Award Abstract #1418590

SCH: INT: Collaborative Research: Modeling Disease Trajectories in Patients with Complex, Multiphenotypic Conditions

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ABSTRACT

Chronic conditions are driving the majority of our health care costs, and this burden is only expected to rise. Beyond the enormous economic impact, they often lead to loss of work productivity, marked decrease in quality of life and disability. A shift from reactive to proactive management of the disease is necessary to improve outcomes and reduce costs, yet clinicians have few tools at their disposal that can help prognosticate which patients are at greatest risk for decline. Decision making is particularly challenging in conditions where large heterogeneity is present in the way the disease might present itself. Simultaneously, due to the rapid proliferation of electronic clinical data stores such as Electronic Health Records and Patient Registries, longitudinal electronic health data (EHD), containing the multitude of clinical measurements taken during routine clinical visits, are becoming available at scale for retrospective analysis. These data provide an unprecedented opportunity to learn about canonical patterns of variability between individuals in the way a disease manifests, and develop

novel approaches for individualizing risk prediction. Traditional clinical risk prediction tools do not exploit the richness -- the diversity, complexity and heterogeneity -- of EHD. This project proposes a novel computational framework for individualized risk prediction from modern electronic health data sources.

This project develops a flexible Bayesian framework for jointly modeling the array of complex measurements present in the electronic health record to track an individual's disease status over time. Towards this, the framework addresses challenges due to missingness and noise in the measurement process, inherent in EHD. In addition, this proposal demonstrates the framework on data collected from large scale population databases over two decades for two different disease groups. This proposal will significantly advance computational modeling for individualized risk prediction from modern electronic health data sources. Through this project, we will also train graduate students and postdoctoral fellows, on whom the majority of the funds provided in this grant are being used; with our rapidly growing healthcare budget, the US is in need for engineers and computational methodologists who can devise new ways to improve and optimize our healthcare utilization and outcomes. For further information on this project see the project web site: http://www.cs.jhu.edu/~ssaria/individualizedRiskPrediction.html