

Lowess = Locally weighted least squares

References:

- Cleveland W. (1979) Robust locally weighted regression and smoothing scatterplots. *Journal of the American Statistical Association*, 74, 829-836.
- Textbooks on Regression methods.

Create a continuous curve that captures the “systematic” relationship between Y (response) and X (predictor), without introducing a parametric model.

One method to create a “smooth” of the scatter-plot of Y vs X

Implemented in most statistical software packages (including S+, R, Minitab)

Parameters of the algorithm:

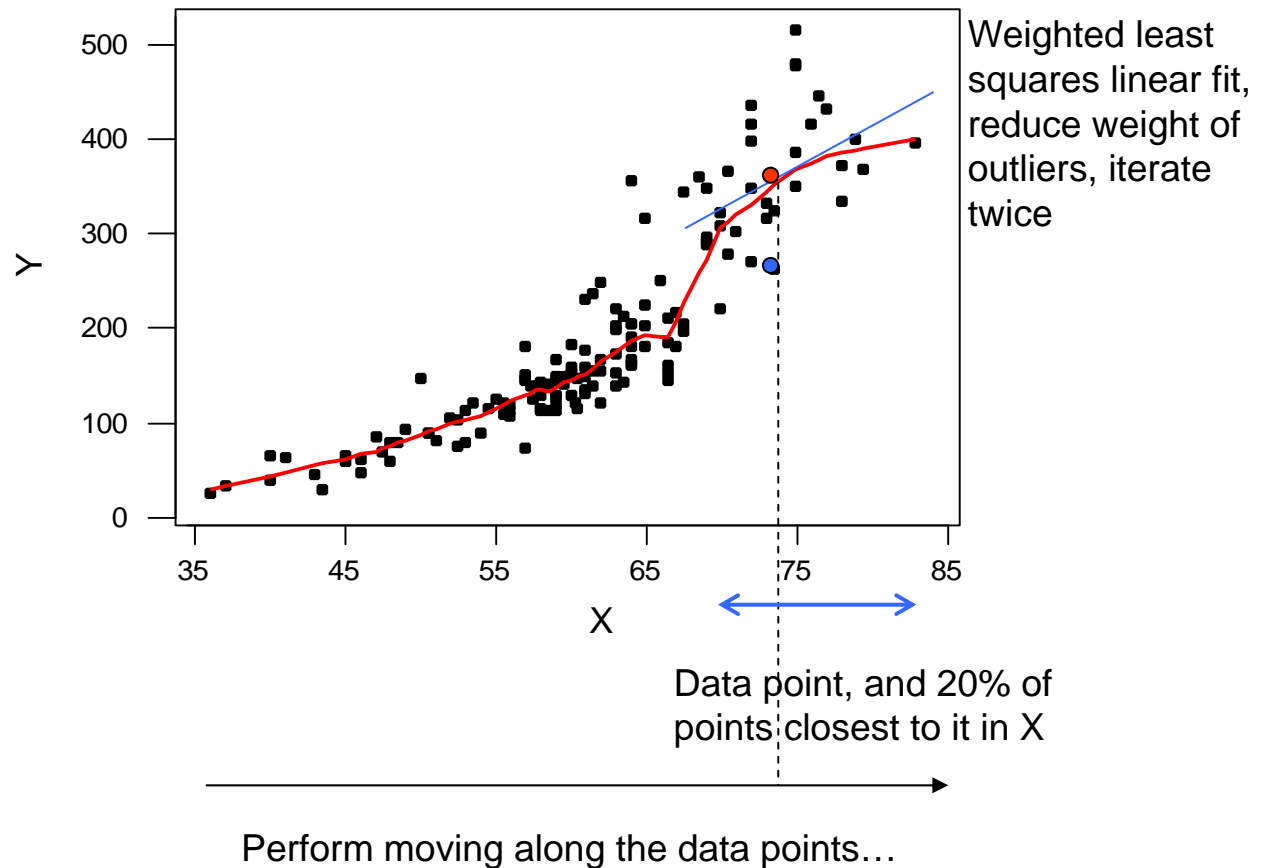
- Fraction of data considered in each local neighborhood (smoothing parameter)
- Degree of locally fitted polynomial (1=linear, 2=quadratic)
- Weight function for the least square fit
- Number of iterative weighted least square fits (in some packages)

(Minitab)

Smoothing fraction = 0.2

Degree = 1

iterations = 2



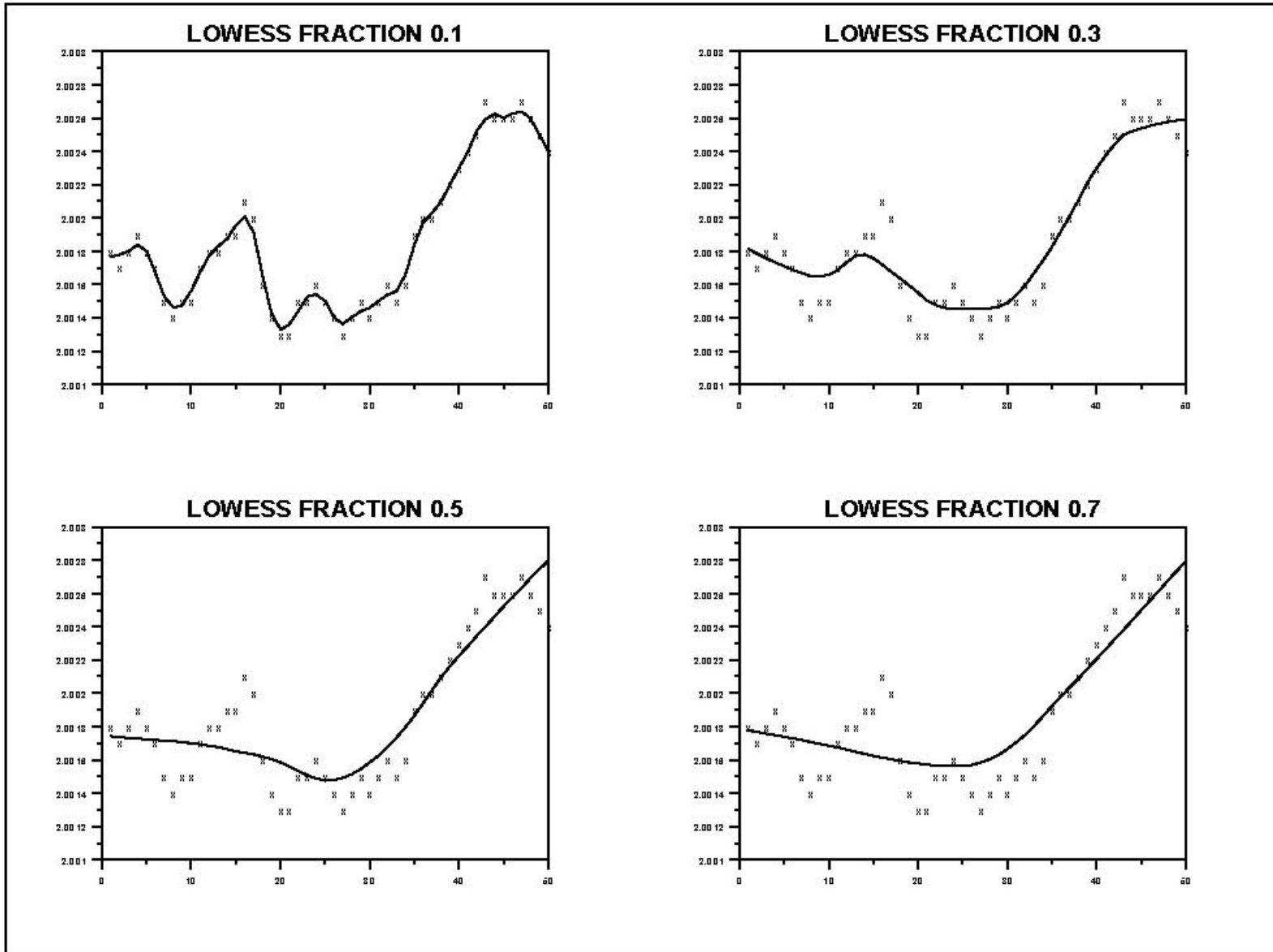
Weighted least squares linear fit

$$\min_{\alpha, \beta} \sum_{i \in N(x)} w_i (y_i - (\alpha + \beta x_i))^2$$

Weight function

$$w_i = \left(1 - \left(\frac{d(x_i, x)}{\max_{j \in N(x)} d(x_j, x)} \right)^3 \right)^3$$

Fraction controls degree of smoothing:



Quadratic (vs linear) fit allows to better capture “bends”:

