# Local Regression

Consider a bivariate regression problem. Given observations , the basic model that can be fitted may be written as

,

where and is a local polynomial of degree (usually 1 or 2), which may be written as

.

Note that the parameters are labeled by since they are estimated by weighted least squares for each value of . The weight function weights the data so that data values near to have greater weight than those farther away from .

We use the tricube weight function,

and define the local neighborhood weights for the data at the point as

where and controls the amount of smoothing, i.e. “**bandwidth**” (larger values of result in more smoothing). As for each , and the local linear model reduces to the standard parametric polynomial regression.

For , is the distance to the nearest neighbor, where . In other words,

where denotes the largest value of .

For , . It follows that as , the local linear model reduces to a parametric polynomial regression of degree . In practice we work with local constant loess, ; local linear, , or local quadratic, .

