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Lecture 3

Basic functions for building regression
models: indicator variables; splines;
interactions WITH applications

Review of key concepts from Lecture 2

- ▶ Two main uses / purposes:
 - ▶ Etiology: creating useful models to describe how Y is caused or associated with a set of X s
 - ▶ Prediction: predicting Y using X
- ▶ Tools for building models to described how Y changes with X
 - ▶ Step function: Mean of Y as a function of X changes with abrupt jumps (up and down)
 - ▶ Linear spline: Mean of Y as a function of X changes linearly with a slope that changes at specified knot points
 - ▶ Cubic spline: Mean of Y as a function of X is locally cubic with curvature that is changes at specified knot points
 - ▶ We will review these today via some data analysis



Review of key concepts from Lecture 2

- ▶ Additional smoothers from Lab 1
 - ▶ “loess”: locally estimated scatterplot smoothing
 - ▶ “lowess”: locally weighted estimated scatterplot smoothing
 - Estimates mean Y at a given X using a polynomial function (degree 1 or 2) based on some fraction of the observed data (span, e.g. 0.3 or 30% of the data) using weights: $(1 - |d|)^3$
 - ▶ “natural spline” or “natural cubic spline”
 - Cubic splines that assume a linear function beyond the boundary knots
 - You can provide the knots
 - Alternatively, you specify the “degrees of freedom”: defines the number of interior knots ($df - 1 - \text{intercept}$) set at appropriate quantile, where the default boundary knots are the min/max value of X



Interactions of simple functions

- ▶ Interactions allow for $E(Y|X) = f(x)$ to vary across subsets of the population of interest
- ▶ Effect modification
- ▶ During the first year of life, is the average “growth rate” in weight for male infants the same as for female infants?



Interactions of simple functions

- ▶ During the first year of life, is the average “growth rate” in weight for male infants the same as for female infants?



Interactions of simple functions

- ▶ During the first year of life, is the average “growth curve” for weight for male infants the same as for female infants?



Interactions of simple functions

- ▶ Is the effect on average medical expenditures of being both poor and older greater than would be expected given the independent effects of poverty and old age alone



And now some ANALYSIS!

- ▶ For the rest of today, we are going to work through several analyses for the Nepali Anthropometry study.

