General Discussion

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General Discussion

Bayesian Flat priors and Frequentists

Sandipan Dey General Discussion · 2 days ago

Is it always true that choosing a non-informative flat prior for Bayesian, the value of MLE of a parameter (as frequentist) will be similar to posterior mean (as Bayesian)?

For example, in linear regression, with a reference flat prior (as per the lectures), does the frequentist confidence interval coincide with the bayesian equal-tailed credibility intervals?

I did a simulation of an experiment with coin tossing, using Beta-Bernoulli conjugate priors and choosing a non-informative prior Beta(0,0), the 95% confidence interval computed was quite different from the 95% credible interval. For example, I obtained the following statistics with 20 data points with coin tossing trials (randomly generated Head / Tails).

prior.mean	0.66
prior.alpha	125.5
prior.beta	65.5
posterior.mean	0.65
posterior.alpha	137.5
posterior.beta	73.5
n	20
num.heads	12
MLE	0.6
conf.int.95	(0.39,0.81)
cred.int.95	(0.59,0.71)

As can be seen, the 95% credibility interval happens to be much narrower than the 95% confidence interval. Should it be the case, or I am doing something wrong?

In general, is the width of the credibility interval less than the confidence interval at the same critical value?

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Sandipan Dey · a few seconds ago

Hello professor, the table shown here is some intermediate step of the sequential Bayesian update, starting with the prior Beta(0,0) and then updating the posterior and again changing the prior to posterior, again after recomputing the posterior: doing these steps a few times (as we can see the updation was done for n = 20 times, repeated with n=20 data points). That's why the prior mean was defined (which was NaN to start with).

But in general, is the width of the credibility interval less than the confidence interval at the same critical value?

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Herbie Lee Staff · 5 hours ago

I'm confused by what you are showing as prior.mean, prior.alpha, and prior.beta. If you are using a Beta(0,0) prior, then the prior alpha and prior beta are each 0, and the prior mean does not exist (it is not a proper distribution, and it does not have finite moments). With a Beta(0,0) prior, the confidence interval and the credible interval should be identical for this problem.

In general, there is often a non-informative prior that will give the same credible interval as a Frequentist confidence interval. This prior is not always flat, for example, the Beta(0,0) is not flat. When one can compute an effective sample size of the prior, the prior for interval equivalence will typically have an effective sample size of zero.

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