

Time-to-Event Prediction of Alzheimer's Disease Progression Using Survival Models and Biomedical Signal Descriptors

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Abstract

Predicting the progression from mild cognitive impairment (MCI) to Alzheimer's disease (AD) is a major challenge in clinical neuroscience. Survival analysis models time-to-event outcomes, but most approaches rely solely on baseline variables and overlook longitudinal information. This study proposes an integrated framework combining classical survival models with temporal descriptors derived from longitudinal neuroimaging biomarkers, using data from the Alzheimer's Disease Neuroimaging Initiative (ADNI). Reference models (Cox, Weibull, and exponential) were fitted with and without temporal descriptors capturing structural brain changes over time. Results show that temporal descriptors improve the concordance index compared to baseline-only models, providing an interpretable and scalable framework for personalized risk assessment in Alzheimer's disease.

Keywords

Alzheimer's disease, biomedical signal processing, longitudinal biomarker, survival analysis, time-to-event prediction.