Functional Maximum Autocorrelation Factors

Rasmus Larsen & Allan Aasbjerg Nielsen
Informatics and Mathematical Modelling, Technical University of Denmark,
DK-2800 Kgs. Lyngby, Denmark. E-Mail: {rl,aa}@imm.dtu.dk

Purpose. We aim at data where samples of an underlying function are observed in a spatial or temporal layout. Examples of underlying functions are reflectance spectra and biological shapes. We apply functional models based on smoothing splines and generalize the functional PCA in [2] to functional maximum autocorrelation factors (MAF) [3, 1]. We apply the method to biological shapes as well as reflectance spectra.

Methods. MAF seeks linear combination of the original variables that maximize autocorrelation between (temporally or spatially) neighbouring observations. This is useful when 'noise' components have higher variance than the interesting signal components. We adapt the multivariate MAF transform to the functional setting. It is assumed that relevant signal components exhibit correlation across the layout of observations. Where the functional PCA can be solved as an eigenvalue problem functional MAF becomes a generalized eigenvalue problem.

Results. We apply the methods to temporally varying outlines of the cardiac wall as observed in MR scans as well as to reflectance spectra in earth observations. The functional MAF outperforms the functional PCA in concentrating the 'interesting' spectra/shape variation in one end of the eigenvalue spectrum and allows for easier interpretation of effects.

Conclusions. Functional MAF analysis is a useful methods for extracting low dimensional models of temporally or spatially varying phenomena.

References

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