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Review Article

The Benefit of Artificial Intelligence in the Analysis of Malignant Brain Diseases: A Mini Review

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ABSTRACT

Brain diseases are considered life-threatening malignant diseases. Malignant brain diseases, such as glioblastoma multiforme (GBM) and metastatic brain tumours, present significant challenges as doctors and healthcare workers must constantly monitor the patient's condition due to their aggressive nature and limited treatment options. In recent decades, artificial intelligence techniques and practices have developed significantly in medical imaging disease diagnosis and contributing to the development of vaccines and vaccines. In this article, we will highlight the ability of artificial intelligence techniques to analyse and diagnose malignant brain diseases, enhance early detection of the disease, and help doctors treat patients. This article concluded that artificial intelligence is an essential part of assisting physicians to make suitable decisions in real-time, and it also has a significant role in clinical practices, improving patient outcomes and providing excellent healthcare to patients.

1. INTRODUCTION

In the medical domain, diagnostic imaging is one of the essential matters that is used to classify brain tumours and determine the type of tumour that the patient suffers from with high accuracy and in a short period [1][2]. This procedure contributes to determining appropriate and effective treatment to reduce the effects of the disease and improve patient outcomes. The integration of artificial intelligence technologies into medical systems has led to a significant improvement in the performance of health institutions in providing outstanding electronic healthcare while enhancing the accuracy of results and reducing human errors [3-5]. In recent years, especially after the COVID-19 pandemic, artificial intelligence has begun to make its way into various fields, and the medical domain is no exception [6][7]. The application of computer vision in medical systems has a significant impact in the field of image diagnosis and analysis, as it has proven its ability to keep up with specialists trained for this objective with high accuracy. Moreover, these systems can achieve these tasks in a significant, instantaneous manner, which is unimaginable for humans, who are limited by factors such as fatigue, exhaustion, and the speed of absorbing and extrapolating person-specific data. Computer vision is a branch of machine learning that grows and enhances based on convolutional neural networks [8][9]. These networks have a remarkable ability to find the most complex patterns hidden in a medical image based on pre-training, as they are provided with a large set of images of what they want to discover or classify with high accuracy [10][11]. This makes it an essential tool in classification tasks where there is incredible complexity when determining the type of tumour a patient has from medical images [12][13]. In other words, this complexity results from the significant anomalies present in these images in terms of location and shape and even the possibility of the presence of different diseases with a similar appearance in the patient, which is challenging to identify, even for specialists in the neurology domain. But there are other clinical tasks in which it can be used computer vision. In fact, there are a large number of medical tools that use digital systems to obtain images of the inside of the patient's body in different dimensions. Whether viewed in real-time, such as through ultrasounds and CT scans, or from impressions, such as MRIs and X-rays, it can be said that computer vision has a comprehensive and great scope in the

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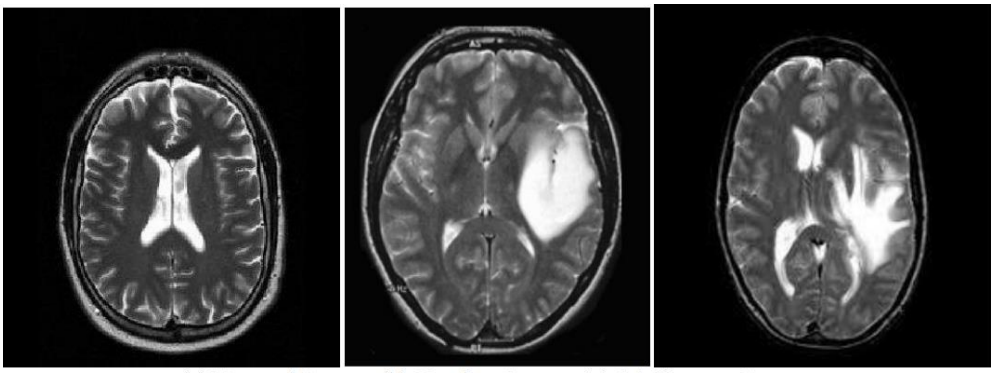
medical field. In the case of brain tumours, MRI is utilised because it is a medical examination that is not harmful to health and provides clear images of internal tissues with details (See Figure 1).



(a)Normal Image (b) Benign Image (c) Malignant Image

Fig. 1. The difference between normal and tumour brain images [14].

Malignant brain diseases (glioblastoma multiforme (GBM) and metastatic brain tumours) are diseases that grow rapidly and increase the number of deaths in the world. It requires the patient to pay significant attention to seeing a physician, making accurate early diagnoses, and following customised treatment strategies regularly. Artificial intelligence techniques, such as machine learning, have a significant role in improving the outcomes of brain tumours [15][16]. Machine learning algorithms have the remarkable ability to analyse huge amounts of neuroimaging data, allowing physicians to see the location of the disease and diagnose it more accurately and promptly [17][18]. These algorithms have the potential to compete with oncology experts. Brain tumours are malignant tumours that grow in the brain or near it. They can occur in brain tissue, including nearby nerves, the pituitary gland, and the membranes that cover the surface of the brain. These tumours have an aggressive nature and have a profound impact on patients' lives. The growth of these tumours makes their early detection and effective management a complex mystery for healthcare professionals. Traditional methods of diagnosing these tumours relied heavily on the experience of radiologists and pathologists who analyse medical images, tissue samples, and patient data by following straightforward strategies, as they have sufficient experience in diagnosing these complex images. In addition, their ability to quickly process a huge amount of information is limited and may sometimes need to be more accurate. Therefore, integrating artificial intelligence technologies and practices into the healthcare environment is considered a major transformative force in developing the capabilities of radiology and brain science specialists. These techniques have the ability to analyse a huge amount of information and have tremendous capabilities in managing data and diagnosing the disease with high accuracy in identifying subtle abnormalities and predicting the development of the disease with remarkable accuracy and speed within the patient’s body. The integration of machine learning algorithms into healthcare and neuroimaging is a significant paradigm shift in dealing with malignant brain diseases. These algorithms have a high potential to study disease behaviours, identify new patterns, and provide a combined and comprehensive vision for monitoring disease development. This mini review contributes to providing a comprehensive overview of the role of artificial intelligence in analysing malignant brain diseases and classifying and diagnosing the disease. Artificial intelligence contributes to enhancing the accuracy of diagnosis, customising treatment strategies, improving patient outcomes, and predicting disease development.

2. AI IN THE FACE OF MALIGNANT BRAIN DISEASES

The application of artificial intelligence techniques and machine learning algorithms in the field of treating neurological tumours has created a significant breakthrough in the way of dealing with malignant diseases that affect the human brain. The capabilities of artificial intelligence are being utilised across various phases of disease management, developing healthcare systems, and assisting physicians in the early detection of diseases and predicting treatment and effects. This section will discuss how artificial intelligence can be used to fight malignant brain diseases and assist physicians in making sound medical decisions.

Early disease detection is one of the primary aspects that all physicians call for adherence to. Identifying tumours, their types and locations in a timely manner can significantly affect treatment strategies, improve patient outcomes, and provide them with advice and treatment. Medical imaging analysis supported by artificial intelligence is a practical tool that aims to analyse tumour behaviour and identify abnormalities and disease areas. Machine learning algorithms analyse CT scans,

X-rays, and MRI scans with high and remarkable accuracy, providing complete details about deformities and tumours and distinguishing between benign and malignant diseases. Moreover, these algorithms contribute to reducing human errors and accelerating the process of diagnosis and classification of data and images. Artificial intelligence techniques are used in the surgical field, where surgeons use systems supported by artificial intelligence to enhance the accuracy of their work and the safety of removing brain tumours. These systems combine preoperative imaging data with the patient's reaction during the surgical procedure in real-time. This procedure assists surgeons to visualise the tumour's location accurately and its relationship to vital brain structures. It also seeks to reduce damage to healthy tissue and enhance surgical results. At significant, malignant brain diseases are heterogeneous, so it is preferable to design methods that contribute to treating patients by providing them with appropriate treatment. Machine learning plays a significant role in analysing genetic and molecular data, identifying the unique characteristics of the tumour, and finding the most practical treatment, as these procedures contribute to saving patients' lives and reducing side effects resulting from taking unnecessary medications. Artificial intelligence techniques contribute to creating models to predict the development of disease stages, analysing patient data and tumour characteristics while providing insights into how the tumour develops within the body and how the patient may respond to the treatment proposed by specialists. All the details displayed by artificial intelligence are essential to physicians because they assist them in making decisions and planning to perform surgery or treatment. Also, artificial intelligence helps discover and develop appropriate treatments for all stages of the disease, as machine learning algorithms can analyse large amounts of data for chemical compounds and predict their effectiveness against malignant brain tumours. Drug discovery and growth are among the priorities of artificial intelligence through the implementation of structures programmed to perform behaviours similar to specialists in drug and vaccine management [19][20]. There is another aspect of artificial intelligence, as it contributes to the development of radiology by creating an advanced approach that extracts quantitative information from medical images. This approach provides details that the human eye cannot see while providing information on the tumour's heterogeneity, shape, and relationship with the brain. The advantages offered by this approach are considered biomarkers for tumour characterization and disease diagnosis. The major goal of this approach is to assist healthcare workers and specialists in monitoring patients and seeing the precise details of the tumour. Continuous monitoring of patients is one of the most important priorities of healthcare workers because it contributes to saving lives, knowing the stages of progress of the treatment suggested for them, and collecting complete details about the patient. Systems that operate with artificial intelligence can assist in data analysis and report any signs indicating recurrence or progression of the disease and allow healthcare workers to intervene immediately, modify treatment plans, improve outcomes, and prevent dangerous stages that may lead to death. Machine learning algorithms are integrated into clinical trials and research studies, analysing patient data based on their medical records and identifying individuals who may benefit from experimental treatments, as they provide an environment in which patients can access advanced and practical therapies. The primary goal of creating predictive models based on artificial intelligence is to study the behaviour of clinical, radiological, and genetic data, as well as to assist in making decisions regarding treatment when dealing with aggressive brain tumours. Artificial intelligence helps reduce disparities in healthcare services and provides electronic services with significant resources. Moreover, the establishment of telemedicine allows people who live in distant areas to get to hospitals and establish continuous communication with physicians and healthcare workers.

3. CONCLUSIONS

Artificial intelligence techniques are valuable in healthcare institutions, especially in managing malignant brain diseases and early disease detection. These techniques have a role in directing surgery, individualising treatment, prognosticating, and determining the appropriate treatment for this disease. Therefore, the presence of these techniques contributes to developing the treatment of malignant brain tumours, enhancing patient outcomes, providing them hope, and saving their lives. Moreover, artificial intelligence techniques are characterised by providing practices for protecting patient data through a set of regulatory frameworks and not allowing anyone to manipulate it or make any modifications. Therefore, the presence of these techniques in the systems of health institutions is considered necessary in the face of malignant brain diseases. Artificial intelligence techniques are constantly growing and have high potential in developing healthcare workers and helping them in continuous monitoring of patients and saving their lives.

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Conflicts Of Interest

The author's disclosure statement confirms the absence of any conflicts of interest.

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