ICCPP-STATISTICS

- Fisher's Exact Test

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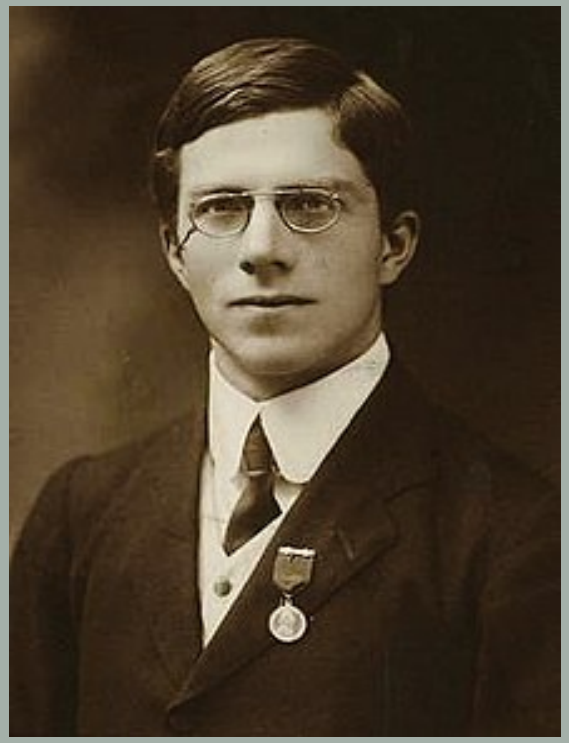

Ronald Fisher (1890-1962)

Fisher's Exact Test

Definition

- Fisher's Exact Test of Independence is a statistical test used when you have two nominal variables and want to find out if proportions for one nominal variable are different among values of the other nominal variable.

Formula

$$p = \frac{(a+b)!(c+d)!(a+c)!(b+d)!}{a!b!c!d!n!}$$

- P = P- value
- a,b,c,d = Values in a contingency table
- n = Total frequency

Use

- Use Fisher's exact test when you have two nominal variables.
- Fisher's exact test assesses the null hypothesis of independence applying hypergeometric distribution of the numbers in the cells of the table.

Use

- The Fisher Exact test is a test of significance that is used in the place of chi square test in 2 by 2 tables, especially in cases of small samples.

Assumptions

- The row and column totals are fixed, not random.
- Sampling or allocation are random and observations are mutually independent within the constraints of fixed marginal totals.

Assumptions

- Each observation is mutually exclusive - in other words each observation can only be classified in one cell.

Example

Question: A medical clinic has 30 patients, 20 women and 10 men. A random sample of 5 patients is drawn. What is the probability that there will be 2 men?

Solution

Step 1

A sample of 5 patients out of $\binom{30}{5}$ can be chosen in ways = 142,506 ways.

Solution

Step 2

A sample of 2 men and 3 women can be drawn in

$$\binom{10}{2} \times \binom{20}{3}$$ ways = 51,300 ways.

Solution

Step 3

Therefore,

P (2 men, 3 women) = $\frac{\binom{10}{2} \times \binom{20}{3}}{\binom{30}{5}}$

= 51300/142506 = 0.359985.

Solution

Step 4

Alternatively,

	Women	Men	Total
In sample	3	2	5
Not in sample	17	8	25
	20	10	30

Solution

Step 5

The probability in Fisher's exact test is thus

$$\frac{20!10!5!25!}{3!2!17!8!30!} = 0.359985.$$

References

Fisher, R A (1954): Statistical Methods for Research Workers. Oliver and Boyd. ISBN 0-05-002170-2.

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