# 1 Some Important Definitions

To understand a diagnostic plot called the residual-leverage plot, we must understand three things:

- Leverage,
- Standardized residuals, and
- Cook's distance.

**Example**

Consider the plots associated with four different situations:

1. a dataset where everything is fine

2. a dataset with a high-leverage, but low-standardized residual point

3. a dataset with a low-leverage, but high-standardized residual point

4. a dataset with a high-leverage, high-standardized residual point

- The plots on the left show the data, the center of the data with a blue dot, the underlying data generating process with a dashed gray line, the model fit with a blue line, and the special point with a red dot.

- On the right are the corresponding residual-leverage plots; the special point is 21.

- The model is badly distorted primarily in the fourth case where there is a point with high leverage and a large (negative) standardized residual.
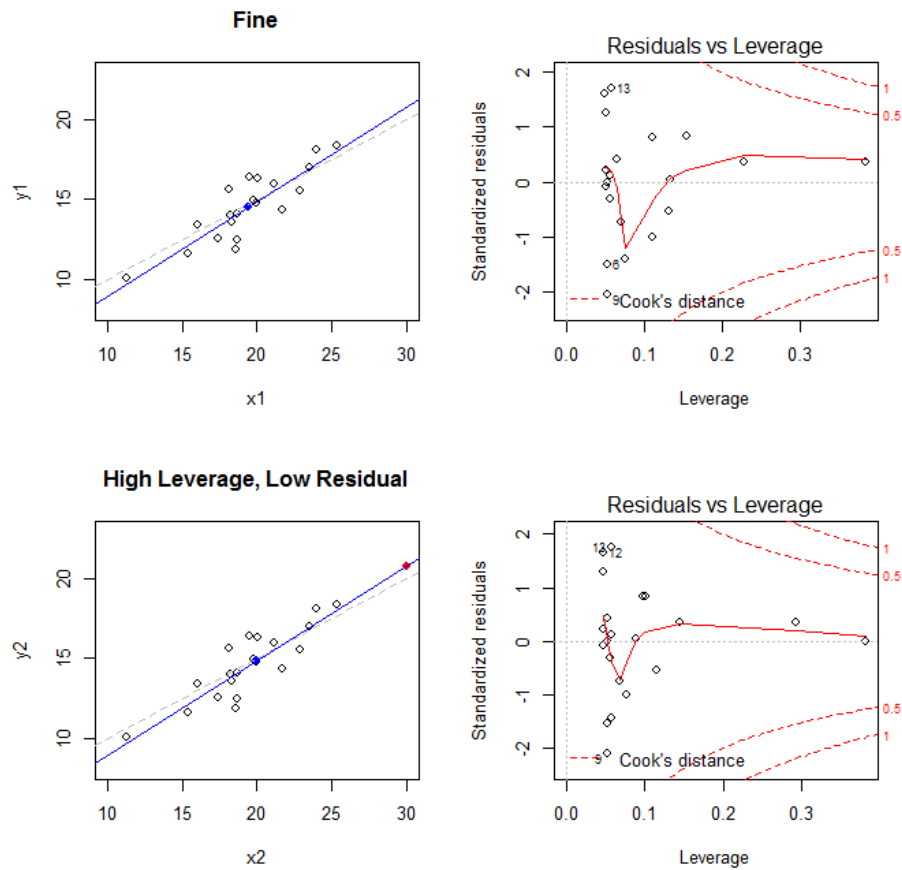
Figure 1:

For reference, here are the values associated with the special points:

```
                            leverage std.residual   cooks.d
high leverage,  low residual  0.3814234    0.0014559 0.0000007
low leverage,  high residual  0.0476191    3.4456341 0.2968102
high leverage, high residual  0.3814234   -3.8086475 4.4722437
```
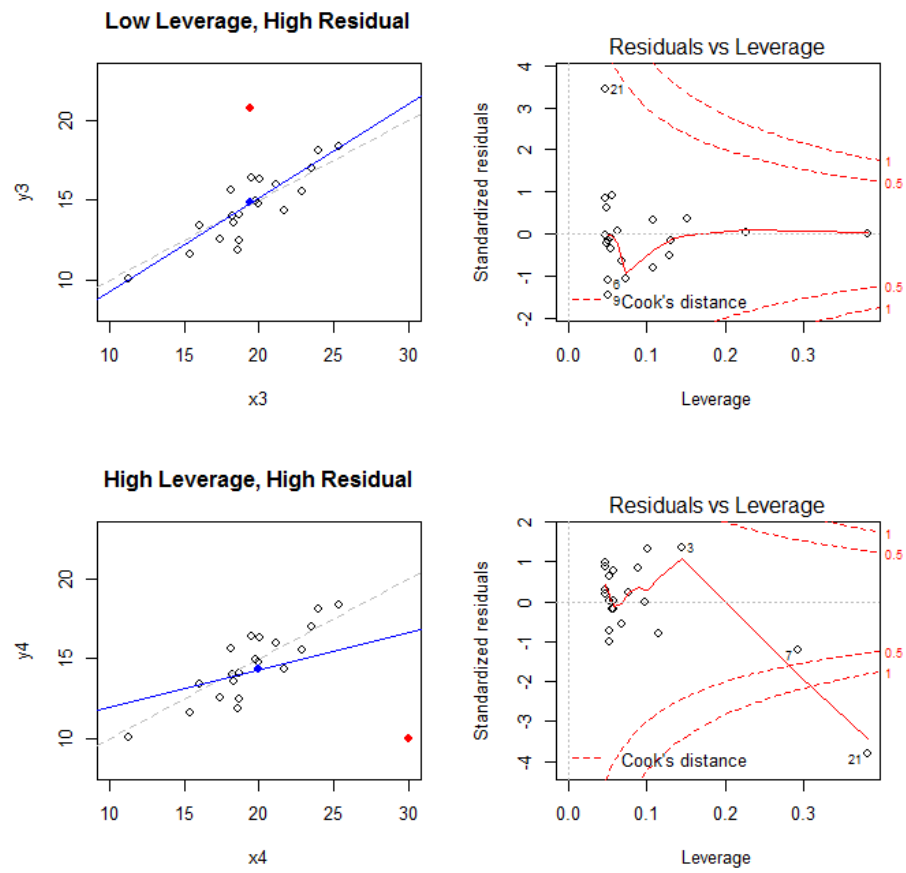
Figure 2:

3