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Insights on Artificial Intelligence in Computer Aided Diagnosis and Awareness of Changes in Brain Imaging

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Introduction

Cancer is currently one of modern medicine's most difficult challenges. They account for nearly a quarter of all deaths worldwide, placing them second only to circulatory diseases as the leading cause of death. The reason for this is the relatively low detection rate, combined with high treatment costs and the possibility of tumour recurrence. There are numerous types of neoplastic diseases and the majority of them necessitate specialised treatment and diagnosis, making cancer a diverse group of illnesses. Lung, colorectal, breast and prostate cancer are the most common cancers, accounting for up to 44% of all cancer-related deaths. The listed neoplastic diseases have a high prevalence due to their commonness and lethality, but there are much deadlier types of tumours.

A group of central nervous system disorders, such as brain tumours, could be an example of this. While brain tumours are not the most common type of neoplastic disease (accounting for approximately 1.8% of cancers worldwide in 2020), they are among the deadliest, accounting for over 250 thousand deaths in 2020, with a five-year survival rate ranging from 75% for children to only 21% for middle-aged people. Furthermore, brain tumours are one of the most common cancerous diseases in children, accounting for 26% of all cancer cases, making them the second most common neoplastic disease after leukaemia.

Discussion

According to the WHO Classification of Tumors of the Central Nervous System, brain tumours are classified into 12 categories, with 120 different types. It is impossible to find a comprehensive dataset with sample images from all possible classes because this data is rare, unbalanced and restricted for privacy and data ownership reasons [1-3]. Furthermore, artificial intelligence algorithms necessitate specific data labelling, which must be performed by a professional, which is often not a priority and raises costs, resulting in fewer properly labelled data sources. As a result, the focus of this work is on a publicly available dataset, glioma, meningioma and pituitary tumours are the three tumour types. Gliomas account for 80% of all malignant brain tumours, with some subtypes being more common in adults (Glioblastoma) and others being more common in children.

Meningiomas, on the other hand, are one of the most common non-malignant brain cancers in adults (over 50% of all cases), whereas pituitary tumours are common non-malignant cases in children (almost 20% of all cases). Because brain cancers only manifest symptoms at a late stage of development and because even identifying the tumour type may necessitate an invasive examination, such as a biopsy, they are a group of diseases that necessitate particularly robust diagnostic methods [4,5]. Magnetic Resonance Imaging (MRI) is regarded as one of the most effective examination methods for central nervous system tumours. It is a type of imaging that provides doctors with a wealth of information about the presence of pathological lesions, their location, size, malignancy and even specific types.

Conclusion

This information, however, is not obtained directly from the examination; it must be extracted from the pixels. Because the MRI method produces dozens of grayscale images, it generates a large amount of data that must be interpreted. Leaving this task to a doctor to complete manually not only increases the time required for a diagnosis, but it also has an impact on the method's robustness, as it is possible to overlook the lesion, particularly when looking at a large number of similar images in IoT healthcare systems. That is why Computer Aided Detection (CAD) algorithms exist.

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