

What is the step-by-step process for performing the Brown-Forsythe Test in R?

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The Brown-Forsythe Test in R is a statistical test used to compare the means of two or more groups. It is a modification of the standard ANOVA test that is more robust to unequal variances in the groups. The step-by-step process for performing the Brown-Forsythe Test in R is as follows:

1. Load the necessary packages: Before performing the test, you need to load the "car" package which contains the necessary function for the Brown-Forsythe Test.
2. Prepare the data: The data should be in a format where each group is represented as a separate column in a data frame. Make sure the data is numeric and there are no missing values.
3. Conduct the test: Use the "oneway.test" function from the "car" package to perform the Brown-Forsythe Test. Specify the variables to be compared and set the "var.equal" argument to FALSE to indicate that the groups have unequal variances.
4. Interpret the results: The output of the test will include the test statistic, degrees of freedom, and p-value. If the p-value is less than the chosen significance level, it indicates that there is a significant difference in the means of the groups.
5. Post-hoc analysis: If the test results are significant, you can perform post-hoc analysis to determine which groups differ significantly from each other. This can be done using the "TukeyHSD" function.
6. Check assumptions: It is important to check the assumptions of the test, such as normality and homogeneity of variances, before interpreting the results.
7. Repeat for different combinations: If you have more than two groups, you can perform the Brown-Forsythe Test for different combinations of groups to compare their means.

Overall, the Brown-Forsythe Test in R is a simple and effective way to compare the means of groups with unequal variances.

Brown-Forsythe Test in R: Step-by-Step Example

A is used to determine whether or not there is a significant difference between the means of three or more independent groups.

One of the of a one-way ANOVA is that the variances of

the populations that they come from are equal.

One of the most common ways to test for this is by using a Brown-Forsythe test, which is a statistical test that uses the following :

H0: The variances among the populations are equal.
HA: The variances among the populations are not equal.

If the p -value of the test is less than some significance level (e.g. $\alpha = .05$) then we reject the null hypothesis and conclude that the variances are not equal among the different populations.

This tutorial provides a step-by-step example of how to perform a Brown-Forsythe test in R.

Step 1: Enter the Data

Suppose we'd like to know whether or not three different workout programs lead to different levels of weight loss.

To test this, we recruit 90 people and randomly assign 30 to use each program. We then measure the weight loss of each person after one month.

The following dataset contains information on how much weight people lost on each program:

```
#make this example reproducible  
set.seed(0)
```

```
#create data frame
```

```
data <- data.frame(program = as.factor(rep(c("A", "B",  
"C"), each = 30)),  
weight_loss = c(runif(30, 0, 3),  
runif(30, 0, 5),  
runif(30, 1, 7)))
```

```
#view first six rows of data frame  
head(data)
```

```
# program weight_loss
```

```
#1 A 2.6900916
```

```
#2 A 0.7965260
```

```
#3 A 1.1163717
```

```
#4 A 1.7185601
```

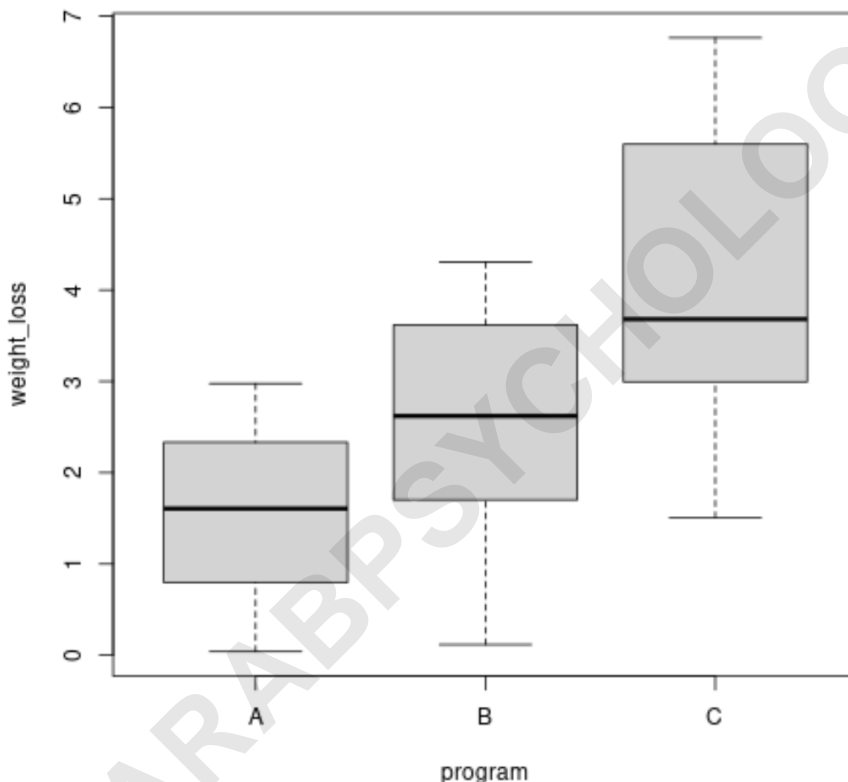
```
#5 A 2.7246234
```

```
#6 A 0.6050458
```

Step 2: Summarize & Visualize the Data

Before we perform a Brown-Forsythe test, we can create boxplots to visualize the variance of weight loss for each group:

```
boxplot(weight_loss ~ program, data = data)
```



We can also calculate the variance of weight loss in each group:

```
#load dplyr packagelibrary(dplyr)
```

```
#calculate variance of weight loss by group
```

```
data %>%
```

```
group_by(program) %>%
```

```
summarize(var=var(weight_loss))
```

```
# A tibble: 3 x 2
```

```
program var
```

```
1 A 0.819
```

```
2 B 1.53
```

```
3 C 2.46
```

Step 3: Perform the Brown-Forsythe Test

To perform a Brown-Forsythe test in R, we can use the `bf.test()` function from the package:

```
#load onewaytests packagelibrary(onewaytests)
```

```
#perform Brown-Forsythe test
```

```
bf.test(weight_loss ~ program, data = data)
```

Brown-Forsythe Test (alpha = 0.05)

data : weight_loss and program

statistic : 30.83304
num df : 2
denom df : 74.0272
p.value : 1.816529e-10

Result : Difference is statistically significant.

The p-value of the test turns out to be less than 0.000 and, as the output declares, the differences in variances between the three groups is statistically significant.

Next Steps

If you fail to reject the null hypothesis of the Brown-Forsythe Test, then you can proceed to perform a one-way ANOVA on the data.

However, if you reject the null hypothesis then this means the assumption of equal variances is violated. In this case, you have two options:

1. Proceed with a One-Way ANOVA anyway.

It turns out that a one-way ANOVA is actually robust to unequal variances as long as the largest variance is no

larger than 4 times the smallest variance.

In step 2 from the example above, we found that the smallest variance was 0.819 and the largest variance was 2.46. Thus, the ratio of the largest to smallest variance is $2.46 / .819 = 3.003$.

Since this value is less than 4, we could simply proceed with the one-way ANOVA.

2. Perform a Kruskal-Wallis Test

If the ratio of the largest variance to the smallest variance is greater than 4, we may instead choose to perform a . This is considered the non-parametric equivalent to the one-way ANOVA.

You can find a step-by-step example of a Kruskal-Wallis test in R .