Analysis of aggregated functional data from mixed populations with application to energy consumption - DTU Orbit (24/12/2018)

**Analysis of aggregated functional data from mixed populations with application to energy consumption**

Understanding energy consumption patterns of different types of consumers is essential in any planning of energy distribution. However, obtaining individual-level consumption information is often either not possible or too expensive. Therefore, we consider data from aggregations of energy use, that is, from sums of individuals’ energy use, where each individual falls into one of C consumer classes. Unfortunately, the exact number of individuals of each class may be unknown due to inaccuracies in consumer registration or irregularities in consumption patterns. We develop a methodology to estimate both the expected energy use of each class as a function of time and the true number of consumers in each class. To accomplish this, we use B-splines to model both the expected consumption and the individual-level random effects. We treat the reported numbers of consumers in each category as random variables with distribution depending on the true number of consumers in each class and on the probabilities of a consumer in one class reporting as another class. We obtain maximum likelihood estimates of all parameters via a maximization algorithm. We introduce a special numerical trick for calculating the maximum likelihood estimates of the true number of consumers in each class. We apply our method to a data set and study our method via simulation.

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