Eliciting Density Ratio Class Priors

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Abstract

Prior parameter distributions of environmental simulation models elicited from experts should represent the current state of knowledge of the scientific community. However, experts are often uncertain in quantifying their beliefs and they are imperfect "measurement devices" of the current knowledge. Therefore, it seems natural to describe knowledge of experts by imprecise, rather than precise probability distributions. There are three major difficulties. (1) It is difficult to choose the most appropriate of the suggested classes of imprecise probabilities. (2) There are no established procedures of eliciting imprecise probabilities. (3) The computational burden of inference and prediction may be increased. This paper addresses the first two concerns. Based on a qualitative analysis of desirable properties, the *Density Ratio Class* of probability distributions is chosen as the recommended representation of imprecise beliefs. Two suggestions are then made for procedures of eliciting *Density Ratio Class* priors. The first procedure extracts imprecision from the scatter of conventionally elicited data around a parameterized cumulative distribution function. The second procedure, recommended for new elicitations, is based on elicited imprecise quantiles or probabilities of the cumulative distribution function. We hope that the suggested elicitation procedures facilitate the use of imprecise probability distributions in environmental prediction and risk assessment.

Keywords. Probability assessment; probability elicitation; elicitation of vague knowledge; robust Bayesian analysis; imprecise probabilities; *Density Ratio Class*; decision analysis.

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