09:40-10:00, Friday, 10 July 1998, CONTRIBUTED-35

Multiple factor analysis by minimum message length estimation

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Previous work by Wallace and Freeman (1992, Journal of the Royal Statistical Society Series B 54, 195-209) on the application of Minimum Message Length (MML) (Wallace and Freeman, 1987, Journal of the Royal Statistical Society Series B 49, 223-65) estimation to the linear factor analysis model of a multivariate Gaussian population is extended to allow several common factors. The extension is not trivial, raising problems in the choice of an appropriate prior for the factors, and in the evaluation of the Fisher information of the model. However, the resulting complications appear to cancel out, giving an estimator similar to the single-factor case.

The estimator has been extensively tested on simulated data, and compared with the maximum likelihood and Akaike Information Criterion estimator. The MML estimator is found to be substantially more accurate, to provide consistent factor scores, and to recover the number of common factors more reliably than a likelihood-ratio test among maximum likelihood models.

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Kolmogorov complexity, minimum message length and inverse learning

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The notion of algorithmic complexity was developed by Kolmogorov (1965, Problems in Information Transmission 1, 1-7) and Chaitin independently of Solomonoff's notion (1964, Information and Control 7, 1-22) of algorithmic probability. Given a Turing Machine, T, the algorithmic complexity of a string, S, is the length of the shortest input to T which would cause T to output S and stop. We outline an earlier result of Wallace and Dowe (1998, Computer Journal, in press) that when the two-part Kolmogorov model is applied to statistical inference, it closely parallels the Minimum Message Length (MML) model of Wallace and Boulton (1968, Computer Journal 11, 185-94) and others.

The MML hypothesis, H, of some data, D, is by definition the hypothesis of the highest posterior probability. MML and Kolmogorov complexity are universal modelling tools, both of which are known to be statistically consistent and invariant.

In modelling data, we might find (for example) that the explanatory variable we wish to model, x_1, is not an explicit function of the other variables in the data set. The MML model of the data might be a mixture model distribution. "Inverse learning" would then say that x_1 is best modelled as a cross-section of the mixture distribution.

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