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Hypothesis Testing

WHAT IS HYPOTHESIS TESTING?

Hypothesis testing enables us to validate or test whether a given hypothesis is true. For example, let's say that we have a engine component designed for a Formula One car.

The mean acceleration time for the car with the original component from 0 to 60 miles per hour is 1.2 seconds. We test the component across multiple teams (100 runs) and we find that the mean of this sample is 1.05 seconds. The sample has a standard deviation of 0.5.

So, the NULL hypothesis is that, the new component is NOT helpful and does not improve acceleration times.

The alternative hypothesis is that it is helpful and does improve acceleration.

We aim to prove one of these two hypothesis true as part of our hypothesis testing.

HOW DO WE DO IT?

Before we get started, some points to remember.

With a normal distribution, the following applies:

1. The centre of the bell curve will be the mean
2. 68.2% of datapoints lie within 1 standard deviation
3. 99.5% of datapoints lie within 2 standard deviations of the mean
4. 99.7% of of datapoints lie within 3 standard deviations of the mean

First we need to calculate the population distribution. This distribution is a probability distribution.

To calculate this, we take: The population standard deviation (or the sample deviation if population is not known) and divide it by the square root of the number of observations).

Population distribution = standard deviation / √sample size

0.5 / √100 = 0.05

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WHAT DOES THAT MEAN?

We now know that our population distribution = 0.05, but what does that mean? It means that the standard deviation of our distribution is 0.05.

If we want to know how far our new value of 1.05 deviates from the original mean of 1.2, we can take the following formula, which tells us how many standard deviations from the original mean, our sampling mean would be.

(1.2 - 1.05) / 0.05 = 3

So, it's 3 standard deviations from the original mean. Remember, 99.7% of values lie within 3 standard deviations from the mean, so if the null hypothesis is true, there is only a 0.3% **(P-Value)** chance that we would have got a result this extreme.

Hence, we should reject the null hypothesis.

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