Introduction to Data Analysis and Visualization in Biomedical Informatics Minitrack

Hesham H. Ali, College of Information Science and Technology, University of Nebraska at Omaha
Kathryn M. Dempsey, Department of Pathology and Microbiology, University of Nebraska Medical Center

The availability of large biological and medical data continues to be the source of major challenges and opportunities in biomedical research and health care industry. New advances in medical technologies promise to produce even more data in the near future and the main question in biomedical research has been how to extract useful knowledge for such wealth of raw data. The development of innovative tools to integrate, analyze and mine such data sources is a key step towards achieving large impact levels. In addition, advanced tools for visualizing biomedical data at various processing stages are critical in maximizing the value of its utilization. As a result, attention has been shifting recently for a focus on data generation technologies to data analysis and data visualization tools. Such tools are critical in taking full advantage of the public and private data currently available to all biomedical researchers.

The focus of data analysis and data visualization in biomedical research highlights the current state of research in the key biomedical research areas such as bioinformatics, medical informatics, public health informatics and biomedical imaging. Main topics to be covered in this mini-track include development of algorithms and tools aimed to solve the vast spectrum of challenging data utilization problems appearing in health care and in various areas related to biomedical research, particularly issues related to the ability to utilize Biological and Clinical databases.

In the first paper of the mini-track, “Optimize Querying of LOINC® with an Ontology: Give Me the Chlamydia Tests the Epidemiologists Want Me to Use!” the authors developed an ontology that classifies the terminology used to describe LOINC® coded tests, which represent criteria developed to create laboratory tests to be reported to public health agencies. The proposed method creates a new ontology term with a logical definition for each lab test. The ontology can be used to query for logic using terms familiar to epidemiologists and to allow the user to visualize selected codes.

The second paper of the mini-track, entitled “A Fuzzy Neural Approach to Classifying Low Back Disorders Risks,” presents an adaptive model for classifying low back disorders risks using neuro-fuzzy inference modeling. The paper also highlights the need for rigorous data sampling, calibration and testing. The obtained results support the validity of using fuzzy neural network approaches to classify medical data.

The third paper titled, “Improve Retrieval Performance on Clinical Notes,” addresses the important issue of query expansion in medical literature and clinical notes search. The authors reviewed several expansion methods, and performed quantitative comparison of search accuracy. The paper explores ways to improve information retrieval from clinical notes and presents various experimental methods that use medical literature in information retrieval. With the assumption that previously known methods have strengths and weaknesses, the authors hypothesize that integrating information retrieval techniques will improve performance. As a result, an integrated approach was implemented and tested. The authors also address common problems with query expansion and why it is difficult to catch all terms/information related to medical terms.

The forth paper, “Visual Analytics for Public Health: Supporting Knowledge Construction and Decision-Making,” demonstrates how visual analytics enable health professionals to understand complex injury data and positively impact decision making process. The paper shows that visual analytics allows for better understanding and analysis of large-scale data and improve diagnosis. The authors argue how such tool can improve collaboration among health care professionals and patients resulting in better decision-making.

The final paper of the mini-track, “Towards Enhanced Accuracy in Medical Diagnostics,” focuses on improving data analysis of ultrasound images. The proposed model incorporates statistical and clinical data of ultrasound scans to predict survivability. Preliminary results on multiple applications of the method suggest a reduction in diagnostic variability.

The amount of available biomedical data continues to grow in an exponential rate and the development of innovative tools to integrate, analyze and visualize such data is a key step towards achieving large impact levels. We hope that the articles included in this mini-track provide another step towards achieving this objective.