Why Are Non-informative Priors Informative?

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A "flat" prior

Let's talk about what people really mean when they use the term "flat," since it can have different meanings.

Often statisticians will refer to a prior as being flat, when a plot of its density actually looks flat, i.e., uniform.

$$\theta \sim \mathsf{Unif}(0, 1).$$

Why do we call it flat? It's assigning equal weight to each parameter value. Does it always do this?

Uniform(0,1) prior
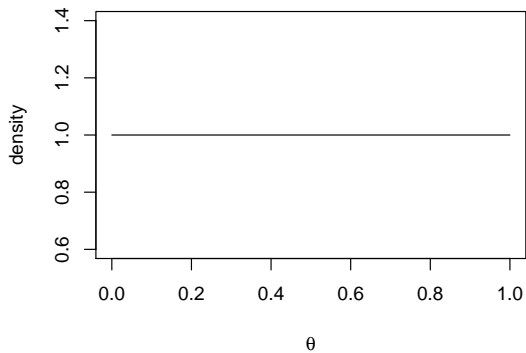
Uniform(0,1) prior (continued)

What happens if we consider though the transformation to $\phi = 1/\theta$.

Is our prior still flat (does it place equal weight at every parameter value)?
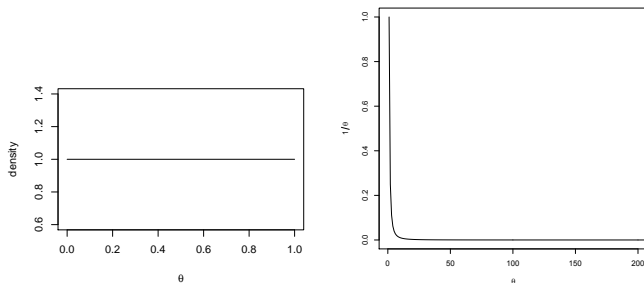
Uniform prior versus the Transformed Prior

Figure 1: Comparison of the Uniform prior and the transformed prior on θ. Observe that the figure on the right is very informative under the transformative, and thus, prior is extremely informative.

Non-informative priors

We must be careful with the notion of non-informative priors as they can be quite informative as we have just illustated with a very simple example .

Further Reading

If you'd like to know more about invariance, please see the the following references.

1. http://www.ctanujit.org/uploads/2/5/3/9/25393293/theory _of_point_estimation.pdf
2. https://www.springer.com/us/book/9780387400846
3. Papers on Subjective and Objective Priors, https://projecteuclid.org/euclid.ba/1340371033