

Bayesian Inference

- **Point Estimation**
- **Credible Intervals**
 - Use central intervals, or intervals of highest posterior density.
- **Hypothesis testing**

Point Estimation

Posterior mean:

The “best” estimator (in terms of minimizing squared error loss) of an unknown parameter is simply the expected value of the parameter under its posterior distribution.

The posterior mean is a.k.a. Bayes estimator.

Example: In the IID Normal example, the Bayes estimator of μ is v^* .

Point Estimation

Posterior mean:

- Easy to obtain from MCMC software.
- The Bayes estimator is not parameterization invariant.

Point Estimation

Posterior mode:

The value of θ that maximizes $\pi(\theta | y)$.

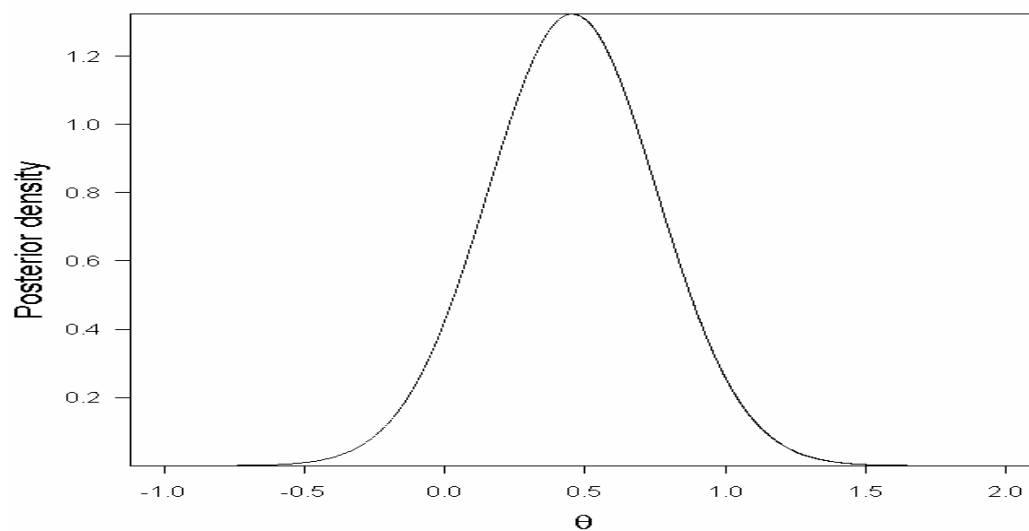
In the IID Normal example, the posterior mode of μ is also v^* .

The posterior mode is calculated by ADMB (Automatic Differentiation Model Builder), but not by WinBUGS.

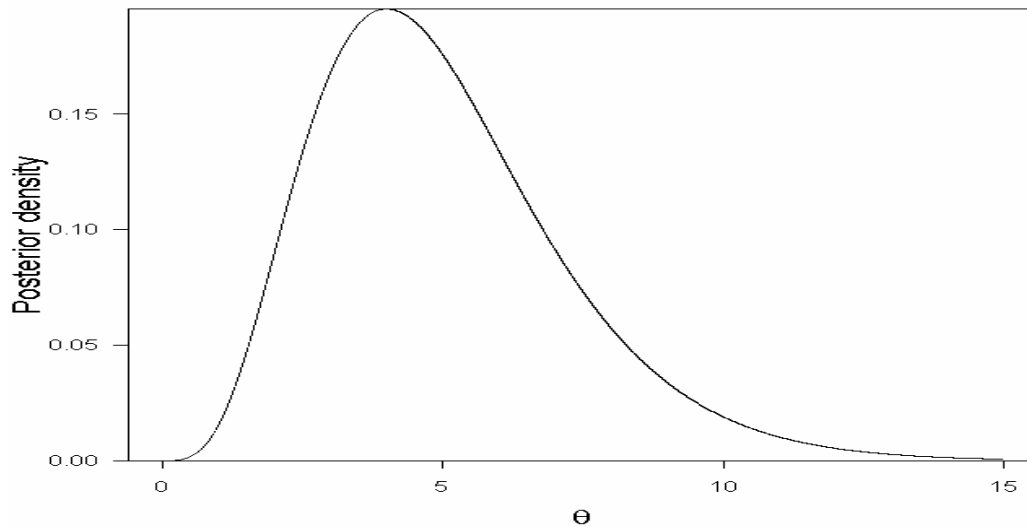
Credible Intervals

Use central intervals or interval of highest posterior density.

HPD Interval (symmetric posterior)



HPD Interval (skewed posterior)



Chapter 3

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Hypothesis testing

From Gelman et al. (2003, *Bayesian Data Analysis*, 2nd Ed., p. 250)

“The perspective of this book has little role for the non-Bayesian concept of hypothesis tests.... In order for a Bayesian analysis to yield a nonzero probability for a point null hypothesis, it must begin with a nonzero prior probability for that hypothesis; in the case of a continuous parameter, such a prior distribution (...) usually seems contrived.”

Chapter 3

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Model Checking

Some frequentist concepts are used in the context of posterior predictive model checking, whereby the observed data are compared to predictive outcomes.

We'll save this until later.

Model comparison/selection

There are Bayesian equivalents of frequentist model selection tools (such as Akaike's Information Criterion, AIC).

The most widely used is the Deviance Information Criterion, DIC.

We'll leave DIC, and other model comparison techniques until later.

