The Predictive Power of Neuroimaging

Organizer:
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From its advent, neuroimaging has offered great potential as a tool to aid in predicting important clinical and developmental outcomes. By illuminating the brain mechanisms that underlie clinically-relevant symptoms, it has been anticipated that neuroimaging measures would contribute to the prediction of a wide range of important matters such as which older persons will develop dementia, which at-risk teens will transition to schizophrenia, which depressed patients will respond to treatment, and which abstinent drug users will relapse. Identifying neurobiological predictors are important both for their diagnostic potential and, by revealing risk factors and vulnerabilities, for exposing possible etiological mechanisms. However, it is only recently that this potential is being realized due, in large part, to the availability of sufficiently powered longitudinal studies and the use of appropriate analytic techniques to determine and quantify prediction. To communicate the current state of the field this symposium will describe a number of applications of neuroimaging in the prediction of important clinical and neurodevelopmental questions. The speakers, drawn from separate European and US institutions, are each experts in employing neuroimaging for prediction. Their studies utilize both functional MRI and PET modalities, address questions that span childhood, adolescence, adulthood and ageing, and employ a number of sophisticated analytic approaches. The talks will address a number of questions where prediction is critical. These include the prediction of drug relapse, the transition to MCI and Alzheimer's, the development of cognitive abilities in childhood, and the prediction of binge drinking in adolescence. Additionally, the symposium will address the importance of utilizing appropriate analytic methods so as to avoid spurious "predictors" and maximize the yield from rich, multi-modal datasets. Finally, we will address two key questions: First, whether or not neuroimaging measures, which can be quite costly, provide unique predictive power over-and-above what is currently provided by existing cognitive and clinical measures; and second, how close is the field to being able to predict outcomes at the individual rather than group level.

Learning Objectives:
Attendees will learn about the value of neuroimaging in predicting important developmental and clinical outcomes. The talks will describe state of the art applications of neuroimaging measures to these predictions and will address the unique predictive value of these measures and their utility in providing prognostic information on an individual patient level. In addition, attendees will learn about best practice in analytic methods. The use of optimal methods is important in avoiding the identification of spurious predictors given the potential for data overfitting that accompanies large multivariate analyses.

Predicting Working Memory Development during Childhood
Torkel Klingberg, Neuroscience Department, Karolinska Institutet, Stockholm, Sweden

Can brain data predict substance use initiation?
Robert Whelan, University of Vermont, University of Vermont, Burlington, VT

Using PET to predict a positive response to treatment and the negative side of addiction in cocaine abuse.
Diana Martinez, Columbia University, New York, United States

Early predictive markers of MCI and AD using pattern analysis methods
Christos Davatzikos, University of Pennsylvania, Philadelphia, PA, United States