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An Univariate Analysis Of ANOVA for TAE Data Set

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Abstract: The objective of this paper is to introduce ANOVA and its different test implementations. Different data sets are employed to find the statistical difference and significance among attributes. Moreover, one way ANOVA and Two way ANOVA tests are performed to discover the dependent and independent variables. Our analysis exemplifies One-way and Two-way ANOVA are basics for ANOVA test. The F-ratio tests are performed to find multiple group dataset and univariate Analysis is performed on Teaching Assistant Evaluation (TAE) data set. After successfully conducting the testing it is found that there is no significant interaction between NES/ Non-ES and Summer/Regular attributes.

Keywords: TAE data set, ANOVA, Univariate Analysis, Dependent variable, Independent variable.

I. INTRODUCTION

Analysis of variance (ANOVA) is a statistical method which evaluates different causes of discrepancy within a data set. The differences are found out n scale-level difference variable by a nominal level variable [1]. It was developed by statistician and evolutionary biologist Ronald Fisher. It discovers the main and interaction effects of classification or independent variable on one or more dependent variable. In regression, ANOVA test is used to identify the independent variables have on the dependent variable. The idea of the evaluation is to conclude whether significant difference exists between groups. One can inspect the relationship between two variables by relating the mean of the dependent variable between the independent variable in the groups [5]. The ANOVA is performed using Statistical Package for the Social Science (SPSS).

For any data set, ANOVA is the initial stage to analyse the factors. After finishing this initial stage, the additional tests are performed to contribute the data set's inconsistency. This ANOVA permits to test more than two groups in similar time to find a relationship between them. There is a test called F statistic, which is also called the F-ratio, is used to test multiple groups of data. If there is no difference exists between these tested data, which is called null hypothesis. The F-ratio's result will be close to 1. The numerator degrees of freedom and denominator degrees of freedom are the collection of distribution functions with two characteristic numbers [2].

ANOVA has two basic designs

- ✓ **One-Way ANOVA**
- ✓ **Two-Way ANOVA**

One-Way ANOVA

One-Way ANOVA is the simplification of T-test for independent samples to conditions with additional groups. It is also known as one –factor ANOVA.

Two-Way ANOVA

Two-Way ANOVA is used when two independent variables of factors and it is interested to know their effect on the same dependent variable.

II. TEACHING ASSISTANT EVALUATION

Teaching Assistant Evaluation (TAE) data set had fetched from the University of California *repository.* It consists of evaluation of teaching performance for three regular and two summer of 151 Teaching

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Assistant. The grades are categorized in to three values of low, medium and high [3].

TABLE 1
Features of TAE data set with type of attribute

Attributes Name	Attributes Type	Attributes Possible Values
English_ Speaker	Binary	1=English Speaker, 2=Non-English Speaker
Course_ Instructor	Categorical	25 Category
Summer_ Semester Regular_ Semester	Binary	1=Summer Semester 2=Regular Semester
Class _ Size	Real	
Class_ Attributes	---	1=Low 2=Medium 3=High

III. Univariate Analysis Of TAE

The univariate ANOVA is the part of the one-way ANOVA. This univariate ANOVA deals with the study of many independent variables. It is used to test the each and every step of element is combined with other element.

One can evaluate every variable individually and jointly [4].

TABLE 2
Between-subjects factors of TAE

		N
NES1	1	29
Non ES2	2	122
Summer1	1	23
Regular2	2	128

From the
Table 2 gives the number of subjects in each label of the factor. This scenario shows 29 Native English Speaker (NES), 122 Non-English Speaker (Non-ES), 23 Summer Regular and 128 teaching assistant.

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TABLE 3
Descriptive Statistics of TAE
Dependent Variable: Performance

NES1 Non ES2	Summer1 Regular2	Mean	Std. Deviation	N
1	1	2.44	.882	9
	2	2.45	.759	20
	Total	2.45	.783	29
2	1	2.64	.497	14
	2	1.82	.783	108
	Total	1.92	.799	122
Total	1	2.57	.662	23
	2	1.92	.809	128
Total	Total	2.02	.820	151

Table 3 provides us the mean, standard deviation and number of cases for the combination of difference of the factors for TAE data set.

Table 4: Tests of between-subjects effects of TAE
Dependent Variable: Performance

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	14.896[a]	3	4.965	8.483	.000
Intercept	362.431	1	362.431	619.187	.000
NES1 Non ES2	.756	1	.756	1.291	.258
Summer1 Regular2	2.735	1	2.735	4.673	.032
NES1 Non ES2 * Summer1 Regular2	2.810	1	2.810	4.801	.030
Error	86.044	147	.585		
Total	717.000	151			
Corrected Total	100.940	150			

a. R Squared = .148 (Adjusted R Squared = .130)

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Null Hypothesis (H_0)

There is no significant interaction between NES/Non-ES and Summer / Regular.

Alternative Hypothesis (H_1)

There is significant interaction between NES/Non-ES and Summer / Regular.

Level of Significance

The level may be fixed at 5% Level of Significance.

Test Statistics

ANOVA test can be carried out for testing between NES/Non- ES and Summer/Regular.

Output

Table 4 labelled Tests of Between-subject's effects. The F-statistics for NES/Non-ES background is 1.291, which is insignificant as p=0.258. There is no significant interaction between NES/ Non-ES and Summer/Regular. Therefore, the null hypothesis (H_0) is accepted. The alternate hypothesis (H_1) is rejected.

The result is shown as the Summer / Regular has a significant effect on the enactment of teaching assistants, F (1,147) =4.673, p < 0. 032.However, NES/Non-ES does not affect the performance of the teaching assistants, F (1,147) = 4.801, p=.030

IV. CONCLUSION

The overview of a statistical method ANOVA is explained in this paper. Test between different groups and the results produced with significant difference are also demonstrated. Hypothesis concepts and the tests performed in One-way ANOVA and Two-way ANOVA concepts with some statistical significance are also plotted. All the experiments are performed using Statistical Package for the Social Science (SPSS). By means of ANOVA test we found that there is no significant interaction between NES/ Non-ES and Summer/Regular attributes. The implementation of ANOVA test in TAE data set is useful in finding the new outcome.

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