Probable Error

- Probable Error use to test the validity of the correlation coefficient. The Probable Error of the coefficient of correlation is an amount, which, if added to or subtracted from the mean correlation coefficient, produces amount with in which the chances are even that a coefficient of correlation from a series selected random will fall.

Why we Calculate Probable Error

- The main aim of the probable error is to evaluate the validity of the correlation coefficient
- This is because the correlation coefficient is calculated from the sample data and we want to generalise it to the population.
- Why we validate the sample correlation.
- It may happen that for one person who calculate the correlation between two variable (X,Y) based on a sample has correlation value 0.8, where as another person calculate the correlation between two variable (X,Y) based on a different sample has correlation value 0.3. Now question is who is true.
- Secondly when a person calculate the correlation between two variable (X,Y) based on a sample of size 10 has correlation value 0.3. Then he increased his sample to 25 and the new correlation value changes to 0.55. Now again the question is which one is correct.
- Answer to this is the validation of the correlation coefficient using probable error.

Definition

Probable error is defined as

$$PE = 0.6745\frac{1-r^2}{\sqrt{n}}$$

Where *r* is the coefficient of correlation and *n* is the number of Pairs

The confidence interval for the population coefficient of correlation are

[*r-PE*, *r+PE*]

Functions of probable error

- If the value of **r** is less than the probable error, the value of **r** is not significant.
- If the value of **r** is more than six times the probable error(r=6PE), the value of **r** is significant.
- If the probable error is less than 0.3, the correlation should not be considered at all.
- If the probable error is small, the correlation definitely existing.

Conditions for the use of Probable Error

- The number of items should be large enough. When the number of pairs of observation is small, the probable error may lead to fallacious conclusions.
- The distribution should have a normal distribution. That is, bell shaped curve.
- The items in the sample must have been selected by random sample method and unbiased manner.
- The statistical measure for which probable error is computed must have been from a sample.

Example-1

Calculate the probable error for the following values and test the significance of correlation

a) n=10 and r=0.9 b) n=10 and r =0.4

a) $PE = 0.6745\frac{1-(0.9)^2}{\sqrt{10}}$ =0.6745x0.06

= 0.04

r is significant only if r>6PE or $\frac{r}{PE} > 6$

Here $\frac{r}{PE} = \frac{0.9}{0.04} = 22.5 > 6$. So r is significant

b) n=10 and r =0.4

$PE = 0.6745\frac{1-(0.4)^2}{\sqrt{10}}$ =0.6745x0.2656

= 0.18

r is significant only if r>6PE or $\frac{r}{PE} > 6$

Here $\frac{r}{PE} = \frac{0.4}{0.18} = 2.2 < 6$. So r is not significant

Example-2

A student calculate the value of r as 0.7 when n=25. Find the limits within which r lies for another sample from the same universe.

Given r=0.7 and n = 25. Here we wanted to calculate the confidence interval for the population coefficient which is given as [*r-PE*, *r+PE*]

$$PE = 0.6745\frac{1-(0.7)^2}{\sqrt{25}} = 0.06745$$

So r - PE = 0.7 - 0.06745 = 0.633

r + PE = = 0.7 + 0.06745 = 0.767

CI is [0.633, 0.767]

Example 3

If the value of coefficient of correlation between two series is 0.9 and its probable error is 0.0128, what would be the value of n?

$PE = 0.6745\frac{1-(0.9)^2}{\sqrt{n}}$ =0.0128

So $\sqrt{n} = 0.6745\frac{1-(0.9)^2}{0.0128}$ = 10

n= 100

Example 4

If r is +0.6 and n=4, would you say that the correlation is significant

Even though r=0.6 yet its significant can be judged on the basis of PE only

$$PE = 0.6745\frac{1-(0.6)^2}{\sqrt{4}} = 0.21584$$

r is significant only if r>6PE or $\frac{r}{PE} > 6$

Here $\frac{r}{PE} = \frac{0.6}{0.21584} = 2.78 < 6.$

So r is not significant, Even though r=0.6. This is so because n is very small.

- For Quarries

THANK YOU

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