

Report on "Bayesian Restricted Likelihood Methods: Conditioning on Insufficient Statistics in Bayesian Regression"

This paper proposes a Bayesian approach for making inference based on robust statistics of the data instead of the original observations. The conditioning robust statistics pass the desirable robustness (to outliers) to the posterior distribution of parameters, thus having the potential to improve inference and prediction. This paper addresses an important problem in statistics and contains interesting ideas. However, there are some major concerns.

The paper focuses on outliers. Although outliers automatically imply that the model is misspecified, model misspecification is much broader including the misspecification of the density of the good data. The paper does not appear to address model misspecification beyond the case when outliers are present. Please revise the scope of the paper as appropriate or provide more examples to ensure outliers and model misspecification are parallel contributions rather than one nested in another.

There are many implementation details that an interested user would like to learn more but feel difficult to find from the current paper. This includes but not limited to the selection of proposal, parameter tuning, recommendations when a practitioner is being faced with a real-world problem, and computational complexity of the entire procedure. See the two referee reports for more details. The authors are also suggested to possibly provide code that is available online with recommended choices as default.

It is unclear how the proposed method outperforms existing work, either conceptually or practically. Referees have provided some competing methods for the authors to consider. I'd like to add another existing strategy in addition to the three solutions mentioned in the bottom paragraph of page 2: Bayesian fractional inference, which uses a fractional likelihood function that raises a usual likelihood function to a fractional power. What is the advantage of the proposed restrictive likelihood approach over Bayesian fractional inference, even conceptually?

Overall, the paper deserves publication after careful and thorough revision. I hope the authors can address all concerns raised in this report and the two well-grounded referee reports.