Maximum likelihood estimation for tied survival data under Cox's regression model via the EM algorithm

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Preprint no. 2007-05
February 5, 2007

Abstract

We consider tied survival data based on Cox's proportional regression model. The standard approaches are the Breslow and Efron approximations and various so called exact methods. All these methods lead to biased estimates when the true underlying model is in fact a Cox model. In this paper we review the methods and suggest a new method based on the missing-data principle using the EM-algorithm that is rather easy to implement, and leads to a score equation that can be solved directly. This score has mean zero. We also show that all the considered methods have the same asymptotic properties and that there is no loss of efficiency when the tie sizes are bounded or even converge to infinity at a given rate. A simulation study compares the finite sample properties of the methods.

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