

Threshold regression for analysis of time-to-event data: with connection to proportional hazard model and applications

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Abstract

The proportional hazards (PH) assumption required by the Cox model is not appropriate in some applications. Moreover, PH regression focuses mainly on hazard ratios and thus does not offer many insights into underlying determinants of survival. Threshold regression (TR) is an alternative methodology that is not built on consideration of hazards.

Threshold regression methodology is based on the concept that the degradation of a machine or a patient's health status follows a stochastic process. For engineering applications, the degradation can often be observed. For medical research, a patient's health status is a complex unobservable process. The onset of disease, or death, occurs when the process first reaches a failure threshold (i.e., a first hitting time). Instead of calendar time, analytical time (also called operational time) can be included in TR regression. The TR model is intuitive and does not require the proportional hazards assumption. It thus provides an important alternative for analyzing time-to-event data.

In this talk, we discuss the connections between these two regression methodologies. A case demonstration is used to highlight the greater understanding of scientific foundations that TR can offer in comparison to PH regression. Applications will also be demonstrated.