

Using the MplusAutomation¹ R Package to Automate Latent Profile Analyses in Mplus²

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- The MplusAutomation package is authored by Michael Hallquist michael.hallquist@gmail.com & Joshua F. Wiley jwiley.psych@gmail.com Please cite the following when using the package: Hallquist, M. N. & Wiley, J. F. (2018). MplusAutomation: An R Package for Facilitating Large-Scale Latent Variable Analyses in Mplus Structural Equation Modeling, 1-18. doi:10.1080/10705511.2017.1402334.
- Mplus software was created by Mplus software. Muthen & Muthen. Please cite the following when using their software: Muthén, L.K. and Muthén, B.O. (1998-2017). Mplus User’s Guide. Eighth Edition. Los Angeles, CA: Muthén & Muthén.

Poster Abstract

Latent class analysis (LCA) and latent profile analysis (LPA) are finite mixture models widely used among social and behavioral scientists. While both models are used to identify meaningful subgroups in cross-sectional analyses, LCA detects patterns in categorical observed variables, whereas LPA detects subgroups in continuous observed variables. Recent examples of LCA and LPA applications include identifying post-traumatic stress disorder patterns and predictors among refugees and splitting latent classes into trees and relating them to external variables (Minihan, 2018; Van Den Bergh & Vermunt, 2019). Mplus (Muthen & Muthen, 2017) is a latent variable modeling program, widely used for running statistical analyses and mixture models such as LCA and LPA. However, because Mplus uses a one-input one-output approach, the program can only run one model at a time. In instances such as LPA or LCA, where researchers must run and compare output from several models at a time, analyses can be burdensome and time consuming. The Mplus Automation package in R (Hallquist & Wiley, 2018) was created to automate processes and decrease some of the burden associated with running large batches of models in Mplus. The package can reduce the effort required to conduct LCA/LPA analyses by automating the process of creating Mplus syntax, running batches of models, and creating tables to compare the output from each model. However, as this package was recently created, there are few researchers familiar with its’ use and little online guidance for researchers looking to try the package. This poster aims to familiarize the audience with the Mplus Automation package by presenting an example of how the package can be used to facilitate LCA/LPA analyses. Using example data to conduct an LPA, the poster will display syntax, output, and results showing the use of the Mplus Automation package, as well as links to further resources and examples. Through this example, the author hopes to convey the benefits of using the Mplus Automation package and help researchers discover and use the package.

Install & Load Package

```
#First, install package
install.packages(MplusAutomation)
#Once package is installed, load the package
library(MplusAutomation)
```

Create Mplus Formatted Dataset

```
#Load your data into R; it helps to have your data in CSV format
data <- read.csv("C:/Users/...Data.csv")
#Create a formatted dataset for Mplus
MplusSyntax <- prepareMplusData(data, "C:/Users/...MplusData.dat")
#This also starts your Mplus syntax, which can be copied/pasted from the console
```

Create Syntax Template

This step must be done outside of R!
It can be done in Notepad or another program that can create .txt files.
This is used to automatically create your .inp files for Mplus.
The start of your syntax can be copied/pasted from the previous step.
For this example, I am using the Iris dataset.

```
[[init]]
iterators = classes;
classes = 2:7;
filename = "[[classes]]-Class LPA.inp";
outputDirectory = "C:/Users/../LPA Models Folder";
[[/init]]
```

```
TITLE:
Iris Dataset Example [[classes]] classes
DATA:
FILE = "C:/Users/xshor/Desktop/MplusData.dat";
VARIABLE:
NAMES = S_Length S_Width P_Length
P_Width Species;
USEVARIABLES = S_Length S_Width P_Length
P_Width;
MISSING=.;
CLASSES = c ([[classes]]);
ANALYSIS:
TYPE=MIXTURE;
OUTPUT:
tech11 tech14;
```

Automatically Create .inp Files from Template

#In R, you can now use your template file to automatically create .inp files
createModels("C:/Users/.../MplusSyntaxTemplate.txt")

#This will automatically create all your .inp files and save them to the output directory specified in the template

#For example, the 2-class .inp file that was automatically created looks like this:

```
TITLE:
Iris Dataset Example 2 classes
DATA:
FILE = "C:/Users/xshor/Desktop/MplusData.dat";
VARIABLE:
NAMES = Sepal_Length Sepal_Width Petal_Length
Petal_Width Species;
USEVARIABLES = Sepal_Length Sepal_Width Petal_Length
Petal_Width;
MISSING=.;
CLASSES = c (2);
ANALYSIS:
TYPE=MIXTURE;
OUTPUT:
tech11 tech14;
```

Automatically Run .inp Files

#R will automatically run all your .inp files from the output file directory using Mplus.
runModels("C:/Users/../LPA Models Folder",
showOutput = TRUE,
replaceOutfile = "never") #"never"/"always" will re-run if the output file already exists, useful for when you have to re-run a few models.

Read .out Files & Create Table

#reads all the output
allOutput <- readModels(C:/Users/../LPA Models Folder")
#You can also read the warnings and errors
warnings <- readModels("C:/Users/../LPA Models Folder",
what = "warn_err")
#You should always go back to your .out files and manually check for warnings and errors

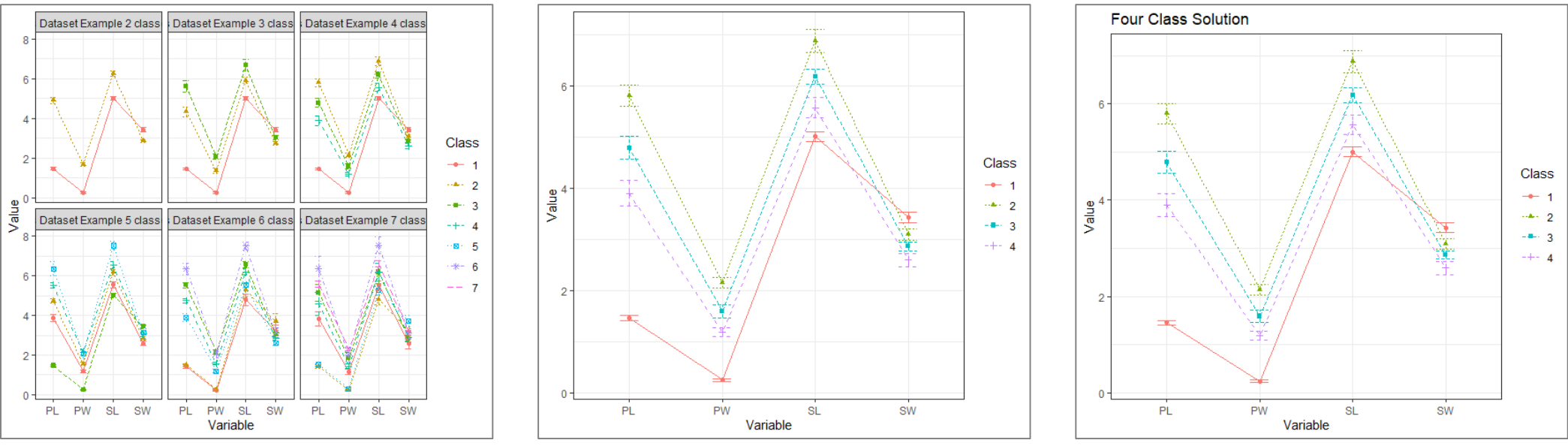
#now you can create an HTML table to compare the models which can be copied/pasted into word
HTMLSummaryTable(allOutput,
filename="C:/Users/xshor/Desktop/MyModelSummary.html",
display=TRUE,
keepCols=c("Title",
"BIC",
"aBIC",
"AIC",
"BLRT_PValue",
"T11_LMR_PValue",
"Entropy"),
sortBy = "Title") #can also sort table by “BIC”, “AIC”, “Entropy”, etc.

#For example, our HTML Table looks like this:

Title	BIC	aBIC	AIC	BLRT_PValue	T11_LMR_PValue	Entropy
Iris Dataset Example 2 classes	1042.97	1001.83	1003.83	0.00	0.00	0.99
Iris Dataset Example 3 classes	813.04	756.08	758.85	0.00	0.02	0.96
Iris Dataset Example 4 classes	735.48	662.69	666.23	0.00	0.03	0.94
Iris Dataset Example 5 classes	694.39	605.77	610.09	0.00	0.06	0.96
Iris Dataset Example 6 classes	693.77	589.33	594.42	0.00	0.26	0.91
Iris Dataset Example 7 classes	671.65	551.39	557.25	0.00	0.81	0.91

Plot Results

#You can create latent profile plots to compare each model
plotMixtures(allOutput)
#You can also create a plot of a specific model
fourclasses <- readModels("C:/Users/.../LPA Models Folder/4-Class LPA.out")
plotMixtures(fourclasses)
#These plots are ggplot objects and can be edited in the same manner. e.g., to add a title...
library(ggplot2)
plotMixtures(fourclasses) +
ggtitle("Four Class Solution")



Additional Resources

<https://cran.r-project.org/web/packages/MplusAutomation/vignettes/Vignette.pdf>
<https://github.com/michaelhallquist/MplusAutomation>
<https://www.statmodel.com/usingmplusviar.shtml>