**Bayesian Hypothesis Testing**

Hypothesis testing enables us to decide based on information obtained from sample data (and prior information in Bayesian) whether to accept or reject a statement or an assumption about the population parameter. This statement or assumption is called statistical hypothesis.

In classical hypothesis testing, a null hypothesis  and the alternative hypothesis  are specified. A test procedure is evaluated in terms of the probabilities of Type I and Type II error. These probabilities of error represent the chance that a sample is observed for which the test procedure will result in the wrong hypothesis being accepted.

In Bayesian analysis, the task of deciding between  and  is conceptually more straightforward. One may say that Bayesian hypothesis testing is less formal than the non-Bayesian varieties. In fact, the Bayesian researchers typically summarize the posterior distribution without applying a rigid decision process. Even if one wants to apply a formal process, Bayesian decision theory is the way to go because it is possible to get a probability distribution over the parameter space and one can make expected utility calculations based on the costs and benefits of different outcomes. There are several different techniques of performing Bayesian testing of hypotheses.

The task of deciding between two hypotheses merely requires the calculation of posterior probabilities as:





and decides between  and  accordingly. The conceptual advantage is that  and  are the actual (subjective) probabilities of the hypotheses in light of the data and prior opinions.

**Posterior Odd Ratio**

It is often convenient to summarize the evidence in terms of posterior odds. It is just the likelihood ratio of the  which is commonly viewed as the odds for, which are given by the data.

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The ratio is called the posterior odd ratio of and  is called the prior odd ratio where, and  the prior probabilities of and  respectively.

**Bayes’ Factor**

Bayes’ factors are the dominant method of Bayesian model testing. The basic notion is that prior and posterior information are combined in a ratio that provides evidence in favor of one model specification versus another. General form of Bayes’ factor is:

 

Here  is the probability distribution from data where as  and  are the prior probability distributions for the two hypotheses respectively. Bayes’ factors are very flexible, allowing multiple hypotheses to be compared simultaneously and nested models are not required in order to make comparisons.