How to become a Bayesian

Shubham Gupta

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1 Introduction

- This is a review of the paper presented here: https://nicebrain.files.wordpress.com/2016/02/etz-etal-preprint-how-to-become-a-bayesian.pdf
- I will try to summarize the materials provided in the paper for reference.

2 Theoritical Sources

- Discuss three sources which will show the primary ideas around Bayesian inference.

2.1 What is Bayesian Inference

- Source: http://web.archive.org/web/20160110224503/http://www2.isye.gatech.edu/ brani/isyebayes/b
- Fisher discusses the probability of getting null hypothesis and anything more extreme than it. This is called the **p-value**.
- Lindley shows that p-value depends on how the experiment was conducted and the definition of the term **extreme results** influences the p-value.
- If something is assumed, a appropriate prior should be assigned to this assumption so that it maximizes the change of the assumption to be true **but also** gives other possible values(the one's not included in the assumption) some probability.
- This method depends only on **observed data.**

2.2 Bayesian Credibility Assignments

- Source: John Krushcke DBDA(Chapter 2)
- Relocate probability of an outcome occuring depending on the evidence gathered. In the chapter, JK uses the example of Sherlock Holmes.
- Generally talks about how to reallocate probabilities and consider new evidence.

2.3 Implications of bayesian statistics for experimental psychology

- Source: http://tinyurl.com/dienes2011
- Explains differences between frequentist and Bayesian paradigms.
- Bayesian methods nature allow inclusion of problem-specific knowledge in the statistical model.
- Frequentist allows $P(data|theory)$.
- Bayesian allows $P(theory|data)$.

2.3.1 Stopping rules

- For frequentist approach, p-value is allowed to be all possible values(i.e not just the null hypothesis).
- Due to this, even if more data is collected, it will not affect the p-value.
- Also, **even if there is no effect**, we will always obtain a statistically significant result.
- For Bayesian approach, collecting more data will help prove null hypothesis is true/false.
- This is because if null hypothesis is true, **Bayes factor** will tend to infinity when the amount of data collected keeps increasing.

2.3.2 Planned versus post hoc comparisons

- In classifical hypothesis testing, it matters if hypothesis was made before or after data collection.
- For Bayesian apporach, it does not matter.

2.3.3 Multiple Testing

- For classical appraoch, number of tests matter when testing multiple thesis.
- For Bayesian, number does not matter. Evaluation of accuracy of each hypothesis that predicts the data matters the most.

2.3.4 Context-dependent Bayes factors

- Two schools of Bayes: Objective and Subjective.

Table 1: Bayesian Schools

Objective	**Subjective**
Fixed BF with specific maths properties	Allows BF that incorporate specific knowledge.
Use standardized effect sizes	Specify prior distributions in terms of raw effect size.

2.4 Structure and motivation of Bayes factors

- Bayes factor shows predictive success of two(or more) models.