International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Significance of Spearman's Rank Correlation Coefficient

Kadakatla Pavan Kumar[1], Visweswararao Reddi[2]

[1]Associate Professor, Department of Statistics, B V Raju College, Bhimavaram., West Godavari Dt. Andhra Pradesh, India
[2]Senior Lecturer In Statistics, Sri G C S R College, Gmr Nagar, Rajam, Vijayanagaram Dist(A.P)

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-distrubution.

INRODUCTION

SPEARMAN'S CORRELATION

Before learning about Spearman's correlation it is important to understand Pearson's Correlation which is statistical measure of the strength of a linear relationship between paired data. Its calculation and subsequent significance testing of it requires the following data assumptions to hold.

Interval or ratio level;

- Linear related;
- Bivariate normally distributed.

If your data does not meet the above assumptions then use Spearman's rank correlation.

Monotonic function

To understand spearman' correlation it is necessary to know what a monotonic is. A monotonic function is one that either never increases or never decreases as its independent variable increases. The following graphs illustrate monotonic functions.

- Monotonically increasing – as the x variable increases the y variable never decreases;
- Monotonically decreases – as the x variable increases the y variable never increases;
- Not monotonic – as the x variable increases the y variable sometime decreases and sometimes increases.

Spearman's correlation coefficient

Spearman's correlation coefficient is a statistical measure of the strength of a monotonic relationship between paired data. In a sample it is denoted by r_s and is by design constrained as follows

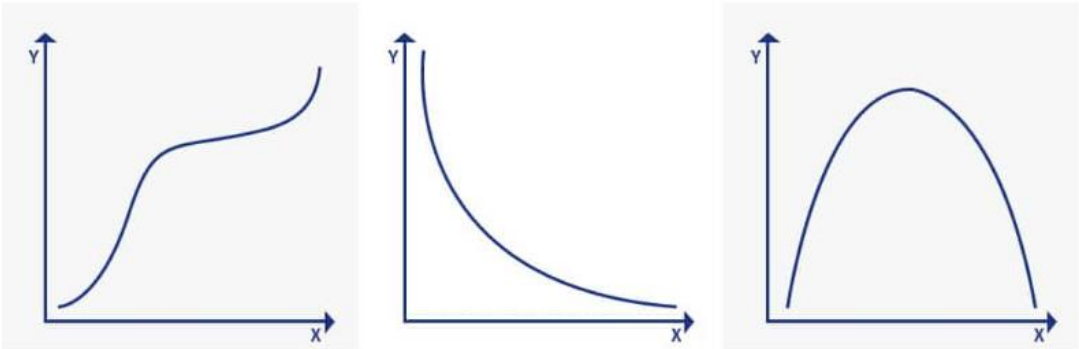
$$-1 \leq r_s \leq 1$$

And its interpretation is similar to that of Pearson's , e.g. the closer r_s is to ± 1 the stronger the monotonic relationship. Correlation is an effect size and so we can verbally describe the strength of the correlation using the following guide for the absolute value of r_s:

- .00-.19 "very weak"
- .20- .39 "weak"
- .40-0.59 " moderate"
- 0.60-0.79 " strong"
- 0.80- 1.0 "very strong"

The calculation of spearman's correlation coefficient and subsequent significance testing of its requires the following data assumptions to hold:

- Interval or ratio level or ordinal;
- Monotonically related.



Example 1: Calculation of rank correlation coefficient

physics	100	95	80	85	100	40	71	75	65	50
Statistics	80	90	85	95	100	50	90	40	60	65

Physics	Statistics	Rank(x)	Rank(y)	d=x-y	d^2
100	80	1.5	6	-4.5	20.25
95	90	3	3.5	-0.5	0.25
80	85	5	5	0	0
85	95	4	2	2	4
100	100	1.5	1	0.5	0.25
40	50	10	9	1	1
70	90	7	3.5	3.5	12.25
75	40	6	10	-4	16
65	60	8	8	0	0
50	65	9	7	2	4
					$\sum d^2 = 58$

$T_x = \frac{M(M^2-1)}{12}$=0.5

$T_y = \frac{M(M^2-1)}{12}$=0.5

$\rho = 1 - \frac{6(\sum d^2 + T_x + T_y)}{n(n^2-1)} = 0.6424$

Hence the strength of the correlation is ***Strong***

Example 2. Ten competitors in a debate contest are ranked by three judges in the following order .

Competitors	A	B	C	D	E	F	G	H	I	J
Ranks by 1st judge	6	5	1	10	2	3	4	9	8	7
Ranks by 2nd judge	5	8	3	4	7	10	2	6	1	9
Ranks by 3rd judge	4	8	6	9	3	2	1	10	7	5

Using the spearman's rank correlation method and state which pair of judges have the nearest approach.

Competitors	R_1	R_2	R_3	$D_1 = R_1 - R_2$	D_1^2	$D_2 = R_1 - R_3$	D_2^2	$D_3 = R_2 - R_3$	D_3^2
A	6	5	4	1	1	2	4	1	1
B	5	8	8	-3	9	-3	9	0	0
C	1	3	6	-2	4	-5	25	-3	9
D	10	4	9	6	36	1	1	-5	25
E	2	7	3	-5	25	-1	1	4	16
F	3	10	2	-7	49	1	1	8	64
G	4	2	1	2	4	3	9	1	1
H	9	6	10	3	9	-1	1	-4	16
I	8	1	7	7	49	1	1	-6	36
J	7	9	5	-2	4	2	4	4	16
					$\sum 190$		$\sum 56$		$\sum 184$

N=10

Rank correlation between judge 1 & 2

$r_{12} = 1 - \frac{6\sum D^2}{N(N^2-1)} = -0.1515$

Rank correlation between judge 1&3

$r_{13} = 1 - \frac{6\sum D^2}{N(N^2-1)} = 0.6606$

Rank correlation between judge 2&3

$r_{23} = 1 - \frac{6\sum D^2}{N(N^2-1)} = -0.1152$

As the rank correlation coefficient between judge 1 & judge 3 is highest , thus judge 1 and judge 3 has the nearest approach.

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.

REFERENCES

1. Barnette, J.J., & McClean, J.E. (1999, November). *Empirically based criteria for determining meaningful effect size.* Paper presented at the annual meeting of the Mid-South Educational Research Association, Point Clear, Alabama.
2. Fisher, R. A. (1915). Frequency distribution of the values of the correlation coefficient in samples from indefinitely large population. *Biometrika,* 10(4), 507 – 521.
3. Goldsman, D. (2010). *Hypothesis testing*. Atlanta: Georgia Institute of Technology Press.
4. Kpolovie, P. J. (2011). *Statistical techniques for advanced research*. New Owerri: Springfield Publishers Ltd.
5. Levin, J. R. (1998). What if there were no more bickering about statistical significance tests? *Research in the Schools*, 5, 43-54.
6. McLean, J. E., & Ernest, J.M. (1998). The role of statistical significance testing in educational research. *Research in the Schools*, 5, 15-22.
7. Nix, T. W., & Barnette, J. (1998a). The data analysis dilemma: Ban or abandon. A review of null hypothesis significance testing. *Research in the Schools*, 5, 3-14.
8. Student (1908). The probable error of a mean. *Biometrika,* 6(1), 1 – 25.