KEY_Lesson24_Basic_Stats_IV_Significance

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1 Lesson 24: Statistical Significance

1.1 An introduction to hypothesis testing

Statistical significance is one of the most important parts of statistics—it's what allows us to make conclusions about our data.

But first, what does **statistical significance** mean? - **Definition: statistical significance** is the likelihood that the difference between a given variation and the baseline is not due to random chance. Statistical significance is calculated using different mathematical formulas, which we'll see later in the lesson.

We can determine if our difference is **statistically significant** by comparing our calculated significance value to the significance level. - **Definition: statistical significance level** is the level at which one can accept whether an event or difference is statistically significant, or not due to random chance. This term is denoted as α. The customary significance level is 5%. - **Definition: confidence level** is the opposite of significance level, where the confidence level indicates the degree of confidence that the result did not occur by chance. This term is calculated as $1 - \alpha$. The customary confidence level is 95%. - **For example**, if you run an A/B testing experiment with a **significance level (α) of 5%**, this means that if you determine a winner, you can be **95% confident ($1 - \alpha$)** that the observed results are real and not an error caused by randomness. But there is a **5%** chance that you could be wrong.

Next, when is statistical significance most **practically used**? - It is used in statistical hypothesis testing. - **For example**, you want to know whether or not having a healthier diet will result in lower levels of C-Reactive protein, and hence fewer incidents of infection and inflammation.

What is **hypothesis testing**? - **Definition: hypothesis testing** is the use of statistic to determine the probability that a given hypothesis is true. - There are two types of statistical hypotheses. - **Definition**: The **null hypothesis**, denoted by H_o, is usually the hypothesis that sample observations result purely from chance. The most common null hypothesis is that the variable in question is equal to 0, i.e. this indicates that the variable has zero effect on the outcome of interest. - **Definition**: The **alternative hypothesis**, denoted by H_1 or H_a, is the hypothesis that sample observations are influenced by some non-random cause. A common alternative hypothesis is that the variable in question has a non-zero effect on the outcome.

2 What is a t-test?

Let's apply these definitions to our diet and C-Reactive Protein example. We want to know whether or not having a healthier diet will result in lower levels of C-Reactive protein, and hence