Paper 2 Title

A comparative review

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NOTES

- This paper is about visual inferences versus Frequentist/Bayesian inference, not visual inference for Bayes/Frequentist

Introduction

The overall goal of statistics is to quantify uncertainty.

Implicitly, many statistical methods revolve around the concept of a hypothesis test.

However, there is no single approach to statistical inference. (George Box quote?)

Early statistical inference is generally regarded as Frequentist.

In the later 20th century, a newer framework developed on the idea that previously known information can help guide inference, known as Bayesian.

In this paper, I will talk about three types of statistical inferences: Frequentist, Bayesian, and visual. The paper is organized

Types of Inference

Structure

- Basic idea
- Creating a null hypothesis
- Hypothesis testing
- Other considerations
- Issues?

Frequentist

The classical framework of statistics revolves around the idea that independent and repeated events follow a stable probability function (Lehmann 2008, 160). Probably the most famous case of this

The Frequentist analysis technique begins with an underlying assumption of the data generating function. In practice, this function is rarely known, and thus is approximated by a reasonable probability function. Some examples include a Poisson distribution for count data, a binomial distribution for proportions of successes, and a normal distribution for unimodal continuous observations.

After data is collected, a hypothesis test can be formulated. The general format of a Frequentist hypothesis test is to assume that a function of the data arose from an assumed data generating function. If the function of the data does not

Bayesian

Bayesian inference begins with some knowledge about the parameter of interest.

Visual

Unlike Frequentist and Bayesian inference, visual inference relies on the nuances of human perception. With visual inference, data is presented in the visual space and treated as a statistic. For example, a common assumption for linear models in the form of $Y = X\beta + \epsilon$ is that the residual term, ϵ, is independently and identically distributed with respect to a Normal distribution with a mean of zero and an unknown variance.

The null data generation process

One potential issue with visual inference is the human nature of wanting to find patterns in randomness.

Example

To effectively demonstrate the three inference types, consider the following example.

Discussion

Conclusion

Gelman and Shalizi (2013)

Gelman, Andrew, and Cosma Rohilla Shalizi. 2013. "Philosophy and the Practice of Bayesian Statistics." *British Journal of Mathematical and Statistical Psychology* 66 (1): 8–38. https://doi.org/10.1111/j.2044-8317.2011.02037.x.

Lehmann, E. L. 2008. "Foundations I: The Frequentist Approach." In, 160–77. New York, NY: Springer New York. https://doi.org/10.1007/978-0-387-71597-1_10.