

# A semiparametric predictive Bayesian approach for ARMA model selection

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## Abstract

In this work we consider, under a Bayesian perspective, the problem of order selection within a finite class,  $\mathcal{M}$ , of stationary and invertible *ARMA* models. Assuming that the final purpose is to predict one or more future realisations of a stochastic process, model selection can be seen as a statistical decision problem, and we want to maximise a suitably defined utility function (Key et al., 1999). The selection criterion we adopt is based on the maximisation of the expected logarithmic utility function (Bernardo, 1979). For each model  $M_i \in \mathcal{M}$ ,  $i = 1, \dots, k$ , such expected value,  $U(M_i)$ , is computed with respect to the predictive density of a semi-parametric model,  $M_0$ , encompassing each  $M_i$  as a particular case. It is assumed that  $M_0$  belongs to the class  $\mathcal{S}$  of short memory Gaussian processes and our uncertainty about  $M_0$  is represented by a prior distribution on the spectral densities of the stochastic processes in  $\mathcal{S}$ . The method we propose is alternative to Bayes factors and does not require that the true model belongs necessarily to  $\mathcal{M}$ . Computation cannot be carried out analitically and the implementation of MCMC methods is required.

## References

- BERNARDO, J.M. (1979). Expected Information as expected Utility. *Annals of Statistics*, 7, 686-690.
- KEY, J.T., PERICCHI, L.R., SMITH, A.F.M. (1999). Bayesian Model Choice: What and Why?, in: *Bayesian Statistics 6*, Bernardo J.M., Berger J.O., Dawid A.P., Smith A.F.M. (Eds.), Oxford University Press, 343-370