

LARGE-SCALE ANALYSIS, MANAGEMENT, AND RETRIEVAL OF BIOLOGICAL AND MEDICAL IMAGES

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ABSTRACT

Biomedical image data have been growing quickly in volume, speed, and complexity, and there is an increasing reliance on the analysis of these data. Biomedical scientists are in need of efficient and accurate analyses of large-scale imaging data, as well as innovative retrieval methods for visually similar imagery across a large-scale data collection to assist complex study in biological and medical applications. Moreover, biomedical images rely on increased resolution to capture subtle phenotypes of diseases, but this poses a challenge for clinicians to sift through haystacks of visual cues to make informative diagnoses. To tackle these challenges, we developed computational methods for large-scale analysis of biological and medical imaging data using simulated annealing to improve the quality of image feature extraction. Furthermore, we designed a Big Data infrastructure for the large-scale image analysis and retrieval of digital pathology images and conducted a longitudinal study of clinician's usage patterns of an image database management system (MDID) to shed light on the potential adoption of new informatics tools. This research also resulted in image analysis, management, and retrieval applications relevant to dermatology, radiology, pathology, life sciences, and palynology disciplines. These tools provide the potential to answer research questions that would not be answerable without our novel innovations that take advantage of Big Data technologies.