Evaluating the Effectiveness of Different Testing Methods for Spearmans Rank Correlation Coefficient Significance

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Abstract: ***In this paper we investigated the experiment of significance of spearman's rank correlation coefficient . It provided an in - depth judgment of dissimilar methods of testing for the significance of spearman's correlation coefficient. It was accomplished that each of the methods provided superior enough test for significance of correlation coefficients, which brings to rest the contrasting views that the SPSS does not provide a test for significance of correlation coefficient. The SPSS was recommended ahead of the t - distribution and z transformation due to its easy, robust, and wide applications. Researchers and academics were charged to expose their mentees to this great scientific discovery,***

Keywords: Spearman's rank correlation coefficient, t - distribution

1. Introduction

Spearman correlation coefficient: Definition

The Spearman's rank coefficient of correlation or Spearman correlation coefficient is a nonparametric measure of rank correlation (statistical dependence of ranking between two variables).

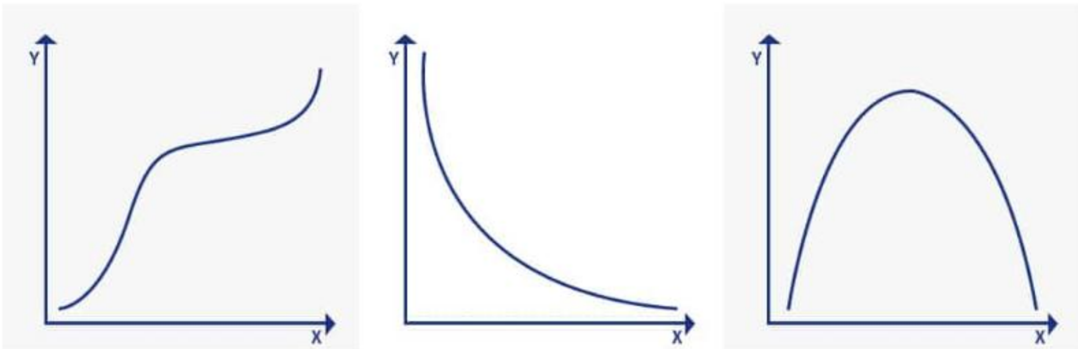
Named after Charles Spearman, it is often denoted by the Greek letter **'ρ' (**rho) and is primarily used for data analysis.

It measures the strength and direction of the association between two ranked variables. But before we talk about the Spearman correlation coefficient, it is important to understand Pearson's correlation first. A Pearson correlation is a statistical measure of the strength of a linear relationship between paired data.

For the calculation and significance testing of the ranking variable, it requires the following data assumption to hold true 1. Interval or Ratio level 2. Linearly related 3. Bivariant distributed

If your data doesn't meet the above assumptions, then you would need Spearman's Coefficient. It is necessary to know what monotonic function is to understand Spearman correlation coefficient.

A monotonic function is one that either never decreases or never increases as it is an independent variable increase. A monotonic function can be explained using the image below:



The image explains three concepts in monotonic function:
1) Monotonically increasing: When the 'x' variable increases and the 'y' variable never decreases.
2) Monotonically decreasing: When the 'x' variable increases but the 'y' variable never increases
3) Not monotonic: When the 'x' variable increases and the 'y' variable sometimes increases and sometimes decreases.

Monotonic relation is less restraining when compared to a linear relationship that is used in Spearman's coefficient. Although monotonicity is not the ultimate requirement for Spearman correlation coefficient, it will not be meaningful to pursue Spearman's correlation without actually determining the strength and direction of a monotonic relationship if it was already known that the relationship between the variable is non - monotonic.

Example 1: Calculation of rank correlation coefficient

Entry - 1	A	B	C	D	E	F	G	H	I	J
Judge 1	2	4	7	6	5	9	8	1	3	10
Judge 2	3	5	6	4	7	10	8	2	1	9

Entry	Judge - 1 (x)	Judge - 2 (y)	x. y
A	2	3	6
B	4	5	20
C	7	6	42
D	6	4	24
E	5	7	35
F	9	10	90
G	8	8	64
H	1	2	2
I	3	1	3
	10	9	90
N=10	$\sum X = 55$	$\sum Y = 55$	$\sum XY = 376$

$$\boldsymbol{r_s} = \frac{\frac{1}{N}[\sum xy - \bar{x}.\bar{y}]}{S_x.S_y}$$

$$\bar{x} = \bar{y} = \frac{55}{10} - 5.5$$

$$S_x = S_y = \sqrt{\frac{385}{10} - (5.5)^2}$$
$$= \sqrt{8.25}$$

$$r_s = S_y \frac{\frac{1}{10}[376 - 5.5^2}{\sqrt{8.25}.\sqrt{8.25}}$$

$$r_s = 0.891$$

Spearman correlation coefficient: Formula and Calculation with Example

$$r_s = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

Here,
N= number of data points of the two variables
D = difference in ranks of the "i^{th}" element

The Spearman Coefficient, ρ , can take a value between +1 to - 1 where,

- A ρ value of +1 means a perfect association of rank
- A ρ value of 0 means no association of ranks
- A ρ value of - 1 means a perfect negative association between ranks.

Closer the ρ value to 0, weaker is the association between the two ranks.

We must be able to rank the data before proceeding with the Spearman's Rank Coefficient of Correlation. It is important to observe if increasing one variable, the other variable follows a monotonic relation.

At every level, you will need to compare the values of the two variables. Here is how the calculations work:

Entry	Judge - 1	Judge - 2	D= (1 - 2)	D^2
A	2	3	- 1	1
B	4	5	- 1	1
C	7	6	1	1
D	6	4	2	4
E	5	7	- 2	4
F	9	10	- 1	1
G	8	8	0	0
H	1	2	- 1	1
I	3	1	2	4
J	10	9	1	1
N=10				$\sum D^2$ =18

$$r_s = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

$$r_s = 1 - \frac{6(18)}{10(100-1)}$$

$$r_s = 1 - 0.109$$

$$r_s = 0.891$$

2. Conclusion

This paper has shown that the test of significance of rank correlation coefficients is very export in research because the degree of relationship alone is not sufficient to bring to a close that a computed correlation coefficient is adequate. It further exposed that one of the method of test of significance i. e t - distribution provided good sufficient test for significance of correlation coefficients

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