

Hypothesis Testing

—

By Saurav Poudel

How to make use of Statistics?

(Random things like Probability Distributions)

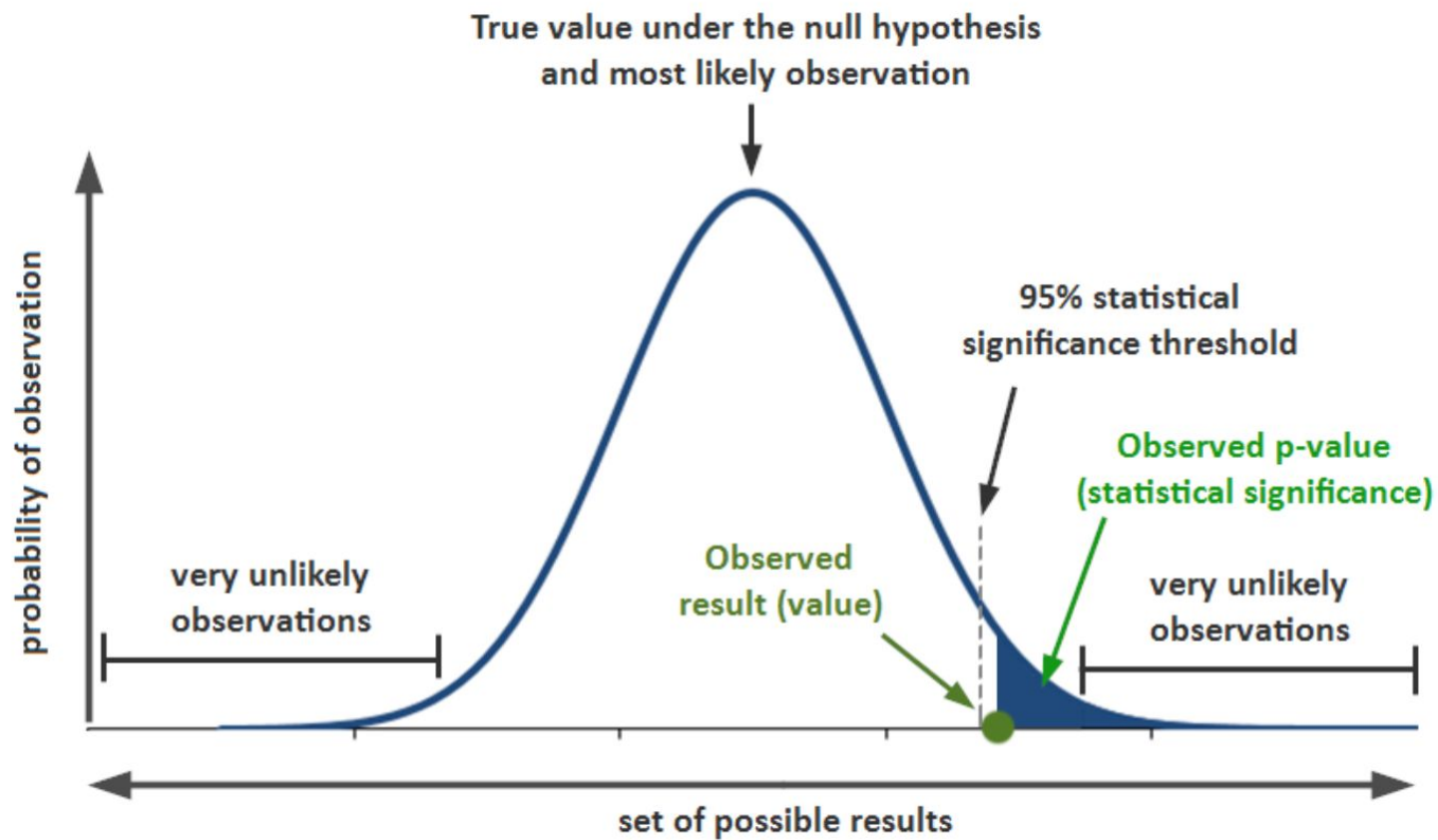
How to make use of Statistical Tests?

Let's say Foodmandu says their average delivery time is 30 mins. How do we check this using Data/Statistics?

Take sample of 30 deliveries and calculate its average??

But can we quantify our belief with that average??

Let's say the average comes 32?? How confident we can be about that number??



But is our data of delivery time Normal for us to use that curve??

How to sneak in Normal Distribution in our problem??

Maybe there's a trick! Central Limit Theorem!!

What if we can take mean of many samples instead?

Samples with Size N

32, 30, 28, 25, 40, 24 = Mean 34

22, 20, 30, 31 = Mean 28

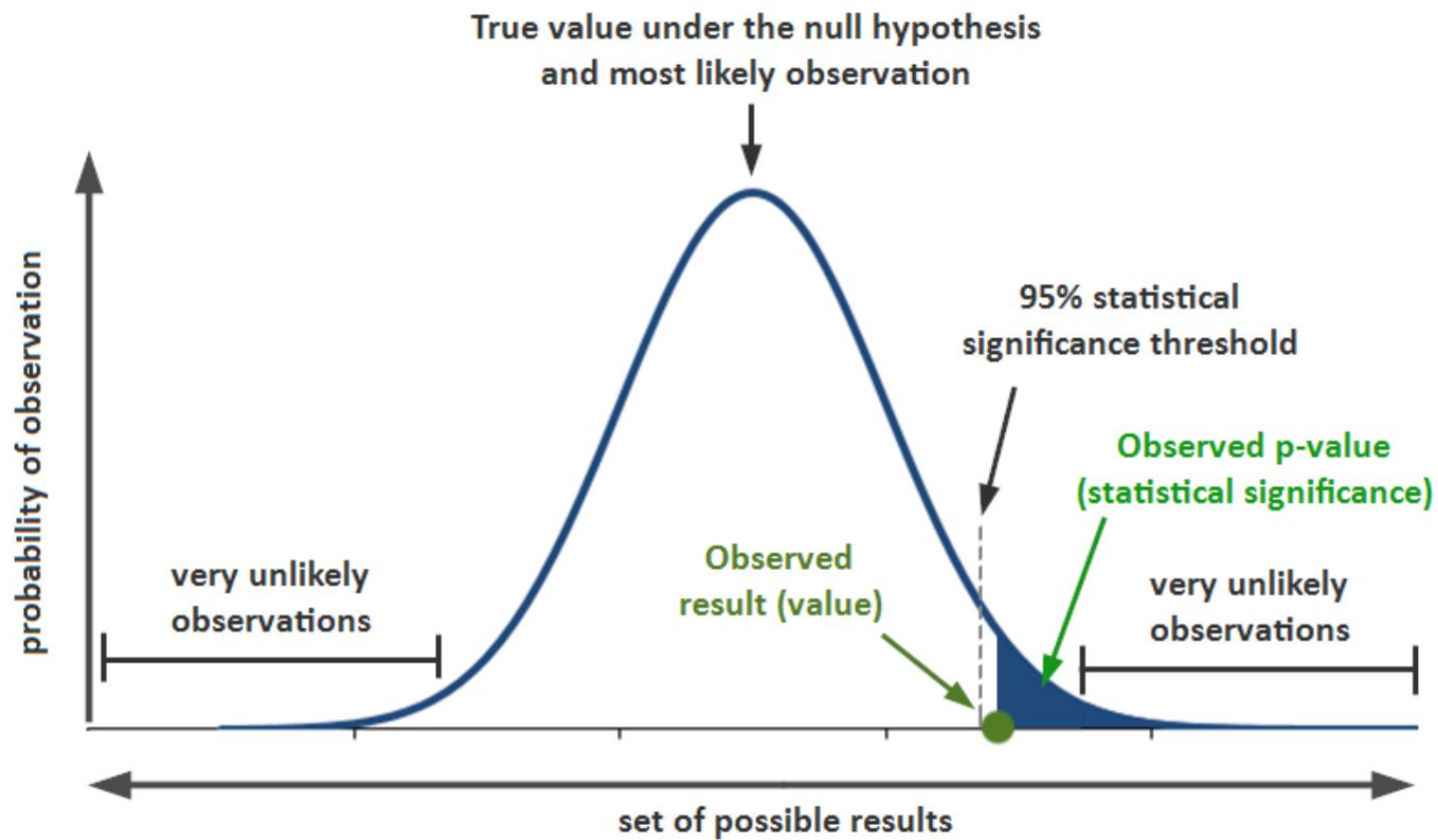
....

.....

32, 40, 25, 28 = Mean 33

Now we plot instead 34, 28 33.





Samples with Size N

32, 30, 28, 25, 40, 24 = Mean 34, SD = 4.2

22, 20, 30, 31 = Mean 28, SD = 3.4

....

.....

32, 40, 25, 28 = Mean 33, SD = 3.6

Now we plot instead 34, 28 33.

That is equivalent to plotting a Normal with mean 34 and SD $4.2/\text{Square Root of } N$. Why???

Thinking about the why part!!

Standard Deviation vs Standard Error

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$$

Coming back to the delivery time question.

With Mean and SE know, we standardize our data (that is, calculate the Z-Score.)

And quantify how far is 30 minutes from our sample mean!

How far do we want our result to be to be sure about our insight?

That is, how 'confident' do we want to be in our insight?

Hypothesis Testing

Now we enter the topic!

- Null vs Alternative
 - Critical Value
 - Statistical Test
 - P-Value
 - Type I / Type II Errors
-

WHAT IS A HYPOTHESIS?



"A hypothesis is an idea that
can be tested"

EXAMPLE

HYPOTHESES

NOTATION

Null hypothesis

H_0

Alternative hypothesis

H_1 or H_A

Smoking causes cancer.

Average height of a Nepali is greater than that of a Chinese.

Delivery time is equal to 30 minutes.



But usually, Null Hypothesis are presented with Null effect.

That is, there is no relation or no change or no difference.

We only reject the Null, that is say there is an effect, when we are 'confident' about it.

And that 'confident' part is the Critical Value part.

Statistical Test Part: That Z score that we used earlier.

Basically, how we are going to compare/measure of result!

P-Value Part: Trickiest Concept in Hypothesis Testing

P-value is the probability of observing a test statistic as extreme—or more extreme—as the one you have observed, if the null hypothesis is true.

How unlikely/extreme our result is if Null were to be true.

(Example to give you intuition about P-Value)

THERE ARE FIVE MAIN STEPS IN HYPOTHESIS TESTING:

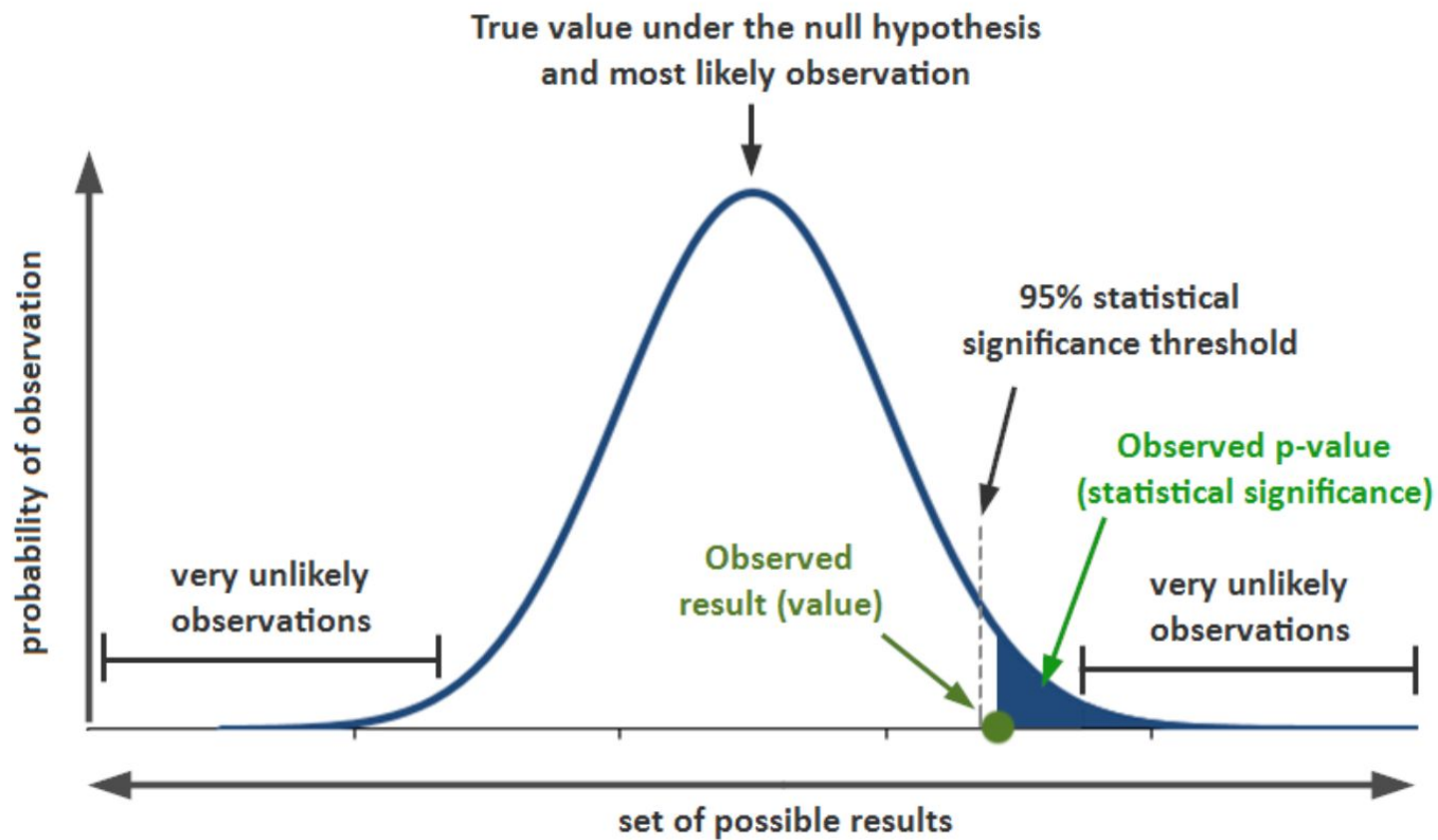
Step 1) State your hypothesis as a Null (H_0) and Alternate (H_a) hypothesis.

Step 2) Choose a significance level (also called alpha or α).

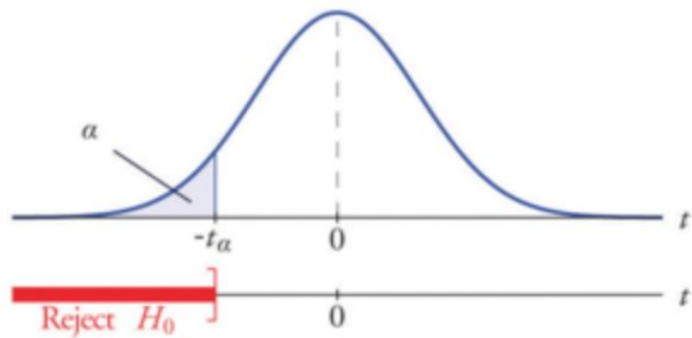
Step 3) Collect data in a way designed to test the hypothesis.

Step 4) Perform an appropriate statistical test: compute the p-value and compare from the test to the significance level.

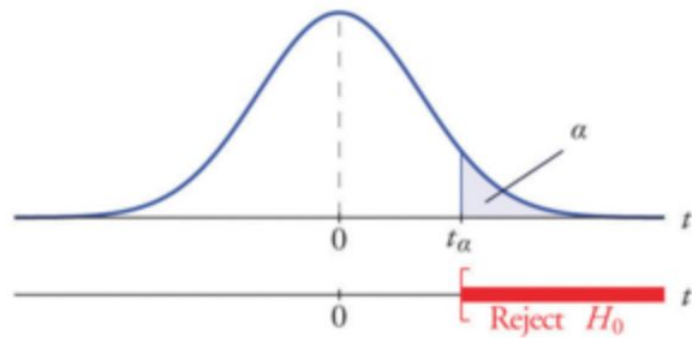
Step 5) Decide whether to “REJECT” the null hypothesis(H_0) or “FAIL TO REJECT” the null hypothesis(H_0).



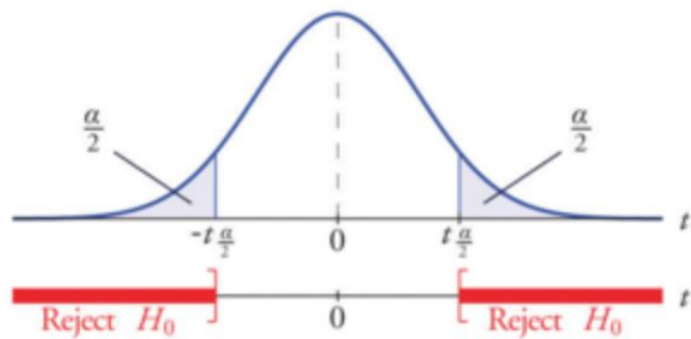
$$H_a : \mu < \mu_0$$






$$H_a : \mu > \mu_0$$



$$H_a : \mu \neq \mu_0$$



		The Person is	
		Innocent	Guilty
The Judge Says	Innocent	 No Error	 Type 2 error
	Guilty	 Type 1 error	No Error



Thank You!

