How to Compare Groups and Find Significant Differences Using ANOVA

Authored by

stats writer

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ANOVA (Analysis of Variance) is a statistical method used to compare means between multiple groups. It is often used in research studies to determine if there is a significant difference between several groups or conditions. In the aforementioned scenarios, ANOVA could be used to analyze data and determine if there is a significant effect, difference, or impact between the various factors being studied. This method allows for a more thorough and accurate analysis, providing valuable insights and conclusions for decision making and further research.

4 Examples of Using ANOVA in Real Life

Often when students learn about a certain topic in school, they're inclined to ask:

When is this ever used in real life?

This is often the case in statistics, when certain techniques and methods seem so obscure that it's hard to imagine them actually being applied in real-life situations.

However, the ANOVA (short for "analysis of variance") is a technique that is actually used all the time in a variety of fields in real life.

In this post, we'll share a quick refresher on what an ANOVA is along with four examples of how it is used in real life situations.

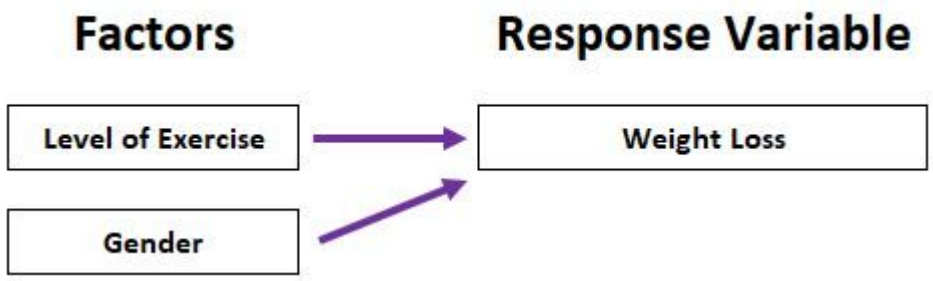
What is an ANOVA?

An ANOVA ("Analysis of Variance") is a statistical technique that is used to determine whether or not there is a significant difference between the means of three or more independent groups. The two most common types of ANOVAs are the one-way ANOVA and two-way ANOVA.

A One-Way ANOVA is used to determine how one factor impacts a response variable. For example, we might want to know if three different studying techniques lead to different mean exam scores. To see if there is a statistically significant difference in mean exam scores, we can conduct a one-way ANOVA.

A Two-Way ANOVA is used to determine how two factors impact a response variable, and to determine whether or not there is an interaction between the two factors on the response variable. For example, we might want to know how gender and how different levels of exercise impact average weight loss. We would conduct

a two-way ANOVA to find out.



It's also possible to conduct a three-way ANOVA, four-way ANOVA, etc. but these are much more uncommon and it can be difficult to interpret ANOVA results if too many factors are used.

Now we will share four different examples of when ANOVA's are actually used in real life.

ANOVA Real Life Example #1

A large scale farm is interested in understanding which of three different fertilizers leads to the highest crop yield. They sprinkle each fertilizer on ten different fields and measure the total yield at the end of the growing season.

To understand whether there is a statistically significant difference in the mean yield that results from these

three fertilizers, researchers can conduct a one-way ANOVA, using "type of fertilizer" as the factor and "crop yield" as the response.

If the overall p-value of the ANOVA is lower than our significance level (typically chosen to be 0.10, 0.05, 0.01) then we can conclude that there is a statistically significant difference in mean crop yield between the three fertilizers. We can then conduct to determine exactly which fertilizer lead to the highest mean yield.

ANOVA Real Life Example #2

Medical researchers want to know if four different medications lead to different mean blood pressure reductions in patients. They randomly assign 20 patients to use each medication for one month, then measure the blood pressure both before and after the patient started using the medication to find the mean blood pressure reduction for each medication.

To understand whether there is a statistically significant difference in the mean blood pressure reduction that results from these medications, researchers can conduct a one-way ANOVA, using "type of medication"

as the factor and "blood pressure reduction" as the response.

If the overall p-value of the ANOVA is lower than our significance level, then we can conclude that there is a statistically significant difference in mean blood pressure reduction between the four medications. We can then conduct to determine exactly which medications lead to significantly different results.

ANOVA Real Life Example #3

A grocery chain wants to know if three different types of advertisements affect mean sales differently. They use each type of advertisement at 10 different stores for one month and measure total sales for each store at the end of the month.

To see if there is a statistically significant difference in mean sales between these three types of advertisements, researchers can conduct a one-way ANOVA, using "type of advertisement" as the factor and "sales" as the response variable.

If the overall p-value of the ANOVA is lower than our significance level, then we can conclude that there is a

statistically significant difference in mean sales between the three types of advertisements. We can then conduct to determine exactly which types of advertisements lead to significantly different results.

ANOVA Real Life Example #4

Biologists want to know how different levels of sunlight exposure (no sunlight, low sunlight, medium sunlight, high sunlight) and watering frequency (daily, weekly) impact the growth of a certain plant. In this case, two factors are involved (level of sunlight exposure and water frequency), so they will conduct a two-way ANOVA to see if either factor significantly impacts plant growth and whether or not the two factors are related to each other.

The results of the ANOVA will tell us whether each individual factor has a significant effect on plant growth. Using this information, the biologists can better understand which level of sunlight exposure and/or watering frequency leads to optimal growth.

Conclusion

ANOVA is used in a wide variety of real-life situations,

but the most common include:

Retail: Store are often interested in understanding whether different types of promotions, store layouts, advertisement tactics, etc. lead to different sales. This is the exact type of analysis that ANOVA is built for.

Medical: Researchers are often interested in whether or not different medications affect patients differently, which is why they often use one-way or two-way ANOVA's in these situations.

Environmental Sciences: Researchers are often interested in understanding how different levels of factors affect plants and wildlife. Because of the nature of these types of analyses, ANOVA's are often used.

So, next time someone asks you when an ANOVA is actually used in real life, feel free to reference these examples!