Re: Bayesian estimation of Expectation in Bernoulli problem

Source: http://sci.tech−archive.net/Archive/sci.stat.math/2007−08/msg00552.html

- *From*: isabellesup@xxxxxxxxxxx

- *Date*: Thu, 23 Aug 2007 10:12:48 −0700

On Aug 23, 10:49 am, quebecs...@xxxxxxx wrote:

> Hi everyone,
>
> I would be interested in a hint, a pointer or some help with the
> following problem.
>
> Consider two coins, C1 and C2, with the following characteristics:
> Pr(heads| C1) = 0.6 and Pr(heads| C2) = 0.4.
>
> Choose one of the coins at random and imagine spinning it repeatedly.
> Given that the first two spins from the chosen coin are tails, what is
> the expectation of the number of additional spins until a head shows
> up?
>
> Below I have indicated my work so far.
>
> Many thanks
>
> Let N be the number of additional spins until a head shows up
> We have N|Pr(heads)=Geometric(Pr(heads))
> and E{N|Pr(heads)}=1/Pr(heads)
>
> E{N}=E[E{N|Pr(heads)}]=E[1/Pr(heads)]
>
> Now I need to find Pr(heads)
>
> That is where I am stuck. I do not know how to write the fact that the
> coin is chosen at random.
>
> What I have is
>
> Pr(heads|first 2 spins are tails, C1)= ((1−p)^2 *0.6) /((1−p)^2
> *0.6+(1−p)^2 *.4)
>
> Thanks for your help.

Hello quebecstat,

Lets see if I can help.

It looks like the prior for p is
P{p=0.6}=1/2
P{p=0.4}=1/2

So that the posterior of p is
Pr(p=0.6|first 2 spins are tails)
= ((1−0.6)^2 *.5) /
((1−.6)^2 *.5+(1−.4)^2 *.5)
=(.4^2 *.5) /
(.4^2 *.5+.6^2 *.5)
=.308

Pr(p=0.4|first 2 spins are tails)
= (.6^2 *.5) /
(.4^2 *.5+.6^2 *.5)
=.692

Now this should help you compute E[1/Pr(heads)]. Although I have to say, I am not too sure how to compute E[1/Pr(heads)].

cheers

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