How can I perform a LOESS regression in R, and can you provide an example?

Authored by

stats writer

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LOESS (Local Regression) is a non-parametric regression method used for fitting a smooth curve through data points. It is often used for visualizing trends or patterns in data. In order to perform a LOESS regression in R, you can use the "loess" function from the "stats" package. This function takes in a response variable and one or more predictor variables, and returns a smooth curve fit to the data. An example of using the "loess" function in R would be to plot a scatter plot of data points and then use the function to add a smoothed line through the points. This allows for a better understanding of the underlying trend in the data.

Perform LOESS Regression in R (With Example)

LOESS regression, sometimes called local regression, is a method that uses local fitting to fit a regression model to a dataset.

The following step-by-step example shows how to perform LOESS regression in R.

Step 1: Create the Data

First, let's create the following data frame in R:

```
#view DataFrame
df <- data.frame(x=c(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14),
y=c(1, 4, 7, 13, 19, 24, 20, 15, 13, 11, 15, 18, 22, 27))

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

x y
1 1 1
2 2 4
3 3 7
4 4 13
5 5 19
6 6 24

Step 2: Fit Several LOESS Regression Models

We can use the loess() function to fit several LOESS regression models to this dataset, using various values for the span parameter:

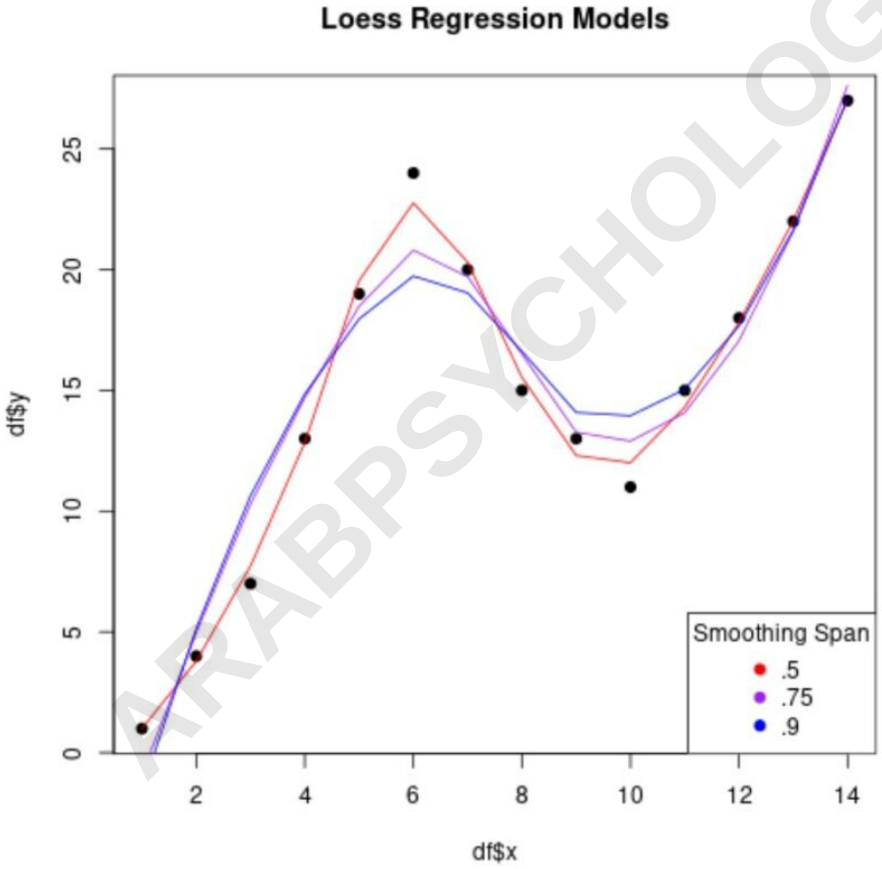
```
#fit several LOESS regression models to dataset
loess50 <- loess(y ~ x, data=df, span=.5)
smooth50 <- predict(loess50)

loess75 <- loess(y ~ x, data=df, span=.75)
smooth75 <- predict(loess75)

loess90 <- loess(y ~ x, data=df, span=.9)
smooth90 <- predict(loess90)

#create scatterplot with each regression line overlaid
plot(df$x, df$y, pch=19, main='Loess Regression
```

```
Models')
lines(smooth50, x=df$x, col='red')
lines(smooth75, x=df$x, col='purple')
lines(smooth90, x=df$x, col='blue')
legend('bottomright', legend=c('.5', '.75', '.9'),
col=c('red', 'purple', 'blue'), pch=19, title='Smoothing
Span')
```



Notice that the lower the value that we use for span, the less "smooth" the regression model will be and the

more the model will attempt to hug the data points.

Step 3: Use K-Fold Cross Validation to Find the Best Model

To find the optimal span value to use, we can perform using functions from the caret package:

```
library(caret)

#define k-fold cross validation method
ctrl <- trainControl(method = "cv", number = 5)
grid <- expand.grid(span = seq(0.5, 0.9, len = 5), degree = 1)

#perform cross-validation using smoothing spans ranging from 0.5 to 0.9
model <- train(y ~ x, data = df, method = "gamLoess", tuneGrid=grid, trControl = ctrl)

#print results of k-fold cross-validation
print(model)

14 samples
1 predictor

No pre-processing
Resampling: Cross-Validated (5 fold)
```

Summary of sample sizes: 12, 11, 11, 11, 11
Resampling results across tuning parameters:

span RMSE Rsquared MAE
0.5 10.148315 0.9570137 6.467066
0.6 7.854113 0.9350278 5.343473
0.7 6.113610 0.8150066 4.769545
0.8 17.814105 0.8202561 11.875943
0.9 26.705626 0.7384931 17.304833

Tuning parameter 'degree' was held constant at a value of 1
RMSE was used to select the optimal model using the smallest value.
The final values used for the model were span = 0.7 and degree = 1.

We can see that the value for span that produced the lowest value for the (RMSE) is 0.7.

Thus, for our final LOESS regression model we would choose to use a value of 0.7 for the span argument within the loess() function.

Additional Resources

The following tutorials provide additional information about regression models in R: