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Brain Tumor Classification Using Deep Learning Methods

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Abstract

Background: A World Health Organization (WHO) February 2018 report recently has shown that the rate of deaths because of brain or central nervous system (CNS) cancer has the highest rate in the Asian continent. Timely and accurate diagnosis of brain tumor is crucial where small errors pose many risks to treatment. Classifying the types of tumors is an important factor in targeted treatment. Since tumor diagnosis is highly invasive, time-consuming, and costly, there is an urgent need for a precise tool to develop a non-invasive, cost-effective, and efficient tool for brain tumor description and grade estimation. Brain scans by using magnetic resonance imaging (MRI), computed tomography (CT), and other imaging techniques are fast and safe to detect tumors.

Methods: In this paper, we used a standard dataset containing 3064 images from different skull views. The size and position of tumors at different angles make it difficult to detect the tumor in the specimens. This MRI dataset consisted of 3064 slices and 1047 coronal images. Coronal images were recorded from behind. Axial images taken from above included 990 images. Also, there were 1027 sagittal images extracted from the skull side. Images in this dataset belonged to 233 patients. The dataset consisted of 708 Meningioma, 1426 Glioma, and 930 Pituitary tumors; thus, we isolated images from different angles of sagittal, coronal, and axial images and then trained them in different categories by using Inception-V3 and Resent, which are deep learning classification methods to make this process more accurate and faster.

Results: Finally, by adjusting the hyper-parameters of each of these methods with performing pre- processing and weighting combinations, we obtained an acceptable evaluation compared to previous methods.

Keywords: Deep/Machine Learning; Medical Imaging; Classification; Brain Tumor; MRI

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Mobile Devices for Viewing Medical Images: A Review of the Literature

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Abstract

Background: The use of portable computing devices, in particular smartphones, is growing rapidly in healthcare. Several studies have reported that physicians can use tablet computers and smartphones for viewing medical images, but it is not clear to what extent and under which circumstances this approach is acceptable.

Objectives: The purpose of this study was to summarize the current evidence on the use of mobile computing devices (tablet computers, smartphones, and personal digital assistants) in viewing medical images.

Methods: We systematically searched PubMed, Scopus, and Web of Science for original studies that reported the use of any kind of portable computing devices, including tablet computers, smartphones, and personal digital assistants, for viewing radiologic examinations and other medical images. The keywords included mobile phone, m-health, radiology, tele-radiology, radiography, smartphone PACS, and PACS viewer. The electronic search was limited to papers in the English language and the publication date of 2008 onward. After removing duplicates and screening of 327 unique records at the title/Abstract level, the full texts of 137 potentially relevant papers were retrieved and checked against inclusion criteria. Finally, 37 papers were included in this study and reviewed.

Results: Both smartphones and tablet computers have been used by radiologists and physicians with other specialties including surgeons, or-

thopedists, emergency physicians, cardiologists, and neurologists. This usage was more dominant where image viewing played an important role in clinical decision making. A range of modalities of medical imaging from plain radiography, to angiography, computed tomography scan, and magnetic resonance imaging (MRI) were reported in the reviewed studies. Although the level of evidence was not high, it was indicated that the size of the smartphone's screen did not affect the clinical performance. More than half of the studies compared the outcome of images viewing using PACS workstations with smartphones and they concluded that there was no significant difference between them. A number of studies have reported that the use of smartphones was associated with the faster interpretation of medical images.

Conclusion: Current literature indicates that smartphones can be used for viewing medical images by clinicians and the outcome is comparable with that of desktop workstations, but further research is needed to confirm these findings.

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Making EEG Experiments Retrievable for Research Purpose: The Preliminary Experience of Standardization of EEG Data in Iranian Brain Mapping Biobank

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Abstract

Background: Increasing technological advances in the field of biological signal recording, along with diverse available data storage and sharing facilities, has made it much easier for researchers to access extensive biological data for use in their studies. Today, data once recorded in a study can be repeatedly reused by other researchers through access to shared databases. Access to biosignal pools, on the one hand, can save considerable energy and reduce costs by preventing duplicate studies. On the other hand, it improves opportunities for meta-analysis and in-depth studies using diverse datasets with greater statistical power, which provides more reliable results, as well as new insights into biological issues. However, the lack of some agreed-upon data standardization and consistency across the research community creates some barriers to reusing data. Data from different studies often have different formats and structures, which may impose extensive data reformatting for meta-analysis and comparative studies. Moreover, there is no standardized structure for organizing biosignals-associated information (e.g. subject demographics or recording technical information) throughout the research community, which may impair subsequent data reporting and analysis due to the lack of some necessary information.

Objectives: In this article, we briefly report on the efforts made by the Iranian Brain Mapping Biobank (IBMB) to develop a standardized format and structure for recording and archiving electroencephalography (EEG) signals.

Methods: In the process of developing a new EEG data structure in IBMB, we focused on three main issues, as follows: (1) what information should be combined with EEG signals as metadata? There is still no agreement on the content of EEG metadata. Thus, in many cases, the recording of information needed for subsequent EEG signal analysis is neglected. By reviewing the international guidelines on EEG performing and reporting (e.g. [1, 2]) along with by consulting the experts from various fields, we proposed a structured template for recording EEG metadata. (2) Which file format is best suited for storing EEG data? To date, many different data formats for storing EEG have been introduced (e.g. EDF, GDF, and TXT). These formats differ in terms of data type, combined metadata content, storage structure, and storage requirements (for an overview see [3]). Although some of these formats are widely accepted, there is no comprehensive format that can meet all the requirements. The format considered by IBMB addresses the needs for a basic format, which is compact while it can save numerical data with high precision, can be easily used in popular processing applications, and can accommodate the suggested EEG metadata. (3) How to organize EEG datasets structurally? The brain imaging data structure (BIDS) project [4] and EEG study schema (ESS) [5] are among a few recently important efforts to create an infrastructure for structured EEG storage. In line with such efforts, we developed a new hierarchical data structure to store EEG data, which can facilitate EEG data retrieval and sharing.