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Data consolidation and analysis system for brain research

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Comprehensive human studies, in particular studies in the field of brain pathology, require strong information support for the consolidation of clinical and biological data from different sources in order to allow processing and analysis of data. The heterogeneity of data sources, the variety of presentation formats and the resource-intensive nature of preprocessing make it difficult to conduct comprehensive interdisciplinary research. Combining data for each individual case is a time-consuming process that requires not only time, but profound knowledge in the field of information technology. To solve the problem of sharing heterogeneous sources of clinical and biological species in brain research, an information system with unified access to heterogeneous data is required. Effective implementation of such a system requires creating a model for combining disparate data into a single information environment and adapting preprocessing methods applied individually to each individual data type. The introduction of a model that solves the fundamental problem of consolidating medical and biological data in the form of a cloud service will solve the problem of organizing researchers' access to consolidation results, and equalizing the geographical distribution of research groups and equipment. We analyze the possibilities and methods of consolidation of clinical and biological data, build a model for the consolidation and interaction of heterogeneous data sources for brain research, programmatically implement the model as a cloud service, and provide an interface for supporting queries in a format encapsulating a complex consolidation architecture from the user. We present the design and implementation of an information system for the collection, consolidation and analysis of patient data; we show and discuss the results of the application of cluster analysis methods for the automatic processing of voxel based magnetic resonance imaging data to facilitate the early diagnosis of Alzheimer's disease. Our results show that a detailed study of the properties of cluster analysis data can significantly help neurophysiologists in the study of Alzheimer's disease, especially with the help of automated data processing provided by the proposed information system.

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