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A survey on brain tumor image analysis

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Abstract

Medical imaging, also known as radiology, is the field of medicine in which medical professionals recreate various images of parts of the body for diagnostic or treatment purposes. Medical imaging procedures include non-invasive tests that allow doctors to diagnose injuries and diseases without being intrusive TechTarget (n.d.). A number of tools and techniques are used to automate the analysis of medical images acquired with various image processing methods. The brain is one of the largest and most complex organs of the human body and anomaly detection from brain images (i.e., MRI, CT, PET, etc.) is one of the major research areas of medical image analysis. Image processing methods such as filtering and thresholding models, geometry models, graph models, region-based analysis, connected component analysis, machine learning (ML) models, the recent deep learning (DL) models, and various hybrid models are used in brain image analysis. Brain tumors are one of the most common brain diseases with a high mortality rate, and it is difficult to analyze from brain images for the versatility of the shape, location, size, texture, and other characteristics. In this paper, a comprehensive review on brain tumor image analysis is presented with basic ideas of brain tumor, brain imaging, brain image analysis tasks, brain image analysis models, brain tumor image features, performance metrics used for evaluating the models, and some available datasets on brain tumor/medical images. Some challenges of brain tumor analysis are also discussed including suggestions for future research directions. The graphical abstract summarizes the contributions of this paper.

Keywords: Brain tumor; Deep learning; MRI; Machine learning; Medical image analysis; Tumor detection; Tumor features; Tumor segmentation.

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