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.

Findings: IBMB has developed a customized EEG header consisting of 60 elements, including subject demographics, and data technical information, which covers data syntactic, semantic, and pragmatic aspects. This metadata combined with EEG is organized into three main hierarchical levels of Study, Session, and Task, corresponding to the same levels of physical EEG storage.

Conclusion: We introduced a new EEG data structure hierarchy and file content with embedded header information. This data structure encompasses all the information needed for reporting and analyzing EEG; thus, it can facilitate EEG data reuse, as well as large-scale analysis. We propose this approach for archiving EEG datasets in research-oriented EEG repositories.

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Prediction of General Intelligence Using DTI Data

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Abstract

Background: Intelligence can be defined as the capability of a person to purposeful performance, logical thinking, and effective interaction with the environment. What we study as intelligence is a collection of talents, such as memory, accuracy, learning, and perception, which are different in different individuals.

Objectives: Using diffusion tensor imaging (DTI) data, we studied relationships between mean fractional anisotropy (FA) in brain structural pathways and full-scale general intelligence (FSIQ) scores.

Methods: The structural connectivity matrix for the whole brain was estimated using 116 regions defined by the AAL atlas. The superiority of this study to others was that the ROIs covered the whole brain and each node represented a small region of the brain; thus, the related connections would be more specific. We identified connections and features that played key roles in FSIQ. Besides, FSIQ was predicted using four regression techniques and the results were compared. The dataset consisted of the data of 29 subjects (15 males and 14 females), with the age range of 18 - 28 years, and the mean age of 25.10 years, recorded in our national brain mapping lab (NBML), Tehran, Iran. All the subjects were healthy, without any brain damage. In addition, none of them had a history of mental illness, brain surgery, or brain-damaging disease. All DTI data were processed using Explore-DTI software to perform eddy current correction and motion correction. Then, all images were registered to the AAL atlas template with 116 nodes using the Explore-DTI software (version 4.8.6). For each subject, DTI-based tractography was done for the whole brain by a deterministic approach based on streamline algorithms. FSIQ was measured using the WAIS-III test. This score was calculated by assessing cognitive abilities such as verbal reasoning, attention to verbal principles, fluid reasoning, spatial processing, and visual stimulations. The dataset mean (standard deviation) of the FSIQ scores was 96.93 (± 10.24). To identify the most important connections for FSIQ prediction, we performed a linear regression between each variable and the FSIQ scores. The significant variables were selected as the connections related to the FSIQ scores. To remove collinearity among variables, a correlation analysis was performed and variables that had a high correlation with another variable ($r > 0.95$) were deleted. Moreover, to reduce the number of features, PCA was applied to the remaining connections. Then, four regression models including linear regression, a support vector regression, a convolutional neural network, and a multilayer perceptron were applied to the data to predict the intelligence scores. In this case, 48 connections were selected after applying correlation analysis and 14 features were the outcome of the PCA step. Highly connected nodes were in the prefrontal,