Scalable Joint Modeling of Longitudinal and Point Process Data for Disease Trajectory Prediction and Improving Management of Chronic Kidney Disease

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Abstract

A major goal in personalized medicine is the ability to provide individualized predictions about the future trajectory of a disease. Moreover, for many complex chronic diseases, patients simultaneously have additional comorbid conditions. Accurate determination of the risk of developing serious complications associated with a disease or its comorbidities may be more clinically useful than prediction of future disease trajectory in such cases. We propose a novel probabilistic generative model that can provide individualized predictions of future disease progression while jointly modeling the pattern of related recurrent adverse events. We fit our model using a scalable variational inference algorithm and apply our method to a large dataset of longitudinal electronic patient health records. Our model gives superior performance in terms of both prediction of future disease trajectories and of future serious events when compared to non-joint models. Our predictions are currently being utilized by our local accountable care organization during chart reviews of high risk patients.

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