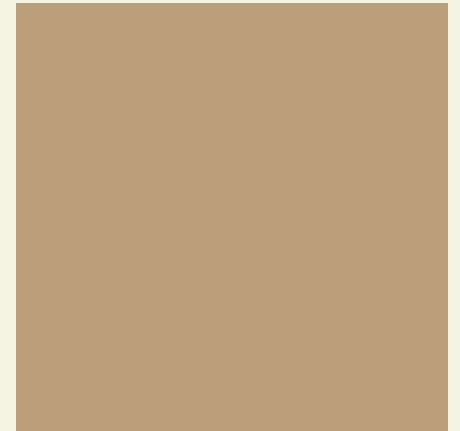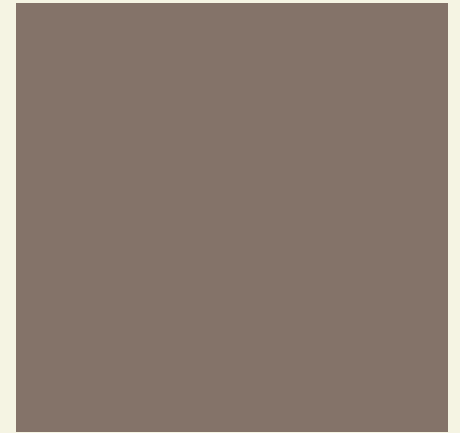+

ICCPP-STATISTICS
- Multivariate Analysis

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# Samual S. Wilks (1906-1964)

Multivariate Analysis

+ Definition

- Multivariate Analysis of Variance (MANOVA), is an advanced form of the more basic analysis of variance (ANOVA).

- In an ANOVA, we examine for statistical differences on one continuous dependent variable by an independent grouping variable.

+ MANOVA

- The MANOVA extends this analysis by taking into account multiple continuous dependent variables, and bundles them together into a weighted linear combination or composite variable.

- The MANOVA will compare whether or not the newly created combination differs by the different groups, or levels, of the independent variable.
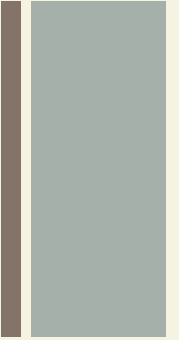
MANOVA
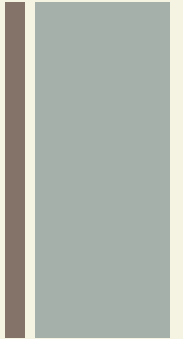
- In this way, the MANOVA essentially tests whether or not the independent grouping variable simultaneously explains a statistically significant amount of variance in the dependent variable.

- An ANOVA will give you a single (univariate) f-value while a MANOVA will give you a multivariate f-value.
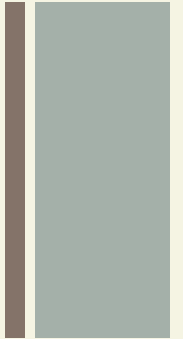
+ Assumptions

- Independent Random Sampling:

  MANOVA assumes that the observations are independent of one another, there is not any pattern for the selection of the sample, and that the sample is completely random.

+ Assumptions

- Level and Measurement of the Variables:

  MANOVA assumes that the independent variables are categorical and the dependent variables are continuous or scale variables.

+ Assumptions

- Absence of multicollinearity:

  The dependent variables cannot have a strong correlation to each other. Tabachnick & Fidell (2012) suggest that no correlation should be above r = .90.
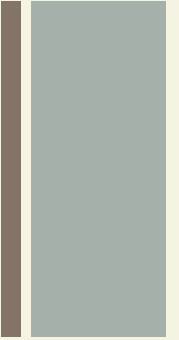
+ Assumptions

- Normality
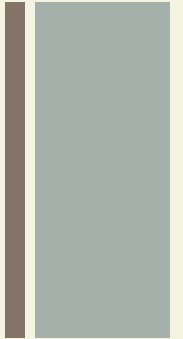 Multivariate normality is present in the data

- Homogeneity of Variance
  Variance between groups is equal
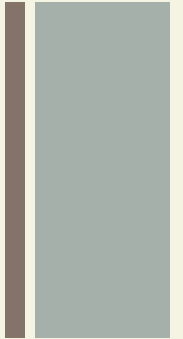
Objective of Multivariate Analysis

MVA or Multivariate Analysis considers multiple factors. The objectives of MVA are:

- Reduction in data or simplification of the structure.

- Grouping and Sorting the data.

- Data is verified based on the variables.

- Establishing a connection between the variables.

- Testing and construction of hypothesis.

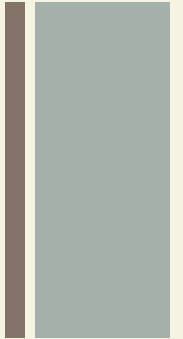# Advantages and Disadvantages of MANOVA vs ANOVA

Advantages:

- MANOVA enables you to test multiple dependent variables.

- MANOVA can protect against Type I errors.

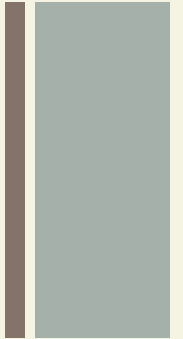# Advantages and Disadvantages of MANOVA vs ANOVA

Disadvantages:

- MANOVA is many times more complicated than ANOVA, making it a challenge to see which independent variables are affecting dependent variables.

- One degree of freedom is lost with the addition of each new variable.

# + Advantages and Disadvantages of Multivariate Analysis

■ Advantages

1. MVA considers multiple variables. These variables can be independent or dependent on each other. The analysis considers the factors and draws an accurate conclusion.

2. The analysis is tested and conclusions are drawn. The drawn conclusions are close to real-life situations.

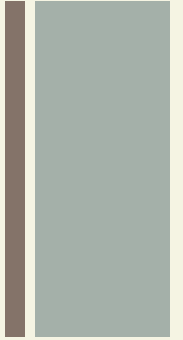# + Advantages and Disadvantages of Multivariate Analysis
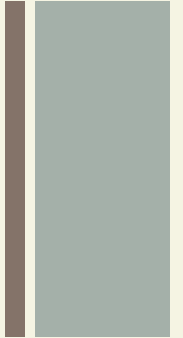
- Disadvantages

  1. MVA is laborious and as it includes complex computations.

  2. The analysis requires a huge amount of observations for multiple variables that are collected and tabulated. This observation process is time-consuming.
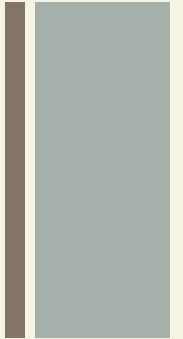
+ Performing the Multivariate Analysis

- There are more than 20 different ways to perform multivariate analysis.

- Which one you choose depends upon the type of data you have and what your goals are.
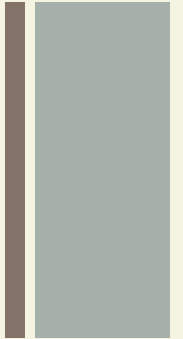
+ Performing the Multivariate Analysis

For example, if you have a single data set you have several choices:

- Additive trees, multidimensional scaling, cluster analysis are appropriate for when the rows and columns in your data table represent the same units and the measure is either a similarity or a distance.
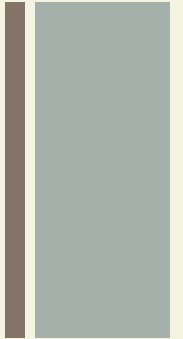
+ Performing the Multivariate Analysis

- Principal component analysis (PCA) decomposes a data table with correlated measures into a new set of uncorrelated measures.

- Correspondence analysis is similar to PCA. However, it applies to contingency tables.
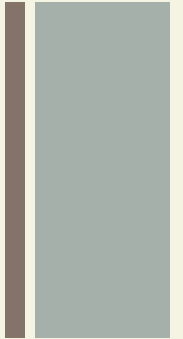
+ Performing the Multivariate Analysis

- This type of analysis is almost always performed with software (like SPSS or SAS), as working with even the smallest of data sets can be overwhelming by hand.

- SPSS: Can be performed using the analysis menu, selecting the "GLM" option, and then choosing the "Multivariate" option from the GLM option.

References

https://www.jigsawacademy.com/blogs/data-science/multivariate-analysis/#What-is-Multivariate-Analysis?,date 25.11.21, 16:30 h MET

https://www.statisticssolutions.com/free-resources/directory-of-statistical-analyses/manova/, date 25.11.21, 16:00 h MET

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Tabachnick, B. G. & Fidell, L. S. (2012). Using multivariate statistics (6th ed.). Boston, MA: Pearson.