Week-03-L-04

Agricultural Statistics in Practice

Analysis of Variance (ANOVA)

Two – Way ANOVA with more than one observations per cell

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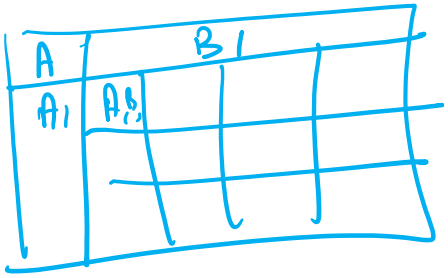
2 Way ANOVA with >1 Obs/cell

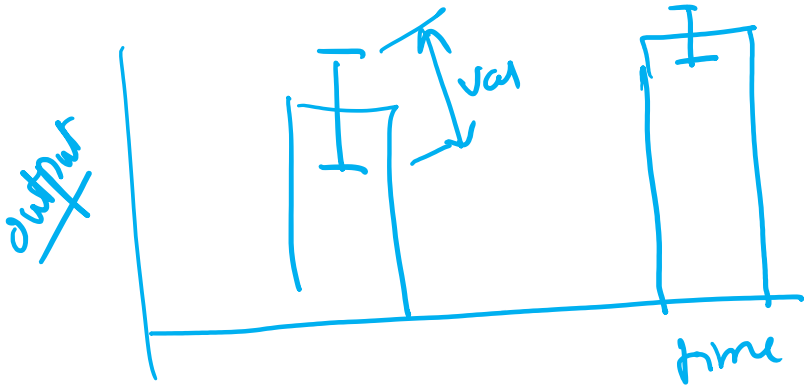
- Used to examine the effects of two independent categorical variables on a continuous dependent variable.
- The data is structured in a two-dimensional table, with one factor determining the rows and the other factor determining the columns.
- Each cell in the table represents a unique combination of the two factors, and there are multiple observations per cell.
- We identify chief effects/factor & interaction between factors on dependent variables, while accounting for within cell variablity.
- It requires assessing variance components and conducting hypothesis tests to evaluate the significance of the effects.

μ_0



Advantages

- Provides a more robust analysis by accounting for within-cell variability.
- It provides a better estimate of the effects and reduces the impact of measurement error.
- More obs = Higher precison = Higher Accuracy.
- Provides insights into the consistency of the effects across different observations.



Two way classification with more than one observation per cell

A	B				
	B1	B2	.....	Bj	.....
A1	(A1B1)1 (A1B1)2 (A1B1)3	(A1B2)1 (A1B2)2 (A1B2)3	....	(A1Bj)1 (A1Bj)2 (A1Bj)3	....
A2	(A2B1)1 (A2B1)2 (A2B1)3	(A2B2)1 (A2B2)2 (A2B2)3	....	(A2Bj)1 (A2Bj)2 (A2Bj)3	....
:	.....	.....	.....	:	.....
:				:	.....
Ai	(AiB1)1 (AiB1)2 (AiB1)3	(AiB2)1 (AiB2)2 (AiB2)3	....	(AiBj)1 (AiBj)2 (AiBj)3	....
:	:	:	.....	:	.....
:	:	:	.....	:	.....

Source:
Applied Statistics for Agriculture, Pradip Kumar Sahu

Calculating

- The formulas and tabulations for Two-Way ANOVA with more than 1 observation per cell are similar to those with one observation per cell.
- However, additional calculations are required to account for within-cell variability, such as calculating within-cell sum of squares and degrees of freedom. Following are the necessary steps:
- Calculate the overall mean of the dependent variable.

a) Compute the sum of squares for each factor, interaction, and within-cell variability, as well as the total sum of squares.

b) Determine the degrees of freedom for each sum of squares.

c) Calculate the mean squares by dividing the sum of squares by their respective degrees of freedom.

d) Conduct hypothesis tests using F-tests to assess the significance of main effects and interactions, considering within-cell variability.

e) Interpret the results, considering the significance of each effect, their interactions, and the within-cell variability.

Use Cases

- In the agriculture industry, a Two-Way ANOVA with more than 1 observation per cell can be applied to analyze the effects of different fertilizer types (Factor 1) and different irrigation levels (Factor 2) on crop yield (dependent variable).
- The study would involve multiple observations of crop yield for each unique combination of fertilizer type and irrigation level.
- By conducting a Two-Way ANOVA, researchers can assess the main effects of fertilizers and irrigation levels, identify potential interactions, and account for within-cell variability, allowing for a more comprehensive understanding of the factors influencing crop yield.

Thank You