Biomedical Informatics Grand Rounds
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Brain imaging genetics for Alzheimer's disease: integrated analysis and machine learning

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Bio: Li Shen, Ph.D., is a Professor of Informatics in the Department of Biostatistics, Epidemiology and Informatics at the Perelman School of Medicine in the University of Pennsylvania. He is an elected fellow of the American Institute for Medical and Biological Engineering (AIMBE). He obtained his Ph.D. degree in Computer Science from Dartmouth College. The central theme of his lab is focused on developing computational and informatics methods for integrative analysis of multimodal imaging data, high throughput omics data, cognitive and other biomarker data, electronic health record (EHR) data, and rich biological knowledge such as pathways and networks, with applications to complex disorders. His research interests include medical image computing, biomedical informatics, machine learning, network science, imaging genomics, Alzheimer's disease, and big data science in biomedicine. He has authored over 280 peer-reviewed articles (h-index 57) in these fields. Dr. Shen's work has been continuously supported by the NIH and NSF, and he is presently the PI of multiple NIH and NSF grants on developing computational methods for various biomedical applications including brain imaging genomics, genetics of Alzheimer's disease, genetics of human connectome, mining drug effects from the EHR data, and big data mining in brain science. He is co-leading the NIA Alzheimer's Disease Sequencing Project AI4AD Consortium and oversees the imaging genomics aspect of this landmark project. Dr. Shen served as the Executive Director of the Medical Image Computing and Computer Assisted Intervention (MICCAI) Society Board of Directors during 2016-2019. He has chaired and co-chaired various professional meetings in medical image computing and bioinformatics. He is an Associate Editor of "BioData Mining" and "Frontiers in Radiology (Section of AI in Radiology)", and serves on the Editorial Board of "Medical Image Analysis" and "Brain Imaging and Behavior".

Abstract: Brain imaging genetics is an emerging data science field, where integrated analysis of brain imaging and genetics data, often combined with other biomarker, clinical and environmental data, is performed to gain new insights into the genetic, molecular and phenotypic characteristics of the brain as well as their impact on normal and disordered brain function and behavior. Many methodological advances in brain imaging genetics are attributed to large-scale landmark biobank projects such as the Alzheimer's Disease Sequencing Project, the Alzheimer's Disease Neuroimaging Initiative, and the UK Biobank. Using the study of Alzheimer's disease as an example, we will discuss fundamental concepts, state-of-the-art statistical and machine learning methods, and innovative applications in this rapidly evolving field. We show that the wide availability of brain imaging genetics data from various large-scale biobanks, coupled with advances in biomedical statistics, informatics and computing, provides enormous opportunities to contribute significantly to biomedical discoveries in brain science and to impact the development of new diagnostic, therapeutic and preventative approaches for complex brain disorders such as Alzheimer's disease.

Educational Objects: Upon completion, participants should be able to:
- Brain imaging genetics can help gain new insights into the genetic, structural and functional characteristics of the brain as well as their impact on phenotypical outcomes.
- Relating genetic variants to multimodal phenotypes with AI can identify imaging and cognitive endophenotypes, each with its own genetic and clinical signatures.
- Integrating genetics and imaging phenotypes with AI can improve the prediction accuracy for clinical outcomes and enable precision diagnosis and prognosis.

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Li Shen
Spouse is an employee of Eli Lilly and Company.
An appropriate mechanism has been implemented to resolve all conflicts of interest prior to the presentation.

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