale of the suggestions, supplied by the AI. In the same manner, the decision-making process within the food systems by the AI; e.g. determination of prices, supply-chain mechanism, or recommendation of the product may not be transparent and consumers and other stakeholders may not be able to contest or protest such decision. It is not only essential that AI systems should be explainable and transparent because this should give rise to trust and accountability [45], but also whether this is so to what extent, remains unclear.

Finally there exist the long terms that the society has to face. The spread of AI can suffocate the traditional industries, and can kill certain professions and affect the nature of the work of the healthcare system and food system. To take but one example, automation of food production and crop cultivation is bound to cause the reduction in the workforce population at least in those places where food production and crop cultivation can be automated, but the same thing cannot be said about telemedicine with the help of AI and AI personal assistants, which are bound to change the status of medical workers [46]. Although the productivity and efficiency, which will be introduced with the introduction of the AI, will be enormous, it must be properly calculated so that the influence on the employment and the social sphere could be minimal possible.

To sum up, overall, the potential of AI as related to the spheres of healthcare and food systems is tremendous on its own; undoubtedly, the ethical issues of the same cannot remain emphasized. To make a fair application of AI, the issue of privacy of data, the presence of algorithm biases, fairness, explain ability and accountability ought to be cited. Reflecting on these ethical considerations in the future, the policymakers, the industry and the technology leaders will be able to calculate a more socially fairer, equitable, and sustainable future through which they can make the productive AI systems potential to serve the entire society come to life [47].

FUTURE DIRECTIONS, AND POTENTIAL

The idea of artificial intelligence (AI) of food system and healthcare industry has fantastic future perspectives. It can be undoubtedly said, that changing technologies will also allow AI to cover more of such areas and by its implementation will lead to the discovery of more innovations and paintings of the way out of some of the biggest problems of the world. The opportunity to solve the healthcare problem, make the food production fruitful and provide a sustainable world is enormous with the help of AI [48]. Nevertheless, this kind of the future way must definitely be planned in mind of such technological advances and effects that they impose on our society.

The technical background used in the research concerning the heat transfer analysis using

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dimensionless numbers, the reduction of high BOD levels in sewage treatment, and the investigation of elementary vibrations contains a lot of grounds in various engineering fields, which is similar to the topical AI implementation in the field of healthcare [49]. Simulations involving planar anthropomorphic manipulators, design and control of dynamic systems (including ball and beam mechanisms with MATLAB/Simulink) are immediately applicable not only to the development of medical robotics and assistive technologies but also to many other fields in robotics [50].

The expansion of OpenFOAM computational tools in modeling contains Computational Fluid Dynamics (CFD) analysis and mesh optimization, which is essential to modeling complete physiologic responses such as pulmonary airflow and arterial blood flow, which are the key to AI-based diagnostics and predictive modeling [51]. Also, the experience of environmental engineering can be applied to the field of healthcare AI, specifically to data filtration and processing approaches; this knowledge can enhance the efficiency and functioning of the system as a whole [52]. All together this multidisciplinary article shows how the principles of engineering along with computational models are increasingly colliding with that of artificial intelligence to change how healthcare currently operates [53].

The other opportunity that appears to be rather promising is the possibility of developing sustainable food production processes with AI assistance. An example that may be used is the cell -cultured food where the AI may be used by optimizing cell culture in order to generate meat substitute. Making personal plans in nutrition can also be ensured with the use of AI, and the planned food and schemes can be sold to the consumers in accordance with their personal needs, genetic, and medical goals. This would be beneficial in setting healthier diet and quarantine diseases as a result of food consumption lifestyles such as obesity disease and diabetes [54].

There are a few trends and problems which must be considered because AI has already become the future of healthcare, not to mention food systems. Among the trends, it is possible to speak concerning the cooperation of AI and human experience which takes place to a greater extent. Human judgment can barely be transformed into a substitute of the decision-making process and AI is only capable of supporting it. One of the solutions that would lead to sorting the problem out, is probably the cooperation between the AI systems and health workers, nutritious experts, agriculturalists and food scientists [55].

Besides, ethical and regulatory frames would be changed as well to respond to the issue of AI. Organizations, governments will gain a capacity to come up with clear set of rules and regulations in place to make AI technologies implementation responsible and transparent. Such discussions will give the utmost concern to the privacy of data, equity, as well as fairness and it will be crucial to come

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up with standard data-handling and algorithms fairness procedures [56].

The possibility of AI in health and food systems is rather bright. The introduction of technology will assist in transforming the health outcomes, food security and even food systems in a very big way courtesy of AI. Nevertheless, it's positive incorporation will demand an insistence on some concern with ethical questions, dynamics of control, and even access to such inventions [57]. AI has a great potential to improve the life of people and society, which can be achieved by investing more in the research and collaboration.

CONCLUSION

Artificial intelligence (AI) will be able to give a lot of assistance to the healthcare system and the food system because it will make some of the most urgent problems in these spheres appear in quite a positive light. Due to the further increase in the popularity of AI solutions, specifically, machine learning, natural language processing, it brings the incomparable opportunities, namely, upgrading the precision of diagnostic work, embracing the personal approach to health care, restructuring the work of the food industry, ensuring sustainable development.

Among the applications of AI, one can single out such sphere of application as the field of medical diagnostics, monitoring of the health of patients, and an efficient scheme of treatment. In such cases, machine learning can be used to study huge volumes of medical data and extract trends that individuals cannot discover (that can be used to make more correct and timely diagnoses). What is more, artificial intelligence can be employed in the process of enhancing patient outcomes because it allows providing personalized medicine due to the personalization of treatment. Besides, even some of the tools such as ChatGPT begin to improve the interactions with the patients and some valuable assistance and facts can be obtained on a live time basis.

AI is helping agricultural practice with food systems and supply-chain effectiveness and sustainability. AI in smart agriculture will equip the farming community to become more effective at monitoring their crops, wastes, and decisions regarding use and structuring of their resources. Food production is also becoming efficient with the assistance of AI tools that would allow satisfying the rising demand in the world and leave minor impacts on the environment. Moreover, AI is able to guide more sustainable and healthy food choices using more knowledge and precise nutrition of the users.

But, at the same time all these needs to be taken with a pinch of salt and all these ethical issues to be approached with caution like the privacy of data, bias and access. Access to AI technologies should be equal, and, specifically, in under-represented areas, as otherwise the overall positive effect cannot be obtained. However, the AI application to the healthcare and food systems has a potential to redefine

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the healthcare and food systems regarding better health outcomes, sustainability, and efficiency of these systems. It will become a potent instrument of turning our forthcoming world more fair and sustainable in case the tools of AI are narrowed down to the most abusive ones and the ethical side of the AI utilization is taken into account.

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