

What is the probability that the absolute value of the z-statistic is greater than the observed value in the logistic regression output in R?

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The probability of the absolute value of the z-statistic being greater than the observed value in the logistic regression output in R can be calculated by determining the area under the normal distribution curve that falls outside the range of the observed z-statistic. This probability represents the likelihood of obtaining a z-statistic that is more extreme than the one observed, assuming the null hypothesis is true. This measure is commonly used in statistical analysis to evaluate the significance of results and determine the strength of evidence against the null hypothesis.

Interpret $\Pr(>|z|)$ in Logistic Regression Output in R

Whenever you perform logistic regression in R, the output of your regression model will be displayed in the following format:

Coefficients:

Estimate Std. Error z value $\Pr(>|z|)$

(Intercept) -17.638452 9.165482 -1.924 0.0543 .

disp -0.004153 0.006621 -0.627 0.5305

drat 4.879396 2.268115 2.151 0.0315 *

The $\Pr(>|z|)$ column represents the p-value associated with the value in the z value column.

If the p-value is less than a certain significance level (e.g. $\alpha = .05$) then this indicates that the predictor variable has a statistically significant relationship with the in the model.

The following example shows how to interpret values in the $\text{Pr}(> |z|)$ column for a logistic regression model in practice.

Example: How to Interpret $\text{Pr}(> |z|)$ Values

The following code shows how to fit a in R using the built-in mtcars dataset:

```
#fit logistic regression model  
model <- glm(am ~ disp + drat, data=mtcars,  
family=binomial)
```

```
#view model summary  
summary(model)
```

Call:

```
glm(formula = am ~ disp + drat, family = binomial, data =  
mtcars)
```

Deviance Residuals:

Min 1Q Median 3Q Max

-1.5773 -0.2273 -0.1155 0.5196 1.8957

Coefficients:

Estimate Std. Error z value $\text{Pr}(> |z|)$

(Intercept) -17.638452 9.165482 -1.924 0.0543 .

disp -0.004153 0.006621 -0.627 0.5305

drat 4.879396 2.268115 2.151 0.0315 *

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 43.230 on 31 degrees of freedom

Residual deviance: 21.268 on 29 degrees of freedom

AIC: 27.268

Number of Fisher Scoring iterations: 6

Here's how to interpret the values in the Pr(>|z|) column:

The p-value for the predictor variable "disp" is .5305. Since this value is not less than .05, it does not have a statistically significant relationship with the response variable in the model. The p-value for the predictor variable "drat" is .0315. Since this value is less than .05, it has a statistically significant relationship with the response variable in the model.

The under the coefficient table tell us that a single asterisk (*) next to the p-value of .0315 means the p-value is statistically significant at $\alpha = .05$.

How is $\Pr(>|z|)$ Calculated?

Here's how the value for $\Pr(>|z|)$ is actually calculated:

Step 1: Calculate the z value

First, we calculate the z value using the following formula:

z value = Estimate / Std. Error

For example, here's how to calculate the z value for the predictor variable "drat":

```
#calculate z-value
```

```
4.879396 / 2.268115
```

```
2.151
```

Step 2: Calculate the p-value

Next, we calculate the two-tailed p-value. This represents the probability that the absolute value of the

normal distribution is greater than 2.151 or less than -2.151.

We can use the following formula in R to calculate this value:

p-value = 2 * (1-pnorm(z value))

For example, here's how to calculate the two-tailed p-value for a z-value of 2.151:

```
#calculate p-value  
2*(1-pnorm(2.151))
```

0.0314762

Notice that this p-value matches the p-value in the regression output from above.

Additional Resources

The following tutorials explain how to fit various regression models in R: