Quick-R

accessing the power of R

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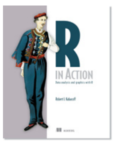
R in Action



R in Action significantly expands upon this material. Use promo code **ria38** for a 38% discount.

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Regression Diagnostics

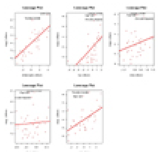
An excellent review of regression diagnostics is provided in John Fox's aptly named Overview of Regression Diagnostics. Dr. Fox's car package provides advanced utilities for regression modeling.

```
# Assume that we are fitting a multiple linear regression
# on the MTCARS data
library(car)
fit <- lm(mpg~disp+hp+wt+drat, data=mtcars)
```

This example is for **exposition only**. We will ignore the fact that this may not be a great way of modeling the this particular set of data!

Outliers

```
# Assessing Outliers
outlierTest(fit) # Bonferonni p-value for most extreme obs
qqPlot(fit, main="QQ Plot") #qq plot for studentized resid
leveragePlots(fit) # leverage plots
```



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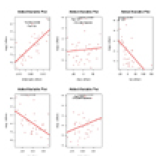
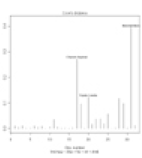
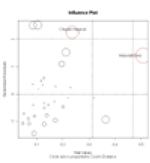
Influential Observations

```
# Influential Observations
# added variable plots
av.Plots(fit)
# Cook's D plot
# identify D values > 4/(n-k-1)
cutoff <- 4/((nrow(mtcars)-length(fit$coefficients)-2))
plot(fit, which=4, cook.levels=cutoff)
# Influence Plot
influencePlot(fit, id.method="identify", main="Influence Plot",
sub="Circle size is proportial to Cook's Distance" )
```







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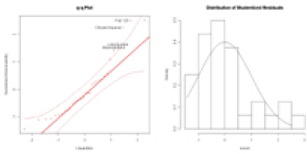
Non-normality

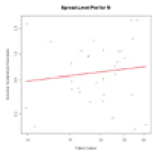
```
# Normality of Residuals
# qq plot for studentized resid
```

```
qqPlot(fit, main="QQ Plot")
# distribution of studentized residuals
library(MASS)
sresid <- studres(fit)
hist(sresid, freq=FALSE,
   main="Distribution of Studentized Residuals")
xfit<-seq(min(sresid),max(sresid),length=40)
yfit<-dnorm(xfit)
lines(xfit, yfit)
```

 click to view

Non-constant Error Variance

```
# Evaluate homoscedasticity
# non-constant error variance test
ncvTest(fit)
# plot studentized residuals vs. fitted values
spreadLevelPlot(fit)
```

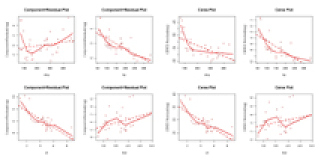
 click to view

Multi-collinearity

```
# Evaluate Collinearity
vif(fit) # variance inflation factors
sqrt(vif(fit)) > 2 # problem?
```

Nonlinearity

```
# Evaluate Nonlinearity
# component + residual plot
crPlots(fit)
# Ceres plots
ceresPlots(fit)
```

 click to view

Non-independence of Errors

```
# Test for Autocorrelated Errors
durbinWatsonTest(fit)
```

Additional Diagnostic Help

The **gvlma( )** function in the [gvlma](#) package, performs a global validation of linear model assumptions as well separate evaluations of skewness, kurtosis, and heteroscedasticity.

```
# Global test of model assumptions
library(gvlma)
gvmodel <- gvlma(fit)
summary(gvmodel)
```

Going Further

If you would like to delve deeper into regression diagnostics, two books written by John Fox can help: Applied regression analysis and generalized linear models (2nd ed) and An R and S-Plus companion to applied regression.