

▼ Introduction to Advanced Bioinformatics Tools for Translational Research Minitrack

Hesham H. Ali
University of Nebraska at Omaha
hesham@unomaha.edu

Simon Sherman
University of Nebraska Medical Center
ssherm@unms.edu

In the current Information age, further progress of Medical Sciences requires successful integration with Computational and Information Sciences. This minitrack provides a number of innovative ways of how such integration can be achieved via translational research. Translational research is aimed to connect basic science and clinical research. In the medical domain, basic research focuses on the development of analytical and experimental methods to better understand physical, chemical and biological processes on the molecular, cellular, tissue and organism levels. Clinical research focuses primarily on the improvement of patient care and clinical outcomes. The papers of this minitrack provide a diverse spectrum of how Bioinformatics tools can help to effectively transfer new knowledge from bench to the clinic and from clinic back to the bench.

The massive size of the current available biological and medical databases and its high rate of growth have a great influence on the types of research currently conducted. Also, researchers are focusing more than ever to maximize the use of these databases. Hence, it would be of great advantage for researchers to utilize the information stored in the available databases to extract new information as well as to understand various biological and medical phenomena. This is particularly critical in managing biological and clinical data. Relevant data is available in different shapes and forms, and employing all available data to extract meaningful properties is an enormous task. Heterogeneous data obtained from microarrays, mass spectrometry experiments, biomedical publications and clinical records can all be used to find potential correlations between various data elements and their properties in the clinical domain.

The first paper of the minitrack, “The Impact of Directionality in Predictions on Text Mining,” by Gondy Leroy et al. introduces new data mining tools to allow biomedical researchers to take advantage of the knowledge included in the currently available medical publications. The developed tools use co-occurrence

relations to identify relevant references. The authors show how the outcome of the text mining process can be positively impacted by incorporating the new parameter of directionality in the relations between concepts. The hypothesis is supported by an experimental testbed of directional relations obtained from the abstracts of biomedical manuscripts.

The second paper in the minitrack, “RFLP-WAVE Analysis for Rapid Identification of Medically Important Fungi,” by Bastola et al. links a variety of molecular techniques such as PCR, cloning, RFLP and HPLC to computational methods to identify a family of microorganisms. Individually, the bench diagnostic tools have many limitations. The proposed molecular diagnostic tool utilizes relational databases and computer algorithms to capture all the strengths of individual molecular techniques to achieve the overall goal of molecular fungal identification. The development of such a powerful tool emphasizes the need for collaborative research that combines molecular biology and computational sciences.

The third paper of the minitrack, “Tree Mining in Mental Health Domain,” by Maja Hadzic et al. introduces a methodology for applying tree mining algorithms in the organization and analysis of patient records in the area of mental illness. With the help of tree mining algorithms and records of mentally ill patients, common patterns can be identified. The extracted data patterns can provide useful information to help in learning more about mental illness and assist in delivery of efficient mental health services. The authors have correctly identified the need for advanced IT techniques to extract useful knowledge from the raw data available in many medical databases.

Effective migration of results obtained from basic research into clinical applications is an extremely challenging task, but such translational research can benefit significantly from advanced Bioinformatics tools. We hope that the articles of this minitrack provide a step towards achieving this objective.