

BLENDING DATA AND MODELS UNDER UNCERTAINTY AND VARIABILITY

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Analysts of risk and reliability frequently need to combine models and data. One typical approach is the Bayesian method; hypothesized prior odds are combined with observations to yield posterior probabilities. However, when the model and/or data are represented as probability bounds carrying both incertitude and variability, alternative techniques to Bayes rule need to be employed in order to characterize the solution space. Here, methods are explored for intersecting the probability bounds of an underlying model and relevant observations. Four different techniques are proposed and discussed, each with separate philosophical implications: (a) the bounds on the prior and observations may be strictly intersected, resulting in an enforced truncation of the posterior solution space; (b) when bounds on probability densities of the prior and observations are also available, these may be combined (much like proposed by Neumaier [1]); (c) the upper and lower bounding probabilities of the cumulative distribution functions from the prior and the observations may be combined to provide a new metric for the posterior probability bounds; and (d) the intersection may be expressed as a fuzzy set based on the degree of overlap of the model's bounds and that of the data.

References

[1] Neumaier, A., 2004. *Reliable Computing*, 10, 249-272.