What is the formula for calculating the intraclass correlation coefficient in R?

Authored by

stats writer

April 27, 2024

The intraclass correlation coefficient (ICC) is a statistical measure used to assess the similarity between observations within a group or cluster. In R, the formula for calculating the ICC is based on the ratio of the between-group variability to the total variability. This can be expressed as ICC = (between-group variability) / (between-group variability + within-group variability). The resulting value ranges from 0 to 1, with a higher value indicating a stronger correlation between observations within the group. This formula is commonly used in various fields of research, such as psychology and biology, to assess the reliability and consistency of measurements within a group.

Calculate Intraclass Correlation Coefficient in R

An (ICC) is used to determine if items or subjects can be rated reliably by different raters.

The value of an ICC can range from 0 to 1, with 0 indicating no among raters and 1 indicating perfect reliability.

The easiest way to calculate ICC in R is to use the icc() function from the irr package, which uses the following syntax:

icc(ratings, model, type, unit)

where:

ratings: A dataframe or matrix of ratingsmodel: The type of model to use. Options include "oneway" or "twoway"type: The type of relationship to calculate

between raters. Options include "consistency" or "agreement"unit: The unit of analysis. Options include "single" or "average"

This tutorial provides an example of how to use this function in practice.

Step 1: Create the Data

Suppose four different judges were asked to rate the quality of 10 different college entrance exams. We can create the following dataframe to holding the ratings of the judges:

```
#create data
data <- data.frame(A=c(1, 1, 3, 6, 6, 7, 8, 9, 8, 7),
B=c(2, 3, 8, 4, 5, 5, 7, 9, 8, 8),
C=c(0, 4, 1, 5, 5, 6, 6, 9, 8, 8),
D=c(1, 2, 3, 3, 6, 4, 6, 8, 8, 9))
```

Step 2: Calculate the Intraclass Correlation Coefficient

Suppose the four judges were randomly selected from a population of qualified entrance exam judges and that we'd like to measure the absolute agreement among judges and that we're interested in using the ratings

from a single rater perspective as the basis for our measurement.

We can use the following code in R to fit a two-way model, using absolute agreement as the relationship among raters, and using single as our unit of interest:

```
#load the interrater reliability packagelibrary(irr)

#define data
data <- data.frame(A=c(1, 1, 3, 6, 6, 7, 8, 9, 8, 7),
B=c(2, 3, 8, 4, 5, 5, 7, 9, 8, 8),
C=c(0, 4, 1, 5, 5, 6, 6, 9, 8, 8),
D=c(1, 2, 3, 3, 6, 4, 6, 8, 8, 9))

#calculate ICC
icc(data, model = "twoway", type = "agreement", unit = "single")

Model: twoway
Type : agreement

Subjects = 10
Raters = 4
ICC(A,1) = 0.782
```

F-Test, H0: r0 = 0 ; H1: r0 > 0
F(9,30) = 15.3 , p = 5.93e-09

95%-Confidence Interval for ICC Population Values:
0.554 < ICC < 0.931

The intraclass correlation coefficient (ICC) turns out to be 0.782.

Here is how to interpret the value of an intraclass correlation coefficient, according to :

Less than 0.50: Poor reliabilityBetween 0.5 and 0.75: Moderate reliabilityBetween 0.75 and 0.9: Good reliabilityGreater than 0.9: Excellent reliability

A Note on Calculating ICC

There are several different versions of an ICC that can be calculated, depending on the following three factors:

Model: One-Way Random Effects, Two-Way Random Effects, or Two-Way Mixed EffectsType of Relationship: Consistency or Absolute AgreementUnit: Single rater or the mean of raters

In the previous example, the ICC that we calculated used the following assumptions:

Model: Two-Way Random EffectsType of Relationship: Absolute AgreementUnit: Single rater

For a detailed explanation of these assumptions, please refer to .