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A Comprehensive Study & Review of How Artificial Intelligence can Helps in Diagnosing Cancer

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ABSTRACT: One of the World Health Organization's top priorities is increasing the percentage of patients who receive an early-stage cancer diagnosis. Screening programs have improved survival in several tumor groupings; nevertheless, risk classification and patient selection remain major obstacles. Furthermore, there are worries about the shortage of diagnostic workers, especially in light of the COVID-19 epidemic, which puts a pressure on radiology and pathology services. In this overview, we go over how AI algorithms could help doctors identify cancer risk in asymptomatic patients, investigate and prioritize symptomatic patients, and diagnose cancer recurrences more accurately. We outline the primary methods of artificial intelligence, including deep learning, neural networks, and historical models like logistic regression, and emphasize their understanding and functionality.

KEYWORDS: screening, deep learning, artificial intelligence, machine learning, and early diagnosis

I. INTRODUCTION

Artificial intelligence (AI) and early cancer diagnosis are two quickly developing topics that have significant areas of overlap. According to national registry data in the UK, there appears to be a strong correlation between the stage of cancer and the 1-year cancer mortality rate, with certain subtypes experiencing more incremental reductions in prognosis with each stage. For instance, 5-year survival rates after excision of stage I illness in lung cancer range from 70 to 90 percent; worldwide, rates are now 19% for women and 13.8% for men. In England, 44.3% of patients received a diagnosis of early-stage (I or II) cancer in 2018; the numbers for lung, stomach, pancreatic, oesophageal, and oropharyngeal cancers were less than 30%. It was said that increasing early diagnosis rates to 75% by 2028 would be a national priority.

II. LITERATURE REVIEW

How are cancer diagnostics being improved by AI?

Cancer ranks as the second most common cause of mortality worldwide. The World Health Organization (WHO) estimates that 10 million people worldwide lost their lives to cancer in 2020. For cancer to be effectively treated and to stop cancer cells from spreading to other areas of the body (metastasis), early identification is crucial. The field of artificial intelligence (AI) has been altering treatment designs, diagnostics, and discoveries. In addition to helping diagnose cancer, it can also help develop cancer therapies, find new therapeutic targets that speed up drug discovery, and enhance cancer surveillance through the analysis of patient and cancer data. Better health outcomes could be achieved through clinical screening and management with AI-guided cancer care. The methods for machine learning (ML) were created using computer and biological.

III. DETAILED STUDY

Is It Possible to Use Artificial Intelligence to See Cancer in New and Improved Ways?

The existence of an IDH1 gene mutation in brain tumors is predicted by a deep learning algorithm that was taught to examine MRI scan images.

Two black-and-white pictures of vague shapes are side by side on a computer screen. A 15-year experienced radiologist named Ismail Baris Turkbey, M.D., has emphasized an area on the left where he believes the fuzzy forms represent a

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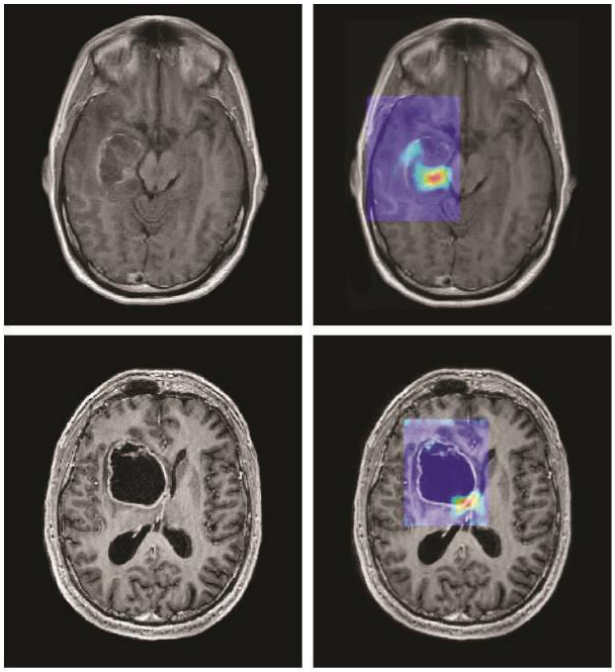
prostate cancer that is gradually but steadily spreading. The identical action has been performed on the opposite side of the screen by an artificial intelligence (AI) computer program, and the results are nearly identical.



Thousands of MRI images, including the black-and-white image of a man with prostate cancer, have been analyzed by the AI program.

This model is merely the beginning in terms of the relationship between artificial intelligence and cancer research. Despite the various applications, a significant amount of that effort has gone into developing tools for cancer imaging.

According to specialists, this research will address issues such as whether these tools are ready to go from research labs into medical offices, if they will truly aid patients, and whether or not all patients would benefit from them.

Artificial intelligence: what is it?

Algorithms, or computer programs, that use data to generate predictions or judgments are referred to as artificial intelligence. Scientists may design an algorithm as a collection of guidelines, or instructions, that the computer must adhere to in order to process information and reach a conclusion.

In other AI techniques, such as machine learning, the algorithm learns how to evaluate and comprehend data on its own. As such, patterns that are not immediately visible to the human eye or brain may be detected by machine learning algorithms. Additionally, these algorithms get better at learning and interpreting the data as they are exposed to more and more fresh data.

Deep learning, a subset of machine learning, has also been applied by researchers to cancer imaging. Algorithms used in deep learning categorize data in a manner like to that of the human brain. Deep learning approaches involve "artificial neural networks," which are models of how brain cells receive, analyze, and react to signals from other regions of the body.

Research on AI for cancer imaging

To answer many queries, such as: Is this a cancerous mass or something else entirely?, doctors use cancer imaging tests. How quickly is it growing if it is cancer? To what extent has it proliferated? Is it regrowing following therapy? AI may help clinicians respond to those queries more quickly, accurately, and consistently, according to studies.

Early detection of cancer

People are routinely screened for precancerous cells, which have the potential to develop into cancer, or for symptoms of cancer with tests including Pap tests and mammograms. Early detection and treatment of cancer is the aim, ideally before it spreads or even develops.

AI technologies have been developed by scientists to support several cancer screening tests, including those for breast cancer. Though research in this field is rapidly changing, AI-based computer algorithms have been utilized to assist clinicians in the interpretation of mammograms for more than 20 years.

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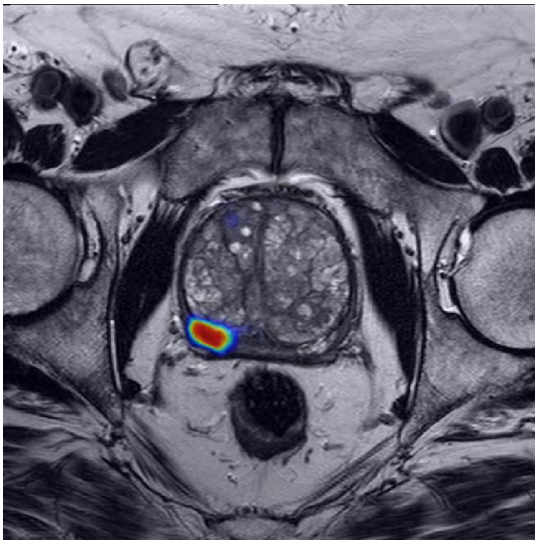
Finding cancer

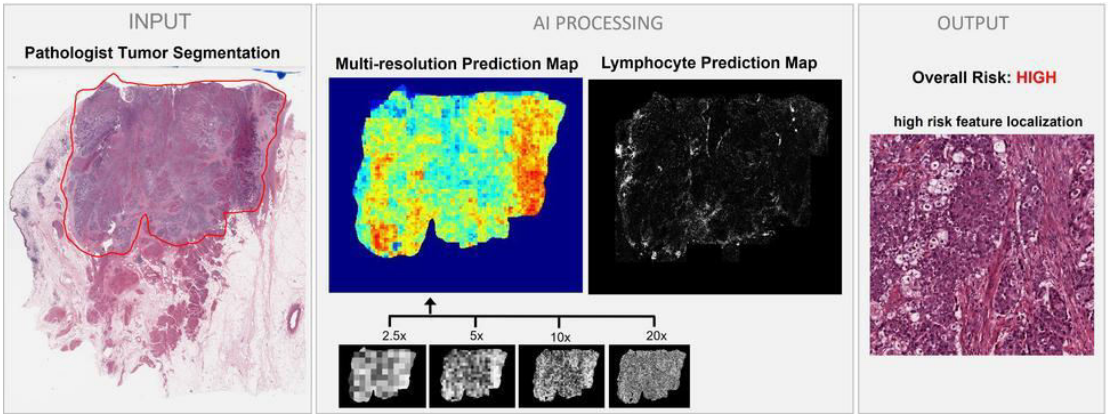
Additionally, AI has demonstrated the ability to enhance cancer detection in those exhibiting symptoms. Multiparametric MRI is a relatively new type of prostate MRI scan that may make it easier for radiologists to identify possibly aggressive prostate cancer. Dr. Turkbey and his colleagues at the NCI's Center for Cancer Research, for example, built an AI model for this purpose.



Selecting a cancer treatment plan

Imaging scans are another tool that doctors use to gather vital information about cancer, including its growth rate, whether it has spread, and whether it is likely return after treatment. Physicians using this information can select the best course of action for their patients.

According to a number of studies, AI may be able to more precisely and more fully extract prognostic information from imaging scans than humans can now. For example, Dr. Harmon and her colleagues have developed a deep learning model that can predict if a patient with bladder cancer would need additional therapy beyond surgery.



IV. FUTURE ASPECT

Are AI cancer imaging tools ready for production use?

Even though researchers are producing AI tools for cancer imaging at a rapid pace, the area is still in its infancy, and many concerns concerning the real-world uses of these tools remain unsolved.

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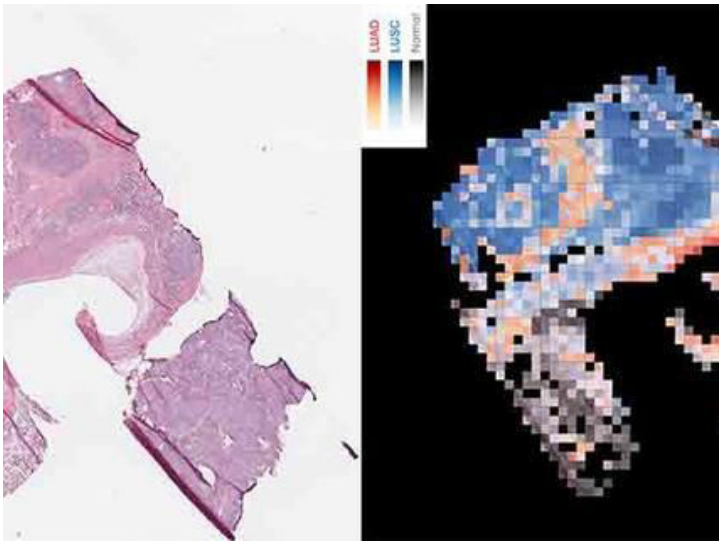

The Meaning of Cancer

A illness known as cancer occurs when some body cells proliferate out of control and invade other bodily regions. With trillions of cells making up the human body, cancer can begin practically anywhere. Human cells typically divide to create new cells as needed by the body by growing and multiplying. New cells replace old ones when they die as a result of aging or injury.

This controlled mechanism can occasionally malfunction, causing damaged or aberrant cells to proliferate and expand when they shouldn't. Tumors are lumps of tissue that can be formed by these cells. Cancerous or benign tumors can both occur.

V. CHALLENGES AND FUTURE DIRECTIONS

Healthcare AI holds great potential, but it also presents a number of difficulties, such as algorithmic fairness, data bias, governance, and security. A substantial amount of ongoing effort in healthcare AI is focused on creating ethical frameworks and standards. Healthcare AI stakeholders have been urged by the WHO to make sure that new technologies prioritize human rights and ethics in their development and application. We have previously addressed common concerns, such as the black-box nature of AI decisions, the impact on patient experience and shared decision-making, and who is responsible if AI is unable to make accurate predictions. A thorough analysis of ethical issues is outside the purview of this review.

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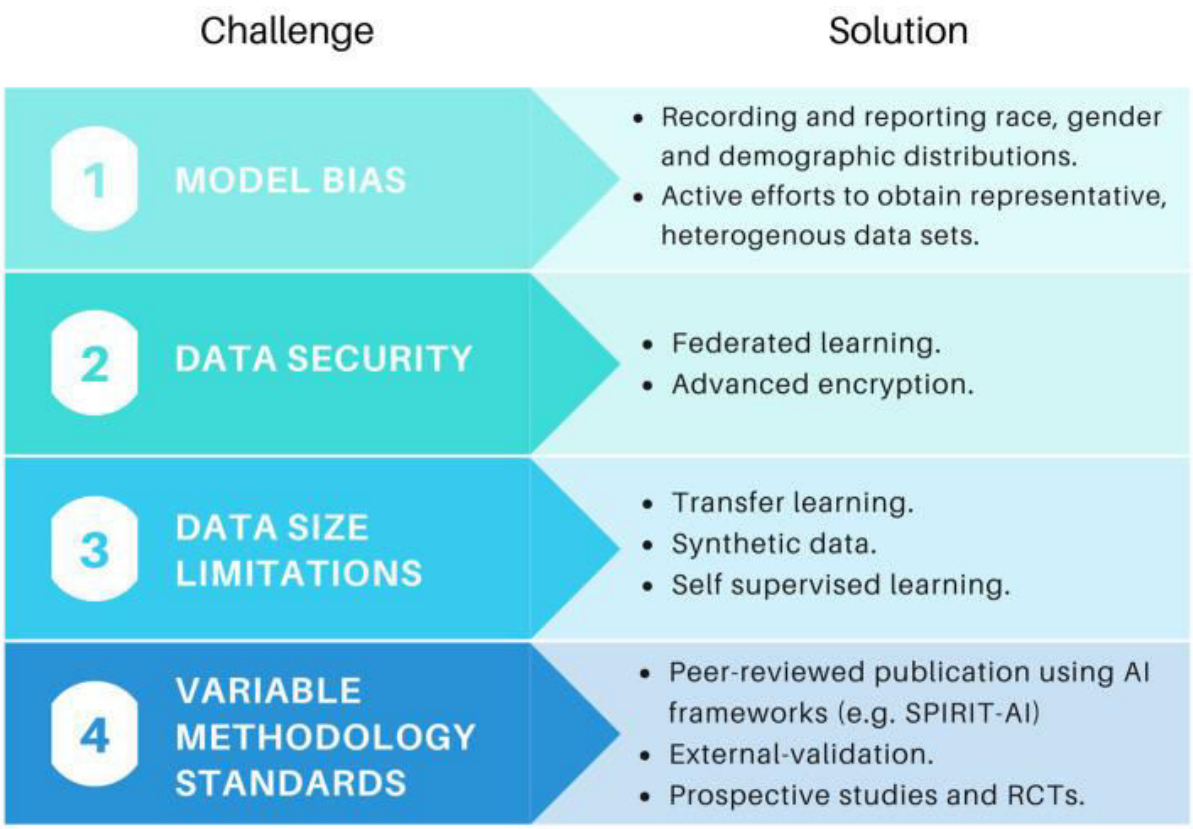

Challenges and possible solutions to improve the robustness of AI models in the future.

VI. CONCLUSION

As we've shown, integrating AI with healthcare data has the power to transform early cancer detection and help with capacity issues via automation. AI may make it possible for us to analyze complicated data from a variety of modalities, such as genomic, metabolomic, radiomic, and clinical text.

Numerous CNN models that have a demonstrated effect on workflow triage have been reported in this review. These models can accurately identify early-stage tumors on scan or biopsy pictures. There are now a lot of commercial options for automated cancer detection, and in the upcoming years, use of these solutions could rise.

We contend that care must be taken to guarantee that models are validated and published in peer-reviewed publications prior to usage in the context of symptomatic patient decision-support. Additionally, we found that there are a lot of obstacles to the use of AI, such as the time-consuming and expensive nature of data storage and anonymization for healthcare organizations. Additionally, we discussed model bias and its effects on generalizability, including the underreporting of crucial demographic data like race and ethnicity.

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