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Bayesian representation of stochastic processes under learning: de Finetti revisited. (English)

Zbl 1056.62509
Econometrica 67, No. 4, 875-893 (1999).

Summary: A probability distribution governing the evolution of a stochastic process has infinitely many Bayesian representations of the form $\mu = \int_\Theta \mu_\theta d\lambda(\theta)$. Among these, a natural representation is one whose components (μ_θ's) are 'learnable' (one can approximate μ_θ by conditioning μ on observation of the process) and 'sufficient for prediction' (μ_θ's predictions are not aided by conditioning on observation of the process).

We show the existence and uniqueness of such a representation under a suitable asymptotic mixing condition on the process. This representation can be obtained by conditioning on the tail-field of the process, and any learnable representation that is sufficient for prediction is asymptotically like the tail-field representation. This result is related to the celebrated de Finetti theorem, but with exchangeability weakened to any asymptotic mixing condition, and with his conclusion of a decomposition into i.i.d. component distributions weakened to components that are learnable and sufficient for prediction."

MSC:

62F15 Bayesian inference
60G09 Exchangeability for stochastic processes
62M99 Inference from stochastic processes
62M45 Neural nets and related approaches to inference from stochastic processes

Full Text: DOI