Understanding Influential Observations

An outlier is a data point that differs more than expected from the general trend of the data. An outlier might be an erroneous data point, or one that is atypical compared with the rest of the data. Outliers have residuals that are considerably larger in absolute value than the residuals of other data points, such as two or three standard deviations from the mean. You can use plots of the residuals versus predicted values and normal probability plots to help identify outliers.

An influential observation is an observation that is so far away from the rest of the data that it singlehandedly exerts influence on the slope of the regression line. It might also influence predicted values. An influential observation might be an indication of erroneous data. Another possibility is that the observation, though valid, is unusual. An influential observation sometimes, but not always, has a large residual compared to the rest of the data points. Influential observations affect model statistics such as parameter estimates, standard errors of the parameter estimates, predicted values, studentized residuals, and so on, when they are excluded from the analysis. Clearly, influential observations are a problem.

You want the regression model to be representative of all of the sample observations, not an artifact of a few. Consequently, it is important to identify these influential data points and assess their impact on the model. Keep in mind that an outlier might or might not be an influential observation, and vice versa. In the example shown here on the left, the data point in red has not affected the slope of the line, but differs from the general trend of the data more than expected, so it could be an outlier and not an influential observation. In the example on the right, the data point in red could be an outlier as well as an influential observation as it has not only affected the slope of the regression line, but it also differs more than expected from the general trend of the data.

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