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lavaangui: A graphical user interface for lavaan with integrated diagrammer

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Summary

Structural equation modeling (SEM) is a popular statistical technique within the social and behavioral sciences. Path diagrams facilitate the specification of Structural Equation Models because drawing them is often faster and less error-prone than specifying a model using equations or matrix algebra. lavaangui is a graphical user interface that allows specifying SEMs by drawing path diagrams. It is available as web application at https://lavaangui.org. Additionally, it can be installed as an R package and then supports creating interactive path diagrams from SEMs. A tutorial is available at https://doi.org/10.31234/osf.io/f4ary.

Statement of need

Traditionally, SEMs had to be specified using a specific modeling syntax. To simplify this process, most current versions of closed-source commercial software packages, such as AMOS (Arbuckle, 2019), Stata (StataCorp LLC, 2023), Mplus (Muthén & Muthén, 1998-2017), EQS (Bentler, 2006), and LISREL (Jöreskog & Sörbom, 22 C.E.), support model specification through the drawing of path diagrams, in addition to syntax-based methods. These graphical user interfaces are typically referred to as diagrammers. While there are several open-source packages available for SEM (Ernst & Peikert, 2024; Fox et al., 2022; Igolkina & Meshcheryakov, 2020; JASP Team, 2024; Neale et al., 2016; Oertzen et al., 2015; Rosseel, 2012; The jamovi project, 2024; van Lissa, 2024), only Ωnyx (Oertzen et al., 2015) includes a diagrammer. However, Ωnyx is standalone software and does not integrate well with other open-source statistical software, particularly R. A practical issue is that installing Ωnyx requires administrator privileges, which many researchers lack. Additionally, Ωnyx uses its own routine to fit SEMs instead of one of the more popular open-source packages. `lavaangui` addresses these limitations: it can be installed as an R package, accessed without installation via https://lavaangui.org on any computer with a browser, and uses `lavaan` as a backend for modeling fitting, which is arguably the most widely used open-source SEM software.

Credits

`lavaangui` consists of a frontend and a backend. Most of the frontend is written in JavaScript, utilizing the Svelte framework. For drawing path diagrams, the Cytoscape.js (Franz et al., 2016) library is used, along with extensions described in Dogrusoz et al. (2018). The CSS framework is Bootstrap, and Bootbox.js is employed for displaying prompts. Parts of the frontend are written in R, using the `Shiny` (Chang et al., 2024) and `DT` (Xie et al., 2024) packages.

The backend is written in R, as a `Shiny` Server. The `lavaan` (Rosseel, 2012) package is used for fitting structural equation models. Some automatic layout algorithms are sourced from the semPlot (Epskamp, 2015) package, while the promises (Cheng, 2024) package enables asynchronous execution.

Arbuckle, J. L. (2019). *IBM SPSS Amos 26 User's Guide*. IBM Corporation.

Bentler, P. M. (2006). *EQS 6 Structural Equations Program Manual* . Multivariate Software, Inc.

Chang, W., Cheng, J., Allaire, J., Sievert, C., Schloerke, B., Xie, Y., Allen, J., McPherson, J., Dipert, A., & Borges, B. (2024). *Shiny: Web application framework for r*. https://CRAN.R-project.org/package=shiny

Cheng, J. (2024). *Promises: Abstractions for promise-based asynchronous programming*. https://CRAN.R-project.org/package=promises

Dogrusoz, U., Karacelik, A., Safarli, I., Balci, H., Dervishi, L., & Siper, M. C. (2018). Efficient methods and readily customizable libraries for managing complexity of large networks. *PLoS ONE*, *13*(5), e0197238. https://doi.org/10.1371/journal.pone.0197238

Epskamp, S. (2015). semPlot: Unified visualizations of structural equation models. *Structural Equation Modeling: A Multidisciplinary Journal*, *22*(3), 474–483.

Ernst, M. S., & Peikert, A. (2024). *StructuralEquationModels.jl (v0.2.2)*. https://doi.org/10.5281/zenodo.10475661; Zenodo. https://doi.org/10.5281/zenodo.10475661

Fox, J., Nie, Z., & Byrnes, J. (2022). *Sem: Structural equation models*. https://CRAN.R-project.org/package=sem

Franz, M., Lopes, C. T., Huck, G., Dong, Y., Sumer, O., & Bader, G. D. (2016). Cytoscape.js: A graph theory library for visualisation and analysis. *Bioinformatics*, *32*(2), 309–311.

Igolkina, A. A., & Meshcheryakov, G. (2020). Semopy: A python package for structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, *27*(6), 952–963.

JASP Team. (2024). *JASP (Version 0.18.3)[Computer software]*. https://jasp-stats.org/

Jöreskog, K. G., & Sörbom, D. (22 C.E.). *LISREL*. https://www.ssicentral.com; Scientific Software International, Inc.

Muthén, L. K., & Muthén, B. O. (1998-2017). *Mplus User's Guide* (8th ed.). Muthén & Muthén.

Neale, M. C., Hunter, M. D., Pritikin, J. N., Zahery, M., Brick, T. R., Kirkpatrick, R. M., Estabrook, R., Bates, T. C., Maes, H. H., & Boker, S. M. (2016). OpenMx 2.0: Extended structural equation and statistical modeling. *Psychometrika*, *81*(2), 535–549. https://doi.org/10.1007/s11336-014-9435-8

Oertzen, T. von, Brandmaier, A. M., & Tsang, S. (2015). Structural equation modeling with Ωnyx. *Structural Equation Modeling: A Multidisciplinary Journal*, *22*(1), 148–161.

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*(2), 1–36. https://doi.org/10.18637/jss.v048.i02

StataCorp LLC. (2023). *Stata statistical software: Release 18*. StataCorp LLC.

The jamovi project. (2024). *Jamovi (version 2.5) [computer software]*. https://www.jamovi.org.

van Lissa, C. J. (2024). *tidySEM: Tidy structural equation modeling*. https://CRAN.R-project.org/package=tidySEM

Xie, Y., Cheng, J., & Tan, X. (2024). *DT: A wrapper of the JavaScript library 'DataTables'*.

https://CRAN.R-project.org/package=DT