Machine Learning for Application of Advanced Biomedical Imaging and Sensing

With advancement in biomedical imaging and medical technologies have been providing us explosive volumes of biological and physiological data, such as medical images, electroencephalography, genomic and protein sequences. The amount of data generated by multimodality image techniques has grown exponentially and the nature of such data is increasingly become more complex. Learning from these data facilitates the understanding of human health and disease. This poses a great challenge on how to develop new advanced imaging methods and computational models for efficient data processing, analysis and modelling in clinical applications and in understanding the underlying biological process. Biological researchers face the current challenge of making effective use of the enormous amount of electronic biomedical data in order to better understand and explain complex biological systems. The biomedical data repositories include data in a wide variety of forms, including bibliographic information from electronic medical journals, gene expression data from microarray experiments, protein identification and quantification data from proteomics experiments, genomic sequences gathered by massively parallel sequencing, and patient healthcare records. The ability to automatically and effectively extract, integrate, understand and make use of information embedded in such heterogeneous – structured and unstructured – data remains a challenging task.

Developed from artificial neural networks, deep learning-based algorithms show great promise in extracting features and learning patterns from complex data. The use of machine learning techniques within the field of Biomedical Imaging & Sensing has risen in recent years. Applications within the literature have included diagnostics, image reconstruction, and the generation of synthetic human data. In terms of methodologies employed within this field, the last few years have seen the rise of deep learning techniques within this field, and the increasing use of novel methodologies such as generative adversarial networks and natural language generation. This field is also becoming increasingly accessible to researchers in Medicine and Biology who have not traditionally been machine learning practitioners

The purpose of this special issue aims to provide a diverse, but complementary, set of contributions to demonstrate new developments and applications of advanced imaging analysis in the multimodal biomedical imaging area. The ultimate goal is to promote research and development of advanced imaging analysis for multimodal biomedical images by publishing high-quality research articles and reviews in this rapidly growing interdisciplinary field. To this end, scholars and practitioners from academia and industrial fields are invited to submit high-quality original contributions to this special issue.

Topics of Interest

The relevant topics include the following (but not limited to):

- Classical machine learning techniques for image analysis
- Machine learning and health outcomes
- Machine learning for biomedical sensing
- The generation of synthetic patient data
- Quantitative image analysis
- Deep learning and diagnosis
- Biomedical image reconstruction
- The generation of natural language descriptions of biomedical images
- New algorithms, models and applications of advanced imaging methods
- Multimodal imaging techniques: data acquisition, reconstruction; 2D, 3D, 4D imaging, etc.)
- Translational multimodality imaging and biomedical applications (e.g., detection, diagnostic analysis, quantitative measurements, image guidance of ultrasonography)
- Variational and combinatorial optimisations for biomedical imaging and image analysis
- Advanced Biomedical image analysis (image processing, Statistical and probabilistic methods for biomedical imaging and image analysis, Machine learning in biomedical imaging and image analysis)
- Visualization
- Biomedical and clinical text mining applications
- Big bio- or clinical- data analytics
- Integration of structured and unstructured resources for biomedical applications
- Information extraction from biomedical and clinical corpora (published literature, grey literature, EHRs, clinical trials, etc.)
- Information retrieval from large biomedical data collections
- Gene sequence annotation
- Protein/RNA structure prediction
- Medical Ontologies and Text Mining
- Entity or Concept recognition in text with ontologies
- Sequence and structural motifs
- Modeling of biochemical pathways and biological networks
- Image Mining in Medical and healthcare informatics
- Data and text Mining solutions in biomedical informatics
- Information integration for Data and Text Mining
- Mining multi-relational data

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