This form documents the artifacts associated with the article (i.e., the data and code supporting the computational findings) and describes how to reproduce the findings.

Part 1: Data

☐ This paper does not involve analysis of external data (i.e., no data are used or the only data are generated by the authors via simulation in their code).

☒ I certify that the author(s) of the manuscript have legitimate access to and permission to use the data used in this manuscript.

Abstract

We study two simulated datasets, which are available in our supplementary materials. In addition, we study real grant panel review data from the American Institute of Biological Sciences (AIBS), which are publicly available online. Code for data cleaning is available in our supplementary materials.

Availability

☒ Data **are** publicly available.
☐ Data **cannot be made** publicly available.

If the data are publicly available, see the *Publicly available data* section. Otherwise, see the *Non-publicly available data* section, below.

Publicly available data

☒ Data are available online at: https://doi.org/10.6084/m9.figshare.19692223.v1

☒ Data are available as part of the paper's supplementary material.

☐ Data are publicly available by request, following the process described here:

☐ Data are or will be made available through some other mechanism, described here:

Non-publicly available data

We have no non-publicly available data.

Description

File format(s)

☒ CSV or other plain text.
☒ Software-specific binary format (.Rda, Python pickle, etc.): .Rda
☐ Standardized binary format (e.g., netCDF, HDF5, etc.):
☐ Other (please specify):

Data dictionary

☐ Provided by authors in the following file(s):
☐ Data file(s) is(are) self-describing (e.g., netCDF files)
☒ Available at the following URL: https://doi.org/10.6084/m9.figshare.19692223.v1

Additional Information (optional)

Part 2: Code

Abstract

We provide source code that includes all necessary model estimation code. Additionally, we have code folders corresponding to each of our data analyses, which include all materials necessary to replicate our analyses in data files.

Description

Code format(s)

- [X] Script files
  - [X] R
  - ☐ Python
  - ☐ Matlab
  - ☐ Other:
- ☐ Package
  - ☐ R
  - ☐ Python
  - ☐ MATLAB toolbox
  - ☐ Other:
- ☐ Reproducible report
  - ☐ R Markdown
  - ☐ Jupyter notebook
  - ☐ Other:
- ☐ Shell script
- ☐ Other (please specify):

Supporting software requirements

Warnes G, Bolker B, Lumley T, Magnusson A, Venables B, Ryodan G, Moeller S (2023). *gtools: Various R Programming Tools*. R package version 3.9.5, https://CRAN.R-project.org/package=gtools.

Bengtsson H (2023). *matrixStats: Functions that Apply to Rows and Columns of Matrices (and to Vectors)*. R package version 1.0.0, https://CRAN.R-project.org/package=matrixStats.

Wickham H, Averick M, Bryan J, Chang W, McGowan LD, François R, Grolemund G, Hayes A, Henry L, Hester J, Kuhn M, Pedersen TL, Miller E, Bache SM, Müller K, Ooms J, Robinson D, Seidel DP, Spinu V, Takahashi K, Vaughan D, Wilke C, Woo K, Yutani H (2019). "Welcome to the tidyverse." *Journal of Open Source Software*, *4*(43), 1686. doi:10.21105/joss.01686 https://doi.org/10.21105/joss.01686.

Hadley Wickham (2007). Reshaping Data with the reshape Package. Journal of Statistical Software, 21(12), 1-20. URL http://www.jstatsoft.org/v21/i12/.

Plate T, Heiberger R (2016). *abind: Combine Multidimensional Arrays.* R package version 1.4-5, https://CRAN.R-project.org/package=abind.

Kahle D, Stamey J (2017). *invgamma: The Inverse Gamma Distribution.* R package version 1.1, https://CRAN.R-project.org/package=invgamma.

Martyn Plummer, Nicky Best, Kate Cowles and Karen Vines (2006). CODA: Convergence Diagnosis and Output Analysis for MCMC, R News, vol 6, 7-11

Wickham H, Seidel D (2022). *scales: Scale Functions for Visualization.* R package version 1.2.1, https://CRAN.R-project.org/package=scales.

Auguie B (2017). *gridExtra: Miscellaneous Functions for "Grid" Graphics.* R package version 2.3, https://CRAN.R-project.org/package=gridExtra.

Wilke C (2022). *ggridges: Ridgeline Plots in 'ggplot2'.* R package version 0.5.4, https://CRAN.R-project.org/package=ggridges.

Panagiotis Papastamoulis (2016). label.switching: An R Package for Dealing with the Label Switching Problem in MCMC Outputs. Journal of Statistical Software, 69(1), 1-24. doi:10.18637/jss.v069.c01

Pearce M (2024). *rankrate: Joint Statistical Models for Preference Learning with Rankings and Ratings.* R package version 1.2.0, https://pearce790.github.io/rankrate/.

Greve J (2021). *fipp: Induced Priors in Bayesian Mixture Models.* R package version 1.0.0, https://CRAN.R-project.org/package=fipp.

Version of primary software used R version 4.3.1

Libraries and dependencies used by the code gtools (3.9.5); matrixStats (1.0.0), parallel (4.3.1), tidyverse (2.0.0), reshape2 (1.4.4), abind (1.4-5), invgamma (1.1), coda (0.19-4), scales (1.2.1), gridExtra (2.3), ggridges (0.5.4), label.switching (1.8), rankrate (1.2.0), fipp (1.0.0).

Supporting system/hardware requirements (optional)

To speed up computation, some analyses were run on a cluster. All .sbatch files are available in the supplementary materials for replication, and all analyses may be run on a desktop computer without parallelization if desired.

Parallelization used

- ☐ No parallel code used
- ☐ Multi-core parallelization on a single machine/node
  - Number of cores used:
- ☒ Multi-machine/multi-node parallelization
  - Number of nodes and cores used: 180 (for some simulation analyses for speed)

License

☒ MIT License (default)
☐ BSD
☐ GPL v3.0
☐ Creative Commons
☐ Other: (please specify)

Additional information (optional)

Part 3: Reproducibility workflow

Scope

The provided workflow reproduces:

☒ Any numbers provided in text in the paper
☒ The computational method(s) presented in the paper (i.e., code is provided that implements the method(s))
☒ All tables and figures in the paper
☐ Selected tables and figures in the paper, as explained and justified below:

Workflow

Location

The workflow is available:

☒ As part of the paper's supplementary material.
☒ In this Git repository: https://github.com/pearce790/BTLB
☐ Other (please specify):

Format(s)

☐ Single master code file
☐ Wrapper (shell) script(s)
☐ Self-contained R Markdown file, Jupyter notebook, or other literate programming approach
☐ Text file (e.g., a readme-style file) that documents workflow
☐ Makefile
☒ Other (more detail in *Instructions* below)

Instructions

We provide source code that includes all necessary model estimation code. Additionally, we have code folders corresponding to each of our data analyses, which include all materials necessary to replicate our analyses in data files. The code in each folder may be run independently to replicate the different sections of the manuscript.

Expected run-time

Approximate time needed to reproduce the analyses on a standard desktop machine:

- ☐ $<$ 1 minute
- ☐ 1-10 minutes
- ☐ 10-60 minutes
- ☐ 1-8 hours
- ☒ $>$ 8 hours
- ☐ Not feasible to run on a desktop machine, as described here:

Additional information (optional)

Notes (optional)