Data Science Seminar

Hosted by the Department of Mathematics and Statistics

- Date: Tuesday, November 28, 2023
- Time: 12:00-1:00 EST
- Room: zoom
- Speaker: Dr. Li Zhang (University of California San Francisco)
- Title: NAIR Software: Unlocking the Immune System's Secrets by Network Analysis and Advanced Machine Learning.

Abstract

Immunotherapy has revolutionized cancer treatment, which depends on the immune system to mediate responses. Significant advances have been made through high-dimension sequences to dissect the immune responses in patients. T cells play a vital role in our body's immune defence, combating cancer. Advanced sequencing technology allows us to delve deeper T-cell receptor (TCR) repertoire and gene expression. To better understand the adaptive immune system, we have developed the Network Analysis of Immune Repertoire (NAIR) software, utilizing cutting- edge statistical approaches and machine learning tools. NAIR constructed sequence networks, and more importantly, it can identify critical disease-associated TCR clusters and shared public TCR clusters across multiple samples. This reveals potential disease-specific signatures, paving the way for targeted therapies. NAIR accommodates both bulk and single-cell sequencing data, unravelling insights at cell level. Expanding NAIR's capabilities, we've integrated single-cell gene expression data using a Graph deep learning model, offering unprecedented insights into T cell functionality. Additionally, NAIR employs an innovative technique to predict binding peptides by integrating TCR sequence vectorization, V/J gene and HLA genotype in a deep learning framework. Through network analysis, advanced statistics, and deep learning, NAIR represents a powerful platform to unlock the complex interplay between adaptive immune system, disease progression, and clinical outcomes, advancing our understanding of immune system dynamics..

Biography of the speaker: Dr. Li Zhang is a Professor of Biostatistics in the Department of Medicine, Division of Hematology and Oncology, with a joint appointment in the Department of Epidemiology and Biostatistics at the University of California San Francisco (UCSF). She obtained her Ph.D. in Statistics from the University of Florida, and before joining UCSF, she was an Assistant Professor at the Cleveland Clinic. She has extensive experience in applying statistics and developing advanced approaches in biomedical research and expertise in cancer research with high-throughput sequencing data analysis. She has published more than 150 papers and designed more than 60 Phase I and II clinical trial studies. Dr. Zhang also serves on Global Action Plan 6 Project for Movember Foundation as the UCSF site PI. She has been or is on multiple NIH, DOD, and foundation grants as a co-Investigator. Her research interest focuses on Immuno-informatics, and she is currently the PI on NIH

R21 and R01 projects focusing on cancer Immunoinformatics. In addition to regularly teaching Biostatistics and serving on students' master committee at UCSF, she leads the UCSF's Fellowship Advancement and Skills Training in Clinical Research (FASTCaR). She also initiated and organizes the annual UCSF cancer center Biostatistics workshop, which aims to provide education to scientists, post-docs, and technicians. Dr. Zhang is very active member of professional community, she was the president of the San Francisco Bay Area Chapter of American Statistical Association (SFASA), now serves the Director of Education in SFASA. She is also a member of the Pathways To Promotion Committee of ASA Statistical Consulting Section. She received outstanding services award from ASA in 2021.