Two-Way ANOVA

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Lab Two for Linear Models and Experimental Design

Abstract

Abstract：In this paper, I will provide the brief answer for the questions in the lab 4. Code and detail information will not be covered. Please contact me if you are interested in code.

Keywords: ANOVA

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According to the Figure 1, there exist an interaction effect between migraine and treatment group. Additionally, there exist the main effects for both migraine and treatment group. However, both main effects are not obvious. Thus, the interaction effects should dominate the main effects.

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Figure 1: Interaction Plot for the effects of treatment group and migraine status on headache intensity

Let’s model the interaction and main effects with two-way ANOVA. The full model can be expressed as:

To test the interaction effect of this model, we have the reduced model as:

We want to test, H0: against H0: . Based on the ANOVA output, we can see that the test for interaction is not significant (F (1, 297) = 2.06; p = .15). The corresponding F table is showing in the Table 1. The F test of the interaction effect in ANOVA is the same as the t test in full model regression for the interaction parameter.

Table 1: ANOVA table for the test for the interaction effect

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | Sum of Square | df | Mean Square | F | P-value |
| Interaction | 485 | 1 | 485 | 2.064 | 0.15 |
| Residuals | 69778 | 297 | 234.9 |  |  |

This result is not consistent with the information that we get from Figure 1. Thus, we should test the simple effect. First, given the migraine status, we analysis the simple effect of treatment group (see Table 2). As we can see the simple effect of treatment group is significant for migraine, while not signification for stress.

Table 2: the simple effect of treatment group on the outcome given migraine diagnosis

|  |  |  |  |
| --- | --- | --- | --- |
| Group | Mean Diff (T-C) | d | P-value |
| Migraine | -6.7 | -0.44 | 0.003 |
| Stress | 4.3 | 0.26 | 0.6 |

Similarly, given the fixed group, we analysis the simple effect of migraine status (see Table 3). There is no simple effect from migraine.

Table 3: the simple effect of treatment group assignment on the outcome given stress-type diagnosis.

|  |  |  |  |
| --- | --- | --- | --- |
| Group | Mean Diff (M-S) | d | P-value |
| Treatment | 3.74 | 0.22 | 0.41 |
| Control | -7.27 | -0.53 | 0.30 |

For the main effect, the reduced models are:

The corresponding results are in Table 4 and 5. Consequently, we can conclude that there is no significant main effect from both treatment group and migraine status. The F test of the interaction effect in ANOVA is the same as the t test in full model regression for the corresponding parameters.

parameter Table 4: ANOVA table for the test of main effect of treatment group

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | Sum of Square | df | Mean Square | F | P-value |
| Interaction | 78 | 1 | 78 | 0.33 | 0.56 |
| Residuals | 69778 | 297 | 234.9 |  |  |

Table 5: ANOVA table for the test of main effect of migraine status

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | Sum of Square | df | Mean Square | F | P-value |
| Interaction | 106 | 1 | 106 | 0.45 | 0.50 |
| Residuals | 69778 | 297 | 234.9 |  |  |