

Prediction of Time to Terminal Event (TTTE) in a Joint Dynamic Model

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Abstract

In this talk, we describe a simulation approach to predict time to terminal event (TTTE) that arises from joint dynamic modeling. Multiple recurrent competing risks (RCRs) such as different types of cancers or infections are often observed with death, a type of terminal event (TE). Since RCRs are often informative about TE, understanding time to death or time to terminal event (TTTE) motivates jointly dynamic modeling of both RCRs and TE. Predicting time to terminal event (TTTE) is a focal interest of such statistical modeling due to its value as a prognostic tool in medical treatments and precision medicine. Given an observational unit's data history up to time τ , the proposed prediction method provides personalized projections for both RCRs and TE in order to predict TTTE. The prediction by simulation method is dynamic in that each simulated occurrence of RCR increases the history we know about an observational unit when simulating paths of TE. Based on the class of joint dynamic models of RCRs and TE in Liu & Peña (2015), we demonstrate how to predict TTTE by the simulation approach, and generate summary statistics of important quantities for prediction purposes. We provide an evaluation of predictive accuracy of the method using empirical Brier Score. We also highlight the size-biased sampling phenomenon of gap time traversing monitoring time related to the probabilistic structure of data under consideration.

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