Prior sensitivity analysis in Bayesian SEM and its application in R

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Oral presentation

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Abstract

There are many research scenarios in which informative (or user-specified) priors have an impact on posterior inference. In addition, diffuse priors have also been found to influence final model estimates in important ways. Given that prior specification has the potential to alter obtained estimates (sometimes in an adverse way), it is always important to assess and report prior impact alongside the final model results being reported for a study. It is important to never blindly rely on default prior settings in software without having a clear understanding of their impact. A sensitivity analysis of priors allows the researcher to methodically examine the impact of prior settings on final results. The researcher will often specify original priors based on desired previous knowledge. After posteriors are estimated and inferences are described, the researcher can then examine the robustness of results to deviations in the priors specified in the original model.

Many Bayesian researchers recommend that a sensitivity analysis accompany original model results. This practice helps the researcher gain a firmer understanding of the robustness of the findings, the impact of theory, and the implications of results obtained. In turn, reporting the sensitivity analysis will also ensure that transparency is promoted within the applied Bayesian literature. Note that there is no right or wrong finding within a prior sensitivity analysis. If results are highly variable to different prior settings, then that is perfectly fine–and it is nothing to worry about. The point here is to be transparent about the role of the priors, and much of that comes from understanding their impact through a sensitivity analysis.

Here we will present a proposed process and specific steps for prior sensitivity analysis in Bayesian Structural Equation Modeling (BSEM) and how to apply it in R. The proposed steps include comparing the model's predictive accuracy with the Leave-One-Out Information Criteria (LOO-IC) and the Widely Applicable Information Criteria (WAIC). Then we will how to compare the model's overall fit, like CFI, SRMR, and gamma-hat, as in BSEM we estimate the posterior distribution of fit indices, we recommend the comparison of the whole posterior between multiple priors. Lastly, we will show how to compare parameters of interest between models with different priors, we will compare the full posterior distribution, point estimates, and variability.

To conclude we will provide recommendations on how to interpret the prior sensitivity comparisons.

Keywords

prior sensitivity, Bayesian SEM, R

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