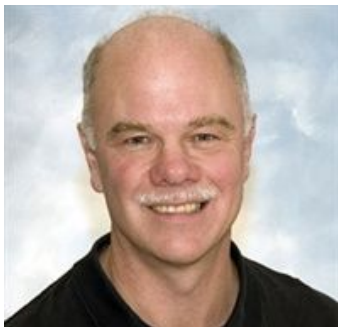
Bilkent EEE Distinguished Seminar Series



Neuroimage Analysis in Autism: from Model-based Estimation to Data-driven Learning

Prof. James S. Duncan

Yale University

Tuesday, March 19, 2024 – 17:30 (online)

https://t.ly/BilEEESem240319

Functional magnetic resonance imaging (fMRI) has been shown to be helpful for the study of autism spectrum disorders (ASD). This talk will describe the evolution of efforts in this area within our group that carry promise for producing objective biomarkers for ASD, as well as predicting patient response to a behavioral therapy known as Pivotal Response Treatment (PRT), using task-based fMRI. Such biomarkers would provide an important step for better understanding the underlying pathophysiology of ASD that could help with objective and personalized diagnosis, provide new targets for development of new treatments, and provide a way to monitor patient progress. Initially a robust, group-wise unified Bayesian framework to detect both hyper and hypo-active communities from connectivity maps will be described. Next, more recent work will be presented that has focused on deriving ASD biomarkers from individual subject's time-series data, based on the classification of individual subjects (into ASD or typical control) and identifying spatially-specific key regions using graph convolutional neural networks and ablation analysis of regions. In addition, a strategy based on recurrent neural networks (using long-short-term memories or LSTMs) will be presented that predicts patient response to PRT behavioral therapy from baseline imaging while incorporating subject-specific phenotypic information for network initialization. Finally, initial efforts on the use of a spatiotemporal transformer strategy for classification and early work on the use of effective connectivity based on whole brain dynamic causal modeling as an alternative or an adjunct to functional connectivity for classification and biomarker analysis will be discussed.

Bio: James S. Duncan is the Ebenezer K. Hunt Professor of Biomedical Engineering and a Professor of Radiology & Biomedical Engineering, Electrical Engineering and Statistics & Data Science at Yale University. Dr. Duncan received his B.S.E.E. with honors from Lafayette College, his M.S. degree from the University of California, Los Angeles and his Ph.D. in Electrical Engineering from the University of Southern California. He is currently the Chair of the Department of Biomedical Engineering. Dr. Duncan's research efforts have been in the areas of computer vision, image processing, and medical imaging, with an emphasis on biomedical image analysis and image-based machine learning. He has published over 300 peer-reviewed articles and has been the principal investigator on a number of peer-reviewed grants from both the National Institutes of Health and the National Science Foundation over the past 35 years. He is a Life Fellow of the Institute of Electrical and Electronic Engineers (IEEE), and a Fellow of the American Institute for Medical and Biological Engineering (AIMBE) and of the Medical Image Computing and Computer Assisted Intervention (MICCAI) Society. In 2014 he was elected to the Connecticut Academy of Science & Engineering. He has served as co-Editor-in-Chief of Medical Image Analysis, Associate Editor of IEEE Transactions on Medical Imaging, and on the Editorial Board of the Proceedings of the IEEE. He is a past President of the MICCAI Society. In 2012, he was elected to the Council of Distinguished Investigators, Academy of Radiology Research and in 2017 received the "Enduring Impact Award" from the MICCAI Society. He served as General Co-Chair of the 2023 MICCAI meeting in Vancouver, Canada.