

STATISTICAL ANALYSIS AND DATA MINING

Original Article

Bayesian survival trees for clustered observations, applied to tooth prognosis

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Abstract

Tooth loss from periodontal disease or dental caries (decay) afflicts most adults over the course of their lives. Survival tree methods for correlated observations 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, using a Laplace approximated marginal likelihood, are detailed for tree construction, and posterior ensemble averaged variable importance ranking and amalgamation procedures are developed. The proposed methods are used to assign each tooth from the Veteran Administration (VA) Dental Longitudinal Study to one of five prognosis categories 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.

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