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Learning User Preferences from Sensors on Wearable Devices

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Thanks to wearable technology, it is increasingly common to obtain successive measurements of a variable that changes over time. A key challenge in various fields is understanding the relationship between a time-dependent variable and a scalar response. In this context, we focus on active lenses equipped with electrochromic glass, currently in development. These lenses allow users to adjust the tint at will, choosing from four different levels of darkness. Our goal is to predict the preferred tint level using ambient light data collected by an Ambient Light Sensor (ALS). We approach this as an ordinal regression problem with a time-dependent predictor. To tackle the complexities of the task, we use an adaptation of the classical ordinal model to include time-dependent covariates. We explore the use of wavelets and B-splines functional basis, as well as regularization techniques such as Lasso or roughness penalty. In cases where first-order information is insufficient, we propose utilizing the ALS signal's signature transform within the ordinal model to leverage second-order information.

Keywords

Ordinal Regression, Functional Data Analysis, Signatures

Classification

Both methodology and application

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