Bayesian Statistics Reading Group Meeting

21/6/2020 2230 HKT

June 18, 2020

1 Why Bayesian?

1. Makes modeling assumption super clear
2. Does not require asymptotic assumptions
3. Gospel for people working with small-N data (the "Small World" Discussion by Chapman & Hill)
4. Inference: No more stargazing. Easier?
5. Easy implementation: Approximation can be "brute-forced" by Gibbs/ Metropolis-Hastings
6. and many more...

2 Key Concepts

1. The definition of probability in Bayesian terms: your belief of something that is true (Hoff p.13)
This is very different from what we've learnt from school, that probability is the chance of something happening upon observing the event multiple times (frequentist interpretation).

2. Inference: Frequentist vs. Bayesian:
Frequentists rely on some form of test statistic, and you conduct hypothesis testing (e.g. t-test, z-test, Wald-type test, etc.). To do these tests you need to observe a large amount of data otherwise it would be hard to reject H_0.
Bayesians look at the updating of beliefs.

3. The Average Likelihood:

$$Pr(X) = E(Pr(X|\theta))) = \int Pr(X|\theta)Pr(X)d\theta$$

which is per the definition of $E(X) = \int xf(x)dx$

4. The Posterior:

$$Pr(\theta|X) = \frac{p(\theta)L(\theta|X)}{\int_\Theta p(\theta)L(\theta|X)d\theta}$$

and

$$Pr(\theta|X) \propto p(\theta)L(\theta|X)$$

In plain English: the Posterior Probability is proportional to the Prior * the Likelihood function

So upon receiving the data and specifying the prior we have all the information we need to estimate the posterior.

3 Discussion Questions

1. is inference in Bayesian statistics easier to understand? What are some of the common problems of reading a paper that uses Bayes?
2. Is there a scenario where Bayesian statistics is not preferred over Frequentist statistics?
3. How do we choose priors? Is a vector of all 0s always a good choice?
4. To what extent does the quality of the data matter?
5. How small N can the N be? Is there a minimum threshold that these things would fail?

4 Format of this reading group

5 AOB