

Colloquium

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Bayesian Multivariate Survival Trees for Tooth Prognosis

Tooth loss from periodontal disease or dental caries (decay) afflicts most adults over the course of their lives. Multivariate survival tree methods have shown potential for developing objective tooth prognosis systems, however the current technology suffers either from prohibitive computational expense or unrealistic simplifying assumptions to overcome computational demands. In this article Bayesian tree methods are developed for correlated survival data, relying on a computationally feasible, yet flexible, frailty model with piecewise constant hazard function. Bayesian stochastic search methods are detailed for tree construction and posterior ensemble averaged variable importance ranking and amalgamation procedures are developed to identify indicators of tooth prognostic groups from a forest of trees. The proposed methods are used to assign each tooth from the VA Dental Longitudinal Study to one of five prognosis categories (good, fair, poor, questionable, and hopeless) and evaluate the effects of clinical factors and genetic polymorphisms in predicting tooth loss. The prognostic rules established may be used in clinical practice to optimize tooth retention and devise periodontal treatment plans.