Artificial Intelligence In Medical Imaging: A Detailed Review

Dr.S.Manju[1], Aswin Balaji G[2]
[1]Associate Professor, Dept of MCA
[2]Dept of MCA
[1, 2] PSG College of Arts & Science, Coimbatore, Tamil Nadu, India.

Abstract- *In recent years, AI and medical imaging coming together have made big changes in healthcare. This survey paper, called " Artificial Intelligence in Medical Imaging: A Detailed Review," explores how AI is used in medical imaging. It looks at many different types of medical images and diseases and talks about the amazing advances that have improved how accurately we can diagnose, plan treatments, and care for patients. In this survey, we take a close look at the latest techniques, like deep learning and special computer programs called CNNs, which have taken the field to new levels. We'll see how AI is used in areas like skin health, brain scans, heart checks, X-rays, eye exams, and nuclear medicine. It's interesting because AI can sometimes do a better job than humans at finding diseases. While we celebrate these big achievements, we also talk about the challenges and things we need to think about when using AI in healthcare. Issues like not having enough data, making sure AI's decisions are clear, and keeping patient information private are some of the things we discuss in this survey. In the end, this paper shows how AI is changing medical imaging and how important it is for researchers, doctors, and policymakers to understand its role in shaping the future of healthcare. It's like a guidebook for everyone interested in how AI is transforming healthcare.*

Keywords- support vector machine, Convolutional Neural Network, Image processing techniques, Meta Analysis

I. INTRODUCTION

Artificial intelligence (AI) is transforming medical imaging, revolutionizing the way we diagnose and treat diseases. AI algorithms can now detect diseases and abnormalities in medical images more accurately than humans, and they are being used to improve diagnosis, treatment planning, and patient care in a wide range of specialties. This is a significant development, as medical imaging is one of the most important tools in healthcare. It allows doctors to see inside the body without surgery and to identify diseases and abnormalities early on, when they are most treatable.AI is making medical imaging more accurate in several ways. First, AI algorithms can be trained on massive datasets of medical images, which allows them to learn patterns that are too subtle or complex for the human eye to see. Second, AI algorithms can be used to reduce noise and improve the quality of medical images. This can make it easier for doctors to identify abnormalities.AI is also making medical imaging more efficient. AI algorithms can automate many of the tasks involved in medical imaging, such as segmenting images and identifying abnormalities. This can free up radiologists and other healthcare professionals to focus on more complex tasks. Finally, AI is making medical imaging more accessible. AI-powered medical imaging devices are becoming more affordable and easier to use. This means that people in developing countries and people with low incomes can now access highquality medical imaging. The potential of AI to revolutionize healthcare is vast. By making medical imaging more accurate, efficient, and accessible, AI can help doctors diagnose diseases earlier, develop better treatment plans, and improve patient outcomes. Here is an example of how AI is being used to improve medical imaging in the real world:

In dermatology, AI is being used to develop new ways to image and diagnose skin cancer. AI algorithms can now detect skin cancer more accurately than human experts. This is a significant development, as skin cancer is the most common type of cancer in the United States. Early detection and treatment of skin cancer is essential for survival. Another example of how AI is being used to improve medical imaging is in cardiology. AI is being used to improve the accuracy of echocardiograms, a type of ultrasound test that is used to diagnose heart disease. AI algorithms can now identify abnormalities in echocardiograms more accurately than human cardiologists. This is important because heart disease is the leading cause of death in the United States.AI is still under development, but it has the potential to revolutionize healthcare. By making medical imaging more accurate, efficient, and accessible, AI can help doctors diagnose diseases earlier, develop better treatment plans, and improve patient outcomes.

II. LITERATURE REVIEW

Table 1 provides a review of the research conducted in the past four years based on the algorithm used in the various image processing technique.

S.No	Year	Author	Proposed Algorithm	Pros	Cons
1.	2015	LeCun, Y., Bengio, Y., & Hinton, G.	Convolutional Neural Network (CNN)	Exceptional accuracy in image classification. Effective feature extraction from medical images. Widespread application in disease detection.	Requires substantial computational resources. Interpretability challenges with deep models.
2.	2016	He, K., Zhang, X., Ren, S., & Sun, J	Convolutional Neural Network (CNN)	Record-breaking accuracy in image classification. Robust to deep network architectures. Suitable for large medical image datasets.	High computational demands during training. Lack of interpretability with very deep models
3.	2017	Esteva, A., et al.	Convolutional Neural Network (CNN)	Dermatologist-level accuracy in skin cancer classification. Enables early detection of skin cancer. Potential for tele dermatology.	Limited availability of labelled dermatology images. Interpretability of deep models.
4.	2014	Liu, S., et al	Deep Learning.	Multimodal approach enhances diagnostic accuracy. Potential for early Alzheimer's detection. Information integration from diverse neuroimaging modalities.	Data acquisition and preprocessing complexity.
5.	2018	Madani, A., et al.	Deep Learning	Rapid and accurate echocardiogram view classification. Improved diagnostic workflow in cardiology. Assistance for less experienced technicians	Requires substantial labelled data for training Potential misclassification in ambiguous cases.
6.	2021	Byeon, S., et al.	Convolutional Neural Network (CNN)	Incorporates explainability in CNNs for medical image diagnosis. Allows clinicians to understand model predictions. Supports trust and acceptance by medical professionals.	Increased model complexity due to explainability mechanisms. Slightly reduced accuracy compared to standard CNNs.
7.	2016	Konečný, J., et al.	Federated Learning	Preserves patient data privacy by training models locally. Suitable for distributed healthcare systems. Adaptable to various medical imaging tasks.	Communication overhead between devices during model aggregation. Ensuring model convergence and quality control.
8.	2019	Obermeyer, Z., et al.	Gradient Boosting	Utilizes electronic health records to predict heart disease mortality. Early intervention opportunities. Provides clinically actionable insights.	Requires access to comprehensive and well maintained EHRs. Ethical concerns regarding patient privacy and consent.
9.	2017	Litjens, G., et al.	Various DL Algorithms	Comprehensive overview of deep learning applications in medical imaging. Highlights diverse algorithms and use cases. Valuable resource for researchers and practitioners.	Lack of in-depth analysis for specific algorithms. Limited focus on pros and cons of individual methods

III.FINDINGS

- AI models in medical image analysis require large computational resources for training and deployment.
- AI models can be difficult to understand, especially deep learning models.
- AI models require large amounts of labelled data to train effectively, which can be difficult to obtain for medical images.
- AI systems can be challenging to integrate with existing radiology workflows.
- There are a number of ethical concerns associated with the use of AI in medical image analysis, such as patient privacy and consent.

IV. CONCLUSION

Artificial intelligence (AI) is transforming medical imaging, making it more accurate, efficient, and accessible. This is having a major impact on healthcare, as it is helping doctors diagnose diseases earlier and develop better treatment plans. There are still some challenges that need to be addressed, such as the lack of data and ethical concerns. However, the potential of AI to improve healthcare is undeniable. In the future, AI and medical imaging will work together to provide even better care for patients.

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