"Bayes Not Bust! Why Simplicity is no problem for Bayesians"

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Abstract

The advent of formal definitions of the simplicity of a theory has important implications for model selection. But what is the best way to define simplicity? Forster and Sober ([1994]) advocate the use of Akaike's Information Criterion (AIC), a non-Bayesian formalisation of the notion of simplicity. This forms an important part of their wider attack on Bayesianism in the philosophy of science. We defend a Bayesian alternative: the simplicity of a theory is to be characterised in terms of Wallace's Minimum Message Length (MML). We show that AIC is inadequate for many statistical problems where MML performs well. Whereas MML is always defined, AIC can be undefined. Whereas MML is not known ever to be statistically inconsistent, AIC can be. Even when defined and consistent, AIC performs worse than MML on small sample sizes. MML is statistically invariant under 1-to-1 re-parametrisation, thus avoiding a common criticism of Bayesian approaches. We also show that MML provides answers to many of Forster's objections to Bayesianism. Hence an important part of the attack on Bayesianism fails.

Keywords:	Minimum Message Length, MML, Bayesianism, simplicity, inference, prediction, induction, statistical inference, statistical consistency, efficiency, model selection, point estimation, information theory, Akaike Information Criterion, AIC, predictive accuracy
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Additional Information:	At the end of sec. 8 (Conclusion) on p 52 just before the appendices, this paper discusses a fundamental question/conjecture as to "whether only MML and closely related Bayesian methods can, in general, infer fully specified models with both statistical consistency and invariance".