Rapport package team

ANOVA Template

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Contents

Description

An ANOVA report with table of descriptives, diagnostic tests and ANOVA-specific statistics.

Introduction

Analysis of Variance or **ANOVA** is a statistical procedure that tests equality of means for several samples. It was first introduced in 1921 by famous English statistician Sir Ronald Aylmer Fisher.

Model Overview

One-Way ANOVA was carried out, with *Gender* as independent variable, and *Internet usage in leisure time (hours per day)* as a response variable. Factor interaction was taken into account.

Descriptives

In order to get more insight on the model data, a table of frequencies for ANOVA factors is displayed, as well as a table of descriptives.

Frequency Table Below lies a frequency table for factors in ANOVA model. Note that the missing values are removed from the summary.

gender	N	%	Cumul. N	Cumul. %
male	410	60.92	410	60.92
female	263	39.08	673	100
Total	673	100	673	100

Descriptive Statistics The following table displays the descriptive statistics of ANOVA model. Factor levels lie on the left-hand side, while the corresponding statistics for response variable are given on the right-hand side.

Gender	Min	Max	Mean	Std.Dev.	Median	IQR
male	0	12	3.27	1.953	3	3
female	0	12	3.064	2.355	2	3

Table 2: Table continues below

Skewness	Kurtosis
0.9443	0.9858
1.398	1.87

Diagnostics

Before we carry out ANOVA, we'd like to check some basic assumptions. For those purposes, normality and homoscedascity tests are carried out alongside several graphs that may help you with your decision on model's main assumptions.

Diagnostics

Method	Statistic	p-value
Lilliefors (Kolmogorov-Smirnov) normality test	0.168	3e-52
Anderson-Darling normality test	18.75	7.261e-44
Shapiro-Wilk normality test	0.9001	1.618e-20

Univariate Normality So, the conclusions we can draw with the help of test statistics:

- based on *Lilliefors test*, distribution of *Internet usage in leisure time (hours per day)* is not normal
- *Anderson-Darling test* confirms violation of normality assumption
- according to *Shapiro-Wilk test*, the distribution of *Internet usage in leisure time (hours per day)* is not normal

As you can see, the applied tests confirm departures from normality of the Internet usage in leisure time (hours per day).

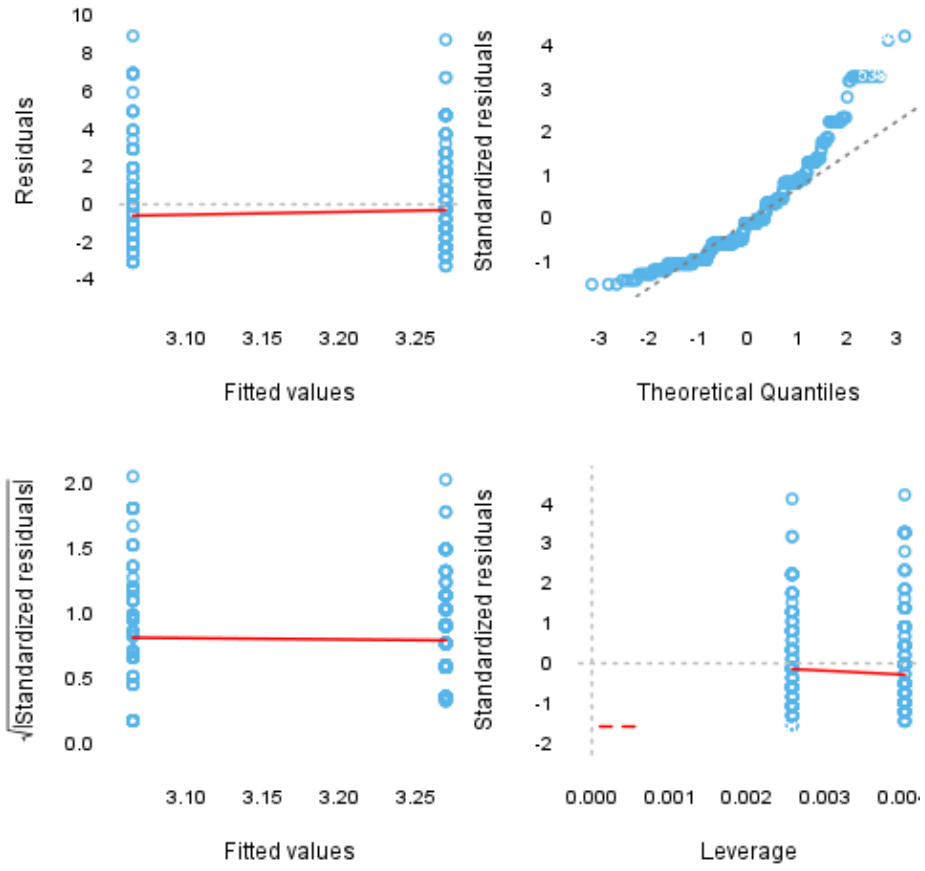
Homoscedascity In order to test homoscedascity, *Bartlett* and *Fligner-Kileen* tests are applied.

Method	Statistic	p-value
Fligner-Killeen test of homogeneity of variances	0.4629	0.4963
Bartlett test of homogeneity of variances	10.77	0.001032

When it comes to equality of variances, applied tests yield inconsistent results. While *Fligner-Kileen test* confirmed the hypotheses of homoscedascity, *Bartlett's test* rejected it.

Diagnostic Plots Here you can see several diagnostic plots for ANOVA model:

- residuals against fitted values
- scale-location plot of square root of residuals against fitted values
- normal Q-Q plot
- residuals against leverages



ANOVA Summary

	Df	Sum.Sq	Mean.Sq	F.value	Pr..F.
gender	1	6.422	6.422	1.43	0.2322
Residuals	636	2856	4.49		

ANOVA Table *F-test* for *Gender* is not statistically significant, which implies that there is no Gender effect on response variable.

Post Hoc test

Results After getting the results of the ANOVA, usually it is advisable to run a post hoc test to explore patterns that were not specified a priori. Now we are presenting Tukey's HSD test.

gender

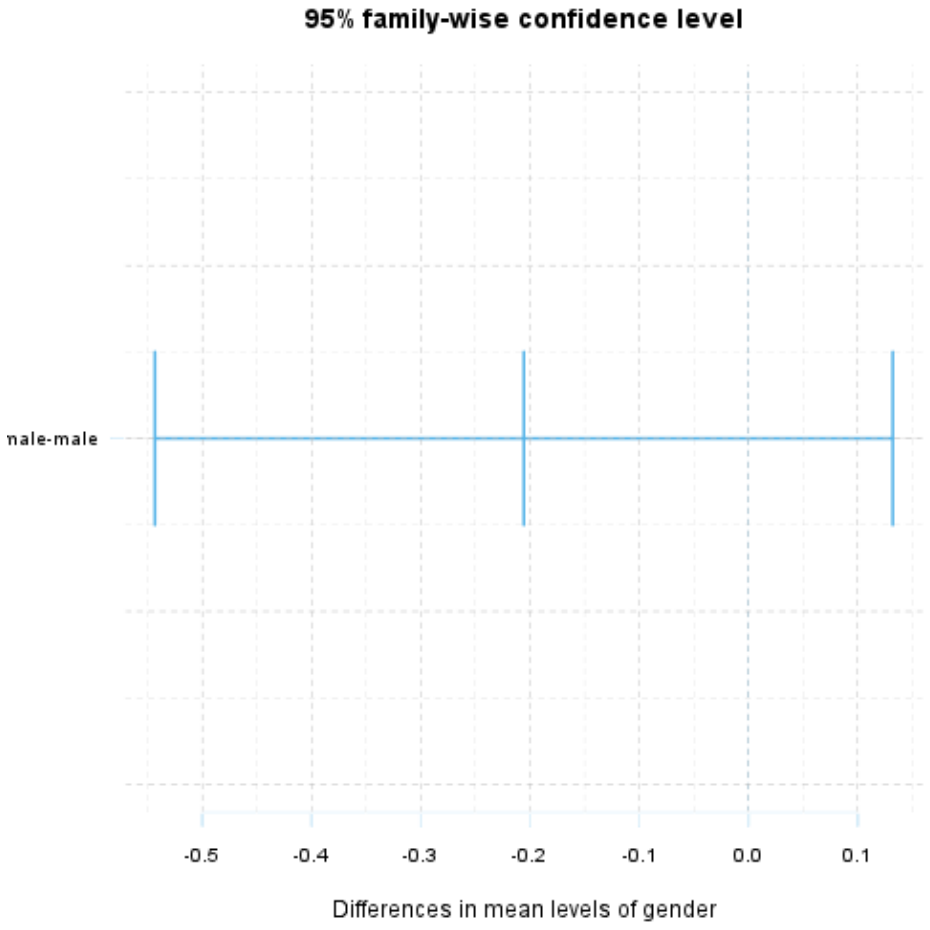
	Difference	Lower Bound	Upper Bound
female-male	-0.206	-0.543	0.132

Table 7: Table continues below

	P value
female-male	*0.232*

There are no categories which differ significantly here.

Plot Below you can see the result of the post hoc test on a plot.



Description

An ANOVA report with table of descriptives, diagnostic tests and ANOVA-specific statistics.

Introduction

Analysis of Variance or **ANOVA** is a statistical procedure that tests equality of means for several samples. It was first introduced in 1921 by famous English statistician Sir Ronald Aylmer Fisher.

Model Overview

Two-Way ANOVA was carried out, with *Gender* and *Relationship status* as independent variables, and *Internet usage in leisure time (hours per day)* as a response variable. Factor interaction was taken into account.

Descriptives

In order to get more insight on the model data, a table of frequencies for ANOVA factors is displayed, as well as a table of descriptives.

Frequency Table Below lies a frequency table for factors in ANOVA model. Note that the missing values are removed from the summary.

gender	partner	N	%	Cumul. N	Cumul. %
male	in a relationship	150	23.7	150	23.7
female	in a relationship	120	18.96	270	42.65
male	married	33	5.213	303	47.87
female	married	29	4.581	332	52.45
male	single	204	32.23	536	84.68
female	single	97	15.32	633	100
Total	Total	633	100	633	100

Descriptive Statistics The following table displays the descriptive statistics of ANOVA model. Factor levels and their combinations lie on the left-hand side, while the corresponding statistics for response variable are given on the right-hand side.

Gender	Relationship status	Min	Max	Mean	Std.Dev.
male	in a relationship	0.5	12	3.058	1.969
male	married	0	8	2.985	2.029
male	single	0	10	3.503	1.936
female	in a relationship	0.5	10	3.044	2.216
female	married	0	10	2.481	1.967
female	single	0	12	3.323	2.679

Table 10: Table continues below

Median	IQR	Skewness	Kurtosis
2.5	2	1.324	2.649
3	2	0.862	0.1509
3	3	0.7574	0.08749
3	3	1.383	1.831
2	1.75	2.063	5.586
3	3.5	1.185	0.9281

Diagnostics

Before we carry out ANOVA, we'd like to check some basic assumptions. For those purposes, normality and homoscedascity tests are carried out alongside several graphs that may help you with your decision on model's main assumptions.

Diagnostics

Method	Statistic	p-value
Lilliefors (Kolmogorov-Smirnov) normality test	0.168	3e-52
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Univariate Normality So, the conclusions we can draw with the help of test statistics:

- based on *Lilliefors test*, distribution of *Internet usage in leisure time (hours per day)* is not normal
- *Anderson-Darling test* confirms violation of normality assumption

- according to *Shapiro-Wilk test*, the distribution of *Internet usage in leisure time (hours per day)* is not normal

As you can see, the applied tests confirm departures from normality of the Internet usage in leisure time (hours per day).

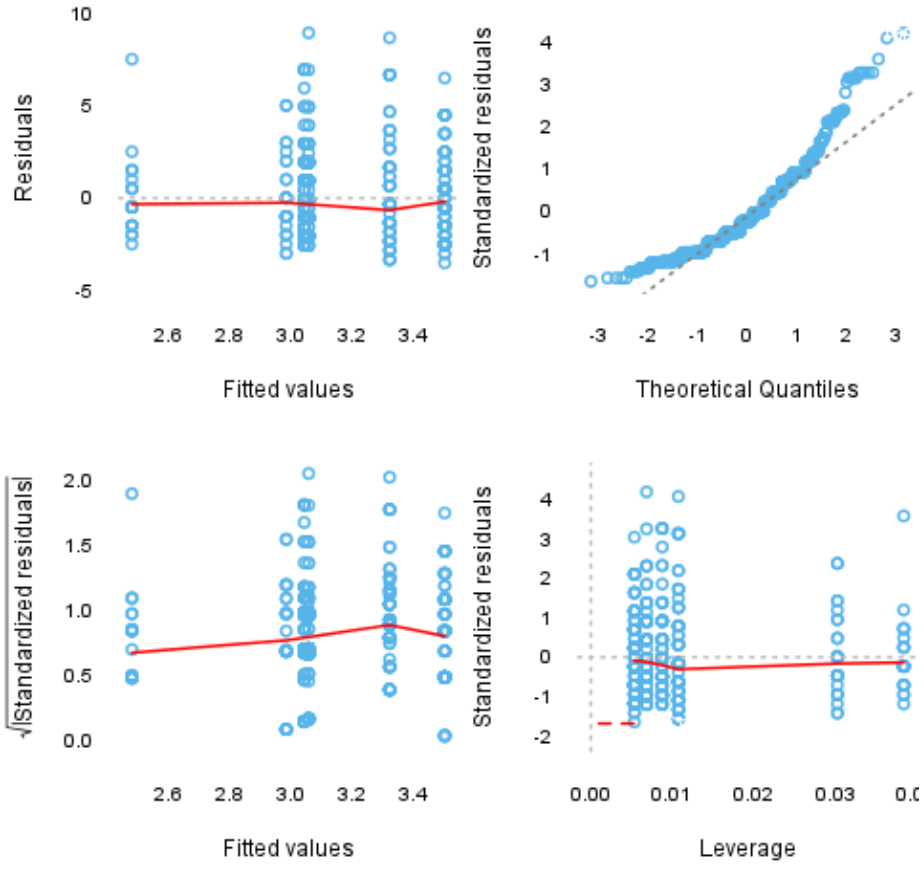
Homoscedascity In order to test homoscedascity, *Bartlett* and *Fligner-Kileen* tests are applied.

Method	Statistic	p-value
Fligner-Killeen test of homogeneity of variances	1.123	0.2892
Bartlett test of homogeneity of variances	11.13	0.0008509

When it comes to equality of variances, applied tests yield inconsistent results. While *Fligner-Kileen test* confirmed the hypotheses of homoscedascity, *Bartlett's test* rejected it.

Diagnostic Plots Here you can see several diagnostic plots for ANOVA model:

- residuals against fitted values
- scale-location plot of square root of residuals against fitted values
- normal Q-Q plot
- residuals against leverages



ANOVA Summary

	Df	Sum.Sq	Mean.Sq	F.value
gender	1	4.947	4.947	1.085
partner	2	31.21	15.61	3.424
gender:partner	2	3.038	1.519	0.3332
Residuals	593	2703	4.558	

Table 14: Table continues below

	Pr..F.
gender	0.2979
partner	0.03324
gender:partner	0.7168
Residuals	

ANOVA Table *F-test* for *Gender* is not statistically significant, which implies that there is no Gender effect on response variable. Effect of *Relationship status* on response variable is significant. Interaction between levels of *Gender* and *Relationship status* wasn't found significant (p = 0.717).

Post Hoc test

Results After getting the results of the ANOVA, usually it is advisable to run a post hoc test to explore patterns that were not specified a priori. Now we are presenting Tukey's HSD test.

gender

	Difference	Lower Bound	Upper Bound
female-male	-0.186	-0.538	0.165

Table 16: Table continues below

	P value
female-male	*0.298*

There are no categories which differ significantly here.

partner

	Difference	Lower Bound
married-in a relationship	-0.289	-1.012

single-in a relationship	0.371	-0.061
single-married	0.66	-0.059

Table 18: Table continues below

	Upper Bound	P value
married-in a relationship	0.435	*0.616*
single-in a relationship	0.803	*0.109*
single-married	1.379	*0.079*

There are no categories which differ significantly here.

gender:partner

	Difference	Lower Bound
female:in a relationship-male:in a relationship	-0.014	-0.777
male:married-male:in a relationship	-0.073	-1.25
female:married-male:in a relationship	-0.577	-1.877
male:single-male:in a relationship	0.444	-0.23
female:single-male:in a relationship	0.264	-0.545
male:married-female:in a relationship	-0.059	-1.266
female:married-female:in a relationship	-0.563	-1.89
male:single-female:in a relationship	0.459	-0.267
female:single-female:in a relationship	0.279	-0.574
female:married-male:married	-0.504	-2.105
male:single-male:married	0.518	-0.635
female:single-male:married	0.338	-0.899

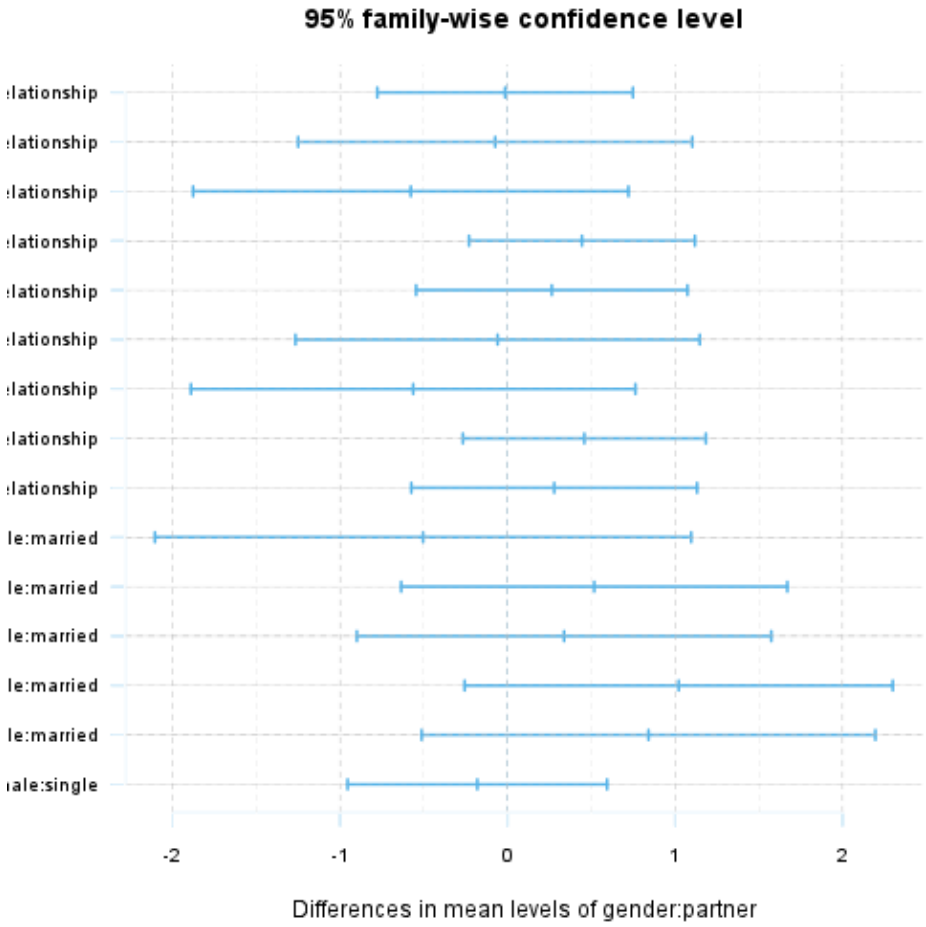
male:single-female:married	1.022	-0.256
female:single-female:married	0.842	-0.512
female:single-male:single	-0.18	-0.955

Table 20: Table continues below

	Upper Bound	P value
female:in a relationship-male:in a relationship	0.749	*1*
male:married-male:in a relationship	1.103	*1*
female:married-male:in a relationship	0.722	*0.801*
male:single-male:in a relationship	1.119	*0.412*
female:single-male:in a relationship	1.074	*0.938*
male:married-female:in a relationship	1.148	*1*
female:married-female:in a relationship	0.764	*0.83*
male:single-female:in a relationship	1.184	*0.461*
female:single-female:in a relationship	1.132	*0.938*
female:married-male:married	1.097	*0.946*
male:single-male:married	1.67	*0.794*
female:single-male:married	1.575	*0.971*
male:single-female:married	2.3	*0.201*
female:single-female:married	2.196	*0.481*
female:single-male:single	0.594	*0.986*

There are no categories which differ significantly here.

Plot Below you can see the result of the post hoc test on a plot.



This report was generated with R (3.0.1) and rapport (0.51) in *3.431* sec on x86_64-unknown-linux-gnu platform.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