STATISTICS SEMINAR

Carlo G. CAMARDA
Institut National d'Etudes Démographiques, Paris, France

Sum of smooth exponentials

Standard smoothing procedures are challenged if the smoothness of the curve to be fitted varies strongly over the domain. A model is presented that conceptualizes the structure of such data as a sum of smooth components, which are modelled on the log scale and are then additively combined. Hence we call this a Sum of Smooth Exponentials (SSE) model.

Parametric and non-parametric structures can be used for describing each component. Data can be given in grouped form, and these groups can be of variable lengths. Furthermore, monotonicity or shape constraints on the components can be incorporated by special penalty matrices. The model can also cope with two-dimensional settings in which, for instance, a dimension change over time. The resulting estimation algorithm leads to a penalized composite link model.

Several examples are used to illustrate the approach. A first data set contains a part of an X-ray diffraction spectrum. It shows a slowly varying baseline plus some isolated peaks. Of the latter the logarithms are modeled. As second group of examples, we will take demographic events, such as migration, childbirth or death which have characteristic age-specific patterns of occurrence. Many demographic rates shows complex shape in their overall age pattern. However such pattern can be attributed to different distinct components. While some of the components can be well described by a parametric model, many others cannot. An additional complication arises if data are provided only in age groups, which is still the case in many official statistics, and is standard if one goes back in time.

Our SSE model can cope with all these cases providing an elegant framework which effectively split our data into several components, which have a clear meaning and can be employed for further analyses.

This is joint work with P.H.C. Eilers (Erasmus Medical Centre, Rotterdam) and J. Gampe (Max Planck Institute for Demographic Research, Rostock).

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Boulevard du Rectorat 7, 4000 Liege (Parking P15-16)