

Bayesian data analysis – comments 1

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Two types of uncertainty

Epistemic and aleatory uncertainty are reviewed nicely in the article: Tony O'Hagan, "Dicing with unknown" *Significance* 1(3):132-133, 2004. Link to the article is in the course web page.

Model and likelihood

Term $p(y|\theta, M)$ has two different names depending on the situation. Due to the short notation used, there is possibility of confusion.

- 1) Term $p(y|\theta, M)$ is called a *model* when it is used to describe uncertainty about y given θ and M . Longer notation $p_y(y|\theta, M)$ shows explicitly that it is a function of y .
- 2) In Bayes rule, the term $p(y|\theta, M)$ is called *likelihood function*. Posterior distribution describes the probability (or probability density) for different values of θ given a fixed y , and thus when the posterior is computed the terms on the right hand side (in Bayes rule) are also evaluated as a function of θ given fixed y . Longer notation $p_\theta(y|\theta, M)$ shows explicitly that it is a function of θ . Term has its own name (likelihood) to make the difference to the model. The likelihood function is unnormalized probability distribution describing uncertainty related to θ (and that's why Bayes rule has the normalization term to get the posterior distribution).