

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

The Final Draft (25% of Total Grade): Due Week 15

Make sure you completely fill out *all* the information in the sections below. Failure to complete these sections fully and honestly may incur a loss of points. Responding to some questions with “no” or “n/a” or “I don’t know yet” *is* acceptable; however, leaving any responses blank is not. If you do not understand any questions you are encouraged to contact your instructor.

Section 1

Name: Lamy Alsuwaidi

Your Major: Computer Engineering

Section 2

On a scale of 1 to 10, how confident are you *now* feeling about writing for this course?

8/10

Section 3

Final grade you received from your previous assignment (Working Draft):

100

Section 4

Based on your last assignment and the lessons you have received so far in ENG 204, what **three** things have you given extra care and attention towards for this assignment?

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

1/ Cohesion: My working draft included many cohesion issues that made the transition between paragraphs and sentences unclear. For this final draft, I worked on ensuring that my paragraphs were cohesive to clarify my arguments to the reader.

2/ Organization: I improved the organization of my sections from the working draft to clarify the supporting and counter arguments.

3/ Researching for more sources: Although I had already found many sources for my working draft, I felt like I was missing strong evidence for some of arguments I presented. In addition, I had an incomplete section in my working draft because I was unable to find reliable sources. For this final draft, I conducted research to find more sources to elaborate on the supporting and counter arguments.

Commented [PMM1]: Nice analysis 😊

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Checklist

Before submitting, make sure that you can write “YES” for each of the items below.

1/ I understand that if I write “YES” to any of these statements then such a response is completely true. I further understand that if there is evidence that I have not responded accurately then my paper will be returned to me ungraded. In such a case, I will have to correct my paper and resubmit it. In so doing, I will be subject to a “late penalty.”

YES

2/ I have accurately and fully completed an Auto-Peer review of my paper.

YES

3/ I have named the file for submission as follows: Working Draft [my iLearn name]

For example: Final Draft Philip Michael McCarthy.

YES

4/ The file I am submitting is a Microsoft Word document.

YES

5/ I have read the rubric and all relevant course material, and included all the information required.

YES

6/ I have changed the header of this paper to the ALL CAPS title of my paper.

YES

7/ I have pressed spellcheck/grammar check and corrected any text as appropriate.

YES

8/ I have carefully read *out loud* my entire paper and corrected issues where appropriate.

YES

9/ I have carefully checked my paper to ensure there are *no* examples of any form of plagiarism. I fully understand what these forms of plagiarism are and I realize fully that any examples of plagiarism will have severe consequences (including *but not limited to* a zero

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

grade, an F for the course, a formal report to administration, and/or having to write a completely new research paper on a different topic). I further confirm that I have had ample opportunity to discuss issues of plagiarism with my instructor and that any and all of my questions have been addressed.

YES

10/ All work submitted in this paper is my own. No other person was involved in any of the actual writing of this paper.

YES

Write Your Paper Below

Begin your paper at the start of the next page. Note that APA Level 1 and Level 2 headers have *not* been provided for you: You are now required to complete these yourself. Complete the paper using appropriate paragraphs. Remember to leave the rubric at the end of the paper.

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Abstract

The current healthcare system needs serious reform to continue meeting the increasing demands of patients. In this paper, I argue that this challenge can be overcome by the employment of artificial intelligence (AI). AI refers to machines or systems that mimic natural intelligence to solve problems and make decisions. The employment of AI in healthcare is beneficial because AI can accurately diagnose and treat patients, improve patient-doctor relationships, reduce stressful working conditions in hospitals, and increase job opportunities. Despite these advantages, patients and physicians are reluctant to trust AI. These concerns include inaccurate diagnoses, compromising patient-doctor relationships, causing unemployment for healthcare workers, and data-bias challenges. I address these concerns by analyzing recent AI breakthroughs to show that the benefits of AI outweigh the risks. I conclude my paper by recommending that healthcare researchers and providers conduct further research on integrating AI into healthcare.

Keywords: Artificial intelligence (AI), healthcare reform, medical diagnostics, perceived care, patient-doctor relationships

Commented [PMM2]: VERY NICE!

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Artificial Intelligence in Healthcare

In this paper, I argue that artificial intelligence (AI) should be employed to facilitate the diagnosis and treatment of hospital patients. The employment of AI has shown great potential to improve and transform existing fields and systems, including the healthcare system. Improving the healthcare system is important because the current ~~healthcare~~ system is facing growing demands and ~~needs~~ requires serious reform to continue meeting the needs of patients. Although the application of AI has demonstrated significant advantages in healthcare, people are still reluctant to trust decisions made by AI (Yokoi et al., 2020). Therefore, I will be addressing the concerns towards employing AI to diagnose and treat hospital patients by providing evidence that shows the advantages far outweigh the concerns.

I support my position with the following arguments. First, employing AI can increase the accuracy and precision of diagnoses and treatments. Numerous studies have shown that the capabilities of AI in diagnosing patients and administering the correct treatment are just as accurate as physicians (Liu et al., 2019). Second, employing AI can improve patient-doctor relationships. Despite AI's inability to replace human emotion, studies have demonstrated that AI can improve and provide alternatives to the traditional patient-doctor relationship (Barrett et al., 2019). Third, employing AI can reduce stressful working conditions in hospitals by automating tasks. The prevalence of hospital violence and overworking has increased in recent years and employing AI can help combat both issues (Kong et al., 2019). Fourth, employing AI in hospitals can increase job opportunities for AI specialists and healthcare workers. Healthcare workers and AI specialists are needed to facilitate the development and employment of these AI systems to ensure patient safety (Lee & Yoon, 2021).

I also consider alternative positions against employing AI in hospitals. These positions include that diagnoses made by AI are not as accurate as human physicians (Jussupow et al., 2021) and that AI cannot ~~have~~ sustain a patient-doctor relationship (Yokoi et al., 2020). While these positions have merit, I present current advancements in the field of

Commented [PMM3]: Really good! 😊

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

AI to show that employing AI to diagnose and treat patients is advantageous. For example, Liu et al. (2019) provide evidence from multiple studies demonstrating that diagnoses made by various AI systems are more accurate than diagnoses made by physicians. In addition, Barrett et al. (2019) demonstrate an alternative to the traditional patient-doctor relationship that is equally beneficial.

This paper is important because in an age of revolutionary technology, it is unwise to ignore the impact of AI on healthcare. As such, this paper is of interest to healthcare researchers and providers because it highlights the current state of AI in healthcare and encourages further development. This further research will help ensure that both healthcare providers and patients trust and take full advantage of medical AI systems. Therefore, it is important to spread awareness on the benefits of employing AI in hospitals to ensure that we reap the full benefits of this revolutionizing technology.

AI in Medical Diagnosis and Treatment

AI can be used to facilitate the diagnosis and treatment of hospital patients. AI can be defined as machines and algorithms that attempt to mimic human intelligence to learn and make decisions (Lee & Yoon, 2021). More specifically, AI uses large datasets to identify patterns and interactions between variables. As such, clinical AI can be defined as the use of algorithms to analyze and act on medical data (Topol, 2019).

Clinically Effective AI Systems

There are two main subdisciplines of AI that have shown effectiveness in clinical settings. First, machine learning (ML) is a subdiscipline of AI that uses data-analytical algorithms to extract relevant data (Bertalan et al., 2018). As such, ML can be used to detect patterns of diseases correlated to a patient's symptoms. In addition, ML can also be used to build models that can provide prognoses (Topol, 2019).

The second subdiscipline of AI that has shown effectiveness in clinical settings is natural language processing (NLP). As defined by Jiang et al. (2017), NLP is a subdiscipline of AI that is concerned with enabling computers to process and understand text or spoken

Commented [PMM4]: 😊

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

language. Jiang et al. argue that using NLP in a clinical setting is useful because large proportions of clinical information, such as laboratory reports or physical examinations, are in the form of text. Accordingly, NLP can extract relevant data from clinical text to aid in diagnosing and treating patients.

Improving Current Diagnostic and Treatment Systems

Clinically effective AI systems can improve the accuracy of diagnoses and treatments administered to hospital patients. More specifically, AI systems can unlock relevant information hidden in massive amounts of clinical data (Jiang et al., 2017). This information in clinical data is key to accurately diagnosing a patient because diagnoses rely on a thorough evaluation of a patient's symptoms and characteristics. Accordingly, AI is well-suited to analyze many variables related to a patient's health to provide an accurate diagnosis.

Although AI is well-suited to diagnose and treat patients, critics may argue that diagnoses made by AI are not as accurate as those made by physicians. However, increasing research shows that AI can perform at a level equal to physicians. For example, Liu et al. (2019) conducted research to assess studies that compared the accuracy of diagnoses made by deep learning algorithms to those made by physicians. The researchers developed a hierarchical model and set of criteria to evaluate and narrow down thousands of articles to those relevant to the study. The result of the study was that deep learning algorithms have demonstrated that their ability to diagnose patients is equal to, and sometimes more accurate than those of physicians.

In addition to regular diagnoses, AI can be used to provide early diagnoses. AI can analyze and detect subtle changes in medical images to detect and diagnose a disease at an early stage (Lee & Yoon, 2021). These early diagnoses are important to increase the chance of effective treatment and ensuring the best patient outcome. For instance, McKinney et al. (2019) present an AI system that can identify breast cancer at earlier stages of the disease. The authors highlight that breast cancer is difficult to detect because the interpretations of mammographic images in breast cancer screenings vary with each clinician. The proposed AI

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

system solves this issue by comparing images from the screening to images of confirmed breast cancer cases. The result of the study demonstrates that the AI system can outperform or perform at a level equal to the radiologists.

Bridging the Gap Between AI and Physicians

While AI has demonstrated high accuracy in diagnoses, some experts in the healthcare industry are concerned about the safety of AI. That is, the healthcare industry is reluctant to implement modern technology because of the potential risk to human life. Despite the risks associated with the employment of AI in healthcare, AI has already been implemented in other high-risk fields. For instance, the aviation industry relies on AI systems to pilot aircrafts. The use of AI in aircrafts allows safe navigation in uncertain and dynamic environments because AI can consider various variables at the same time (Wall & Krummel, 2020). Although people were skeptical at the time, AI systems are safely piloting aircrafts today. As such, the only method to determine the competence of AI in healthcare is to apply AI to real clinical settings.

Applying AI to real clinical settings will be a challenging task. More specifically, applying AI to preexisting diagnostic systems is difficult because of the considerable differences between both systems (Cabitza et al., 2020). For example, one challenge in employing AI to clinical settings is understanding how AI comes to a diagnostic conclusion. As AI develops more complex algorithms, it becomes difficult to understand the decision process of the system (Yokoi et al., 2020). Since trust in the capabilities of AI is important for medical applications, clarifying how an AI system comes to a conclusion can help foster trust in patients and physicians (Siau & Wang, 2019).

One way to bridge the gap between AI and physicians is AI augmentation. AI augmentation is the enhancement of human abilities through AI. A study conducted by Jussupow et al. (2021) aims to observe this enhancement by assessing the performance of physicians with AI augmentation. In the study, novice physicians made diagnostic decisions regarding pulmonary function values from a CT scan with the support of an AI system. To

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

determine the efficiency of AI augmentation, the AI system was designed to provide both correct and incorrect advice to the novice physicians. Jussupow et al. found that when the physicians practiced both self-monitoring and system-monitoring, decision augmentation was significantly more accurate than without decision augmentation.

Although there are challenges, AI can support providers and patients at every stage of care. For instance, AI can provide physicians with a second opinion when diagnosing a patient (Jussupow et al., 2021). In addition, AI can provide physicians with a predictive analysis using patient data to determine the best treatment options for the patients (Ahmad et al. 2021). These benefits demonstrate that the cooperation of AI and physicians can help improve diagnosis and treatment quality. As such, instead of viewing the relationship as AI versus physicians, the relationship should be viewed as physicians alone versus physicians complemented by AI.

Commented [PMM5]: You are SUCH a good writer! 😊

Patient-Doctor Relationships with AI

The patient-doctor relationship is a core element of healthcare. As defined by Ridd et al. (2009), the patient-doctor relationship is a consensual relationship where ~~a-patients~~ places trust in doctors to help them maintain or regain their health. In addition, Ridd et al. highlight that knowledge, trust, loyalty, and regard are indicators of a strong patient-doctor relationship. In contrast to traditional patient-doctor relationships, patient-AI relationships rely solely on the patient's trust in the AI system. Therefore, it is important to establish and maintain trust in a patient-AI relationship to improve patient outcomes and experiences.

Distrust of AI

Despite research supporting the efficacy of AI in healthcare, patients are reluctant to trust decisions made by AI. A study conducted by Yokoi et al. (2020) investigates trust in patient-AI interaction. The researchers conducted an online experiment where individuals were surveyed about scenarios regarding options of treatment in a hospital. The researchers found evidence suggesting that humans were overall less likely to trust an AI system than a human physician despite both providing the same treatment options.

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Understanding the reason for patients' distrust in AI is key to improving the AI-patient relationship. As argued by Longoni et al. (2019), patients are reluctant to trust AI because patients believe that AI will neglect a patient's unique characteristics and circumstances. This belief of uniqueness neglect emerges because patients view machines as only capable of operating in a standardized manner. In addition, the authors highlight patients are more likely to exhibit resistance to medical AI when deciding for themselves or for a person perceived as unique than when deciding for a person who was not perceived as unique.

Another reason for the lack of trust that patients have in AI is AI's inability to express emotion and empathy in the same way that humans do. Although some AI systems attempt to mimic human affection, patients perceive that affection as disingenuous (Stephanidis et al., 2019). As a result, patients are less likely to trust an AI system than a human physician.

How AI Can Transform Patient-Doctor Relationships

Despite current AI's inability to replace human emotion, there are equally beneficial alternatives to the traditional patient-doctor relationship. For example, Barrett et al. (2019) propose an unorthodox approach to treating heart failure. This proposed model aims to combat the lack of personalized treatment for heart failure. The proposed model includes a combination of AI and gamification to provide personalized care to patients without the interference of healthcare professionals. Barrett et al. highlight the improved engagement and treatment quality reported by the patients using the AI system. Overall, the model demonstrates how AI can provide the same benefits that patient-doctor relationships do.

AI can also aid in strengthening existing patient-doctor relationships. AI allows physicians to spend more time with their patients by automating administrative tasks related to diagnoses and treatments (Lee & Yoon, 2021). Similarly, AI can allow patients to change the dynamic of a patient-doctor relationship by giving patients more control over the diagnostic and treatment process (Barrett et al., 2019). This increase in control from the

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

patients' side transforms the traditional patient-doctor relationship from authoritative to collaborative.

In addition to the alternatives and benefits that AI can provide to patient-doctor relationships, the concerns that patients have towards AI can also be alleviated. By using AI to give patients more control over the diagnostic and treatment process, patients will be more likely to trust decisions made by AI systems (Barrett et al., 2019). Therefore, more research should be conducted to increase the accessibility of AI to improve the patient-AI relationship (Stephanidis et al., 2019).

Improving Hospital Working Conditions With AI

The quality of a hospital's environment directly influences the quality of healthcare provided (Melo, 2018). More specifically, hospitals are dynamic environments shaped by the interactions between patients and healthcare workers. Therefore, it is important to maintain a positive work environment to ensure the delivery of high-quality healthcare.

Physician and Nurse Stress in Hospitals

Physicians and nurses have a major impact on patient experiences and healthcare quality. However, studies suggest that healthcare workers are struggling to provide high-quality healthcare because of stress (e.g., Kong et al., 2019). As reported by Salari et al. (2020), physicians and nurses are stressed because of their responsibility to care for patients.

~~More specifically~~ ~~That is,~~ staffing shortages and the increasing demand for healthcare services in hospitals have resulted in physicians and nurses being responsible for many patients at a time. These increased responsibilities have made it difficult for physicians and nurses to provide timely and high-quality healthcare. As a result, the inability to meet patients' needs has caused physicians and nurses to become stressed

Another major contributor to the increase in healthcare worker stress is hospital violence. Although violence towards healthcare workers has always been a global health problem, causes associated with the increasing demand for healthcare services have caused the frequency of hospital violence to increase. Kong et al. (2019) assess the increasing

Commented [PMM6]: Just because "more specifically" has been used quite a lot

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

prevalence of hospital violence towards physicians in Chinese hospitals. The authors argue that Chinese health officials have failed to properly improve their medical care standards and effectively manage their healthcare workers. Kong et al. also argue that the lack of ~~proper~~ appropriate management towards healthcare workers has transformed hospitals into a battleground where physicians are the main target. As a result, Chinese medical students express regret towards choosing to learn medicine and only one-sixth of medical students pursue a medical-related profession after graduation.

Employing AI to Reduce Physician and Nurse Stress

Despite the challenges associated with resolving physician and nurse stress, AI can reduce stressful working conditions in hospitals in numerous ways. For instance, AI can increase the speed of administering diagnoses and treatments. Topol (2019) estimates that AI can process over 250,000,000 images used for diagnosing patients daily. The speed of diagnoses made by AI systems is advantageous because it will increase the efficiency of diagnostic systems and the speed of treatments. This increased efficiency will help combat physician stress and burnout because physicians can spend more time on engaging tasks.

Another way that AI can reduce stressful working conditions in hospitals is by providing prognoses. AI can also provide prognoses to determine the likely course of a medical condition. According to Mansour et al. (2019), prognoses can aid in reducing the large number of hospital patients being admitted because accurate prognoses will prevent readmission of patients. For example, an article by Schaefer et al. (2020) demonstrates how AI can be used to treat and prognose rare diseases. According to Schaefer et al., it takes more than five years, eight physicians, and two to three misdiagnoses until a patient receives a correct diagnosis for a rare disease. The long diagnosis process can cause stress and frustration for both the patient and physicians. The authors suggest that AI can be used to improve the diagnosis and treatment of rare diseases because AI can easily extract and memorize large quantities of information on rare diseases that would otherwise burden a human physician.

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Global Healthcare With AI

Employing AI will cause a paradigm shift in healthcare worldwide. More specifically, the employment of AI worldwide proposes many benefits to the healthcare system, but also many challenges. Understanding these benefits and challenges is important to effectively employ AI to healthcare systems worldwide. As such, assessing the global impact that AI has on healthcare will aid in overcoming these challenges and taking full advantage of the benefits AI has to offer to the healthcare system.

Global Data and AI

The effectiveness of AI relies on the data provided to the AI system. By employing clinical AI systems worldwide, these AI systems will have access to more clinical datasets and can be used to diagnose and treat more patients. For instance, resource-poor settings can employ AI to diagnose and treat patients when medical experts are unavailable (Wahl et al., 2018). As such, increased access to clinical datasets is beneficial because AI systems can unlock relevant information to accelerate the development of the AI system and improve patient outcomes (Lee & Yoon, 2021).

Providing clinical AI access to global healthcare datasets can benefit the healthcare system in numerous ways. One benefit of providing global healthcare datasets to clinical AI systems is that these AI systems can help with disease management. For example, Yoganandhan et al. (2021) demonstrate how the employment of AI during the COVID-19 pandemic benefits the healthcare system. The COVID-19 outbreak puts frontline healthcare workers at risk for infection while providing treatment to infected patients. To minimize this risk of infection, the authors argue that the employment of AI in hospitals can reduce the number of physical interactions between patients and healthcare workers.

In addition to disease management, AI can help combat implicit bias among physicians. As defined by Chapman et al. (2013), implicit bias refers to unintended bias that impacts decision-making. Chapman et al. argue that implicit bias among physicians may lead to patients receiving inaccurate diagnoses and poor treatment. Implicit bias can be reduced by

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

the employment of AI. For example, Rezk et al. (2022) suggest that AI can be used to improve the diagnosis and treatment of skin conditions. Rezk et al. argue that the underrepresentation of dark skin images in dermatological textbooks reflects racial injustice in healthcare. This underrepresentation can result in delayed and incorrect diagnoses for people of color. To compensate for this lack of representation, the researchers propose an AI system that evaluates clinical images to detect skin cancer for all skin tones. Although the AI system is still in development, this system is a step towards improving patient outcomes by reducing implicit bias and increasing representation.

Despite AI's ability to combat implicit bias, critics argue that AI also has the potential to be biased. More specifically, outcomes generated by AI systems reflect bias in the data used to train the AI system. According to Leslie et al. (2021), AI systems trained on biased clinical data could reinforce and amplify discrimination against patients in numerous ways. First, patterns of health discrimination in datasets can be reflected in the outputs of the AI system. Second, the lack of representation in datasets will cause the AI system to provide inaccurate outputs. Third, choices made during the design, development, and deployment of these AI systems can impact the AI system's reliability.

Although AI can reflect bias, bias in AI systems can be minimized. For instance, Norori et al. (2021) highlight that the global availability of datasets for AI can reduce bias and reflect the needs of more diverse populations. In addition, Crigger et al. (2022) suggest a framework that can guide AI specialists, healthcare officials, and physicians to develop and adopt unbiased AI systems. Overall, bias in AI systems can be minimized by providing diverse datasets to these AI systems. Therefore, it is important for healthcare officials and AI developers to account for any potential biases during the design, development, and deployment of these clinical AI systems (Leslie et al., 2021).

Increased Job Opportunities in Healthcare and AI Development

The increasing prevalence of AI will require healthcare and AI specialists to maintain the AI systems. Despite this requirement, critics argue that AI is causing a rise in

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

unemployment for healthcare workers. With the current trajectory of healthcare, global staff shortages are expected to continue increasing (Topol, 2019). However, the reasons for the rise in unemployment for healthcare workers are issues rooted in the current healthcare system and not necessarily AI. Bertalan et al. (2018) argue that the real reasons for the healthcare workforce crisis are physician shortages, physician burnout, and high demand for chronic care.

The issues causing the healthcare workforce crisis can be resolved by the employment of AI. That is, AI can create more healthcare jobs than it eliminates. Despite the employment of AI in hospitals, healthcare workers will still be needed. In addition, AI specialists will be required to resolve any issues related to medical AI systems. For instance, Wall and Krummel (2020) address the safety of automated AI surgeries. The authors highlight that automated surgeries always require facilitation by professional surgeons to maintain patient safety in case an unanticipated situation arises. Similarly, physicians and nurses are still needed to facilitate clinical diagnoses and treatments made by AI to ensure patient safety.

In addition to creating more jobs in healthcare, AI can provide medical specialists with job opportunities in AI development. AI development requires professionals in fields such as computer scientists, cybersecurity specialists, data analysts, and human-AI interaction (Lee & Yoon, 2021). In the case of clinical AI systems, the data used to train the AI systems must be validated by medical specialists to verify that the AI systems are beneficial to implement (Ahmad et al., 2021). As such, leveraging AI's full potential requires collaboration between professionals in various fields.

Conclusion

The current healthcare system is facing a growing demand for healthcare services and is struggling to meet the needs of patients. AI can improve and transform current systems because AI offers numerous advantages over traditional healthcare systems. Among the numerous advantages of AI in healthcare are improving the accuracy and speed of diagnostic systems, maintaining a healthy work environment, and increasing job opportunities.

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Although AI has demonstrated success in controlled research trials, critics are concerned about the safety of AI in real clinical environments. First, critics argue that diagnoses made by AI are not as accurate as those made by physicians. However, evidence shows that the diagnostic performance of AI is equal to that of physicians. Second, a challenge for AI is replicating patient-doctor relationships. Despite AI's inability to accurately mimic empathy, AI can improve and provide alternatives to the traditional patient-doctor relationship. Third, critics argue that AI is biased and can negatively impact patient outcomes. Although AI can reflect data bias, researchers demonstrate that AI bias can be overcome by accounting for potential biases during the design, development, and deployment of these AI systems. Fourth, some people argue that the rise in unemployment for healthcare workers can be attributed to the employment of AI. By contrast, the true reason for the rise in unemployment are issues rooted in the healthcare system and these issues can be resolved by the employment of AI.

Despite the concerns of employing AI in healthcare, the benefits far outweigh the concerns. Although research highlights the advantages of AI, it is important to note that research on AI in healthcare is mostly limited to research conducted in controlled environments that do not accurately reflect real clinical environments. As such, conducting more research on integrating AI into healthcare should be a priority for all healthcare researchers and providers to drive the adoption of AI in healthcare.

References

Ahmad, Z., Rahim, S., Zubair, M., & Abdul-Ghafar, J. (2021). Artificial intelligence in medicine, current applications, and future role with special emphasis on its potential and promise in pathology: Present and future impact, obstacles including costs and acceptance among pathologists, practical and philosophical considerations. *Diagnostic Pathology*, 16(1), 1–16. <https://doi.org/10.1186/s13000-021-01085-4>

Commented [PMM7]: Just wonderful work!!!! 😊

I can only imagine how much time and effort you put into this work ...

I hope you are very proud ... you should be 😊

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Barrett, M., Boyne, J., Brandts, J., Brunner-La Rocca, H., De Maesschalk, L., De Wit, K., ...

Dixon, L. (2019). Artificial intelligence supported patient self-care in chronic heart failure: A paradigm shift from reactive to predictive, preventive, and personalized care. *EPMA Journal*, 10, 445–464. <https://doi.org/10.1007/s13167-019-00188-9>

Bertalan, M., Gergely, H., & Zsuzsanna, G. (2018). Will artificial intelligence solve the human resource crisis in healthcare? *BMC Health Services Research*, 18(1), 1–4. <https://doi.org/10.1186/s12913-018-3359-4>

Cabitza, F., Campagner, A., & Balsano, C. (2020). Bridging the “last mile” gap between AI implementation and operation: “Data awareness” that matters. *Annals of Translational Medicine*, 8(7), 501–510. <https://doi.org/10.21037/atm.2020.03.63>

Chapman, E. N., Kaatz, A., & Carnes, M. (2013). Physicians and implicit bias: How doctors may unwittingly perpetuate health care disparities. *Journal of General Internal Medicine*, 28(11), 1504–1510. <https://doi.org/10.1007/s11606-013-2441-1>

Crigger, E., Reinbold, K., Hanson, C., Kao, A., Blake, K., & Irons, M. (2022). Trustworthy augmented intelligence in health care. *Journal of Medical Systems*, 46(2). <https://doi.org/10.1007/s10916-021-01790-z>

Jiang, F., Jiang, Y., Zhi, H., Dong, Y., Li, H., Ma, S., Wang, Y., Dong, Q., Shen, H., & Wang, Y. (2017). Artificial intelligence in healthcare: Past, present, and future. *Stroke and Vascular Neurology*, 2(4), 230–243. <https://doi.org/10.1136/svn-2017-000101>

Jussupow, E., Spohrer, K., Heinzl, A., & Gawlitza, J. (2021). Augmenting medical diagnosis decisions? An investigation into physicians’ decision-making process with artificial intelligence. *Information Systems Research*, 32(3), 713–735. <https://doi.org/10.1287/isre.2020.0980>

Kong, X., Ai, B., Kong, Y., Su, L., Ning, Y., Howard, N., ... & Fang, Y. (2019). Artificial intelligence: A key to relieve China’s insufficient and unequally distributed medical resources. *American Journal of Translational Research*, 11(5), 2632–2640.

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Lee, D., & Yoon, S. (2021). Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges. *International Journal of Environmental Research and Public Health*, 18(1).

<https://doi.org/10.3390/ijerph18010271>

Leslie, D., Mazumder, A., Peppin, A., Wolters, M. K., & Hagerty, A. (2021). Does "AI" stand for augmenting inequality in the era of covid-19 healthcare? *BMJ (Clinical Research Ed.)*, 372. <https://doi.org/10.1136/bmj.n304>

Liu, X., Faes, L., Kale, A. U., Wagner, S. K., Fu, D. J., Bruynseels, A., Mahendiran, T., ... & Denniston, A. K. (2019). A comparison of deep learning performance against health-care professionals in detecting diseases from medical imaging: A systematic review and meta-analysis. *The Lancet Digital Health*, 1(6), 271–297.

[https://doi.org/10.1016/S2589-7500\(19\)30123-2](https://doi.org/10.1016/S2589-7500(19)30123-2)

Longoni, C., Bonezzi, A., & Morewedge, C. K. (2019). Resistance to medical artificial intelligence. *Journal of Consumer Research*, 46(4), 629–650.

<https://doi.org/10.1093/jcr/ucz013>

Mansour, N., Rafeh, W., & Afram, G. (2019). The role of self-awareness, augmented artificial intelligence and enhanced leadership competencies in developing future academic physicians. *Middle East Journal of Family Medicine*, 17(10), 27–35.

<https://doi.org/10.5742/MEWFM.2019.93687>

Melo, S. (2018). The role of place on healthcare quality improvement: A qualitative case study of a teaching hospital. *Social Science & Medicine*, 202, 136–142.

<https://doi.org/10.1016/j.socscimed.2018.03.003>

McKinney, S., Sieniek, M., Godbole, V., Godwin, J., Antropova, N., Ashrafian, H., ... & Shetty, S. (2020). International evaluation of an AI system for breast cancer screening. *Nature Medicine*, 577(7788), 89–93. <https://doi.org/10.1038/s41586-019-1799-6>

<https://doi.org/10.1038/s41586-019-1799-6>

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

- Norori, N., Hu, Q., Aellen, F. M., Faraci, F. D., & Tzovara, A. (2021). Addressing bias in big data and AI for health care: A call for open science. *Patterns*, 2(10).
<https://doi.org/10.1016/j.patter.2021.100347>
- Rezk, E., Eltorki, M., & El-Dakhakhni, W. (2022). Leveraging artificial intelligence to improve the diversity of dermatological skin color pathology: Protocol for an algorithm development and validation study. *JMIR Research Protocols*, 11(3).
<https://doi.org/10.2196/34896>
- Ridd, M., Shaw, A., Lewis, G., & Salisbury, C. (2009). The patient-doctor relationship: A synthesis of the qualitative literature on patients' perspectives. *The British Journal of General Practice: The Journal of the Royal College of General Practitioners*, 59(561), 116–133. <https://doi.org/10.3399/bjgp09X420248>
- Salari, N., Khazaie, H., Hosseinian-Far, A., Khaledi-Paveh, B., Kazemini, M., Mohammadi, M., Shohaimi, ... & Eskandari, S. (2020). The prevalence of stress, anxiety and depression within front-line healthcare workers caring for covid-19 patients: A systematic review and meta-regression. *Human Resources for Health*, 18(1), 1-14.
<https://doi.org/10.1186/s12960-020-00544-1>
- Schaefer, J., Lehne, M., Schepers, J., Prasser, F., & Thun, S. (2020). The use of machine learning in rare diseases: A scoping review. *Orphanet Journal of Rare Diseases*, 15(1), 145–155. <https://doi.org/10.1186/s13023-020-01424-6>
- Siau, K. & Wang, W. (2019). Artificial intelligence, machine learning, automation, robotics, future of work and future of humanity: A review and research agenda. *Journal of Database Management*, 30(1), 61–79. <https://doi.org/10.4018/JDM.2019010104>
- Stephanidis, C., Salvendy, G., Chen, J., Dong, J., Duffy, V., Fang, X., ... & Zhou, J. (2019). Seven HCI grand challenges. *International Journal of Human-Computer Interaction*, 35(14), 1229–1269. <https://doi.org/10.1080/10447318.2019.1619259>

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

- Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. *Nature Medicine*, 25(1), 44–56. <https://doi.org/10.1038/s41591-018-0300-7>
- Wahl, B., Cossy-Gantner, A., Germann, S., & Schwalbe, N. R. (2018). Artificial intelligence (AI) and global health: How can AI contribute to health in resource-poor settings? *BMJ Global Health*, 3(4). <https://doi.org/10.1136/bmjgh-2018-000798>
- Wall, J., & Krummel, T. (2020). The digital surgeon: How big data, automation, and artificial intelligence will change surgical practice. *Journal of Pediatric Surgery*, 55, 47–50. <https://doi.org/10.1016/j.jpedsurg.2019.09.008>
- Yoganandhan, A., Rajesh Kanna, G., Subhash, S. D., & Hebinson Jothi, J. (2021). Retrospective and prospective application of robots and artificial intelligence in global pandemic and epidemic diseases. *Vacunas (English Edition)*, 22(2), 98–105. <https://doi.org/10.1016/j.vacune.2020.12.002>
- Yokoi, R., Eguchi, Y., Fujita, T., & Nakayachi, K. (2020). Artificial intelligence is trusted less than a doctor in medical treatment decisions: Influence of perceived care and value similarity. *International Journal of Human-Computer Interaction*, 37, 981-990. <https://doi.org/10.1080/10447318.2020.1861763>

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

The Final Draft will be evaluated based on the rubric below as well as all materials, instructions, and feedback provided by the instructor. Note that evaluations assume good punctuation, word choice, grammar, presentation, and strength of arguments. Evaluations also assume an appropriate quality of writing, length of response, and that language issues discussed in class have been followed appropriately. Points will be deducted if these assumption are not met. Points will also be deducted if the template has not been completely and appropriately filled out, or if any item from the template is missing. A further points' deduction will occur if an incorrectly named file is submitted.

Rubric for Evaluating the Final Research Paper

Final Research Paper

The final research paper is 10-12 pages (3200 – 3850 words, excluding reference list, abstract, and title page) and incorporates feedback from the drafting process.

Elements		Points
Content		
	Title Page	
	Abstract and Key Words	/5
	Effectively summarizes research paper (between 130 and 150 words)	
	Lists 3-5 relevant key words	
	Introduction (~1 page)	/5
	Provides appropriate and compelling entry to the topic	
	Clearly articulates the research question(s) and/or thesis	
	Body (~9-11 pages)	/50
	Presents a well-structured, logically-argued, and cohesive discussion	
	Includes headings that reflect the paper organization	

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

	Supports all points/arguments with credible and relevant evidence and cites definitions of key terms/ideas as applicable	
	Synthesizes multiple sources	
	Shows originality, critical thinking, and in-depth, nuanced analysis	
	Conclusion (~up to 1 page)	/8
	Restates main points and addresses the research question/thesis	
	Comes to logical conclusion from evidence	
	Makes final comment(s)	
	References	/7
	Uses correctly formatted APA in-text citations	
	Includes correctly formatted APA references	
	Contains all and only the cited texts	
	Style	/10
	Entire paper	
	Is polished in tone and style appropriate for an academic audience	
	Uses clear and sophisticated language and variety in sentence structure	
	Mechanics	/5
	Entire paper	
	Is accurate in terms of grammar, spelling, punctuation, capitalization, word choice, and transitionals	
	Format/ Layout	/5
	Entire paper	
	Follows APA page layout (title page, running head, headings, font, etc.)	
	Revision	/5
	Incorporates feedback from the Working Draft and any consultations	

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Total		/100
--------------	--	------