Multivariate GLM, MANOVA, and MANCOVA

Multivariate (generalized linear model) GLM is the extended form of GLM, and it deals with more than one dependent variable and one or more independent variables. It involves analyses such as the MANOVA and MANCOVA, which are the extended forms of the ANOVA and the ANCOVA, and regression models..

The MANOVA in multivariate GLM extends the ANOVA 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. 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.

There is a term called Step down MANOVA which can also be called Roy-Bargman Stepdown F test. Step down MANOVA in multivariate GLM is used to perform a significance test of the main effects in order to prevent the inflation of Type I errors.

MANCOVA in multivariate GLM is an extension of ANCOVA. Essentially, the MANCOVA assesses for statistical differences on multiple continuous dependent variables by an independent grouping variable, while controlling for a third variable called the covariate; multiple covariates can be used, depending on the sample size. Covariates are added so that it can reduce error terms and so that the analysis eliminates the covariates' effect on the relationship between the independent grouping variable and the continuous dependent variables.

MANCOVA is a kind of 'what if analysis' in which the researcher analyzes what the results would be if all the cases scored equally on the covariates, such that the factors over and beyond the covariates are diminished.

Basically, the MANOVA and MANCOVA in multivariate GLM are two-step procedures which involve the significance test (are there significant differences) and the post hoc test (if significant differences exist, where do they lie).

There are certain significance tests in MANOVA/MANCOVA. These are the Hotelling's T square test, the Wilk's lambda U test, and the Pillai's trace test.

There are certain assumptions of Multivariate GLM. These assumptions are as follows:

- The independent variables are categorical in nature.
- The dependent variables are continuous and interval in nature.
- The covariate variables are assumed to be measured without error (or as reliably as possible). They must be related to the dependent variables. They can be either

dichotomous, ordinal, or continuous.
- The residuals in multivariate GLM are randomly distributed.
- There should be no outliers as MANCOVA is highly sensitive to outliers in the covariates.

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Resources

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