



# Outline

## Variations on regression models

Polynomial regression models: e.g.

$Y_i = \beta_0 + \beta_1 x_i + \beta_2 x_i^2 + \dots + \beta_n x_i^n, i = 1, \dots, n$ . where  $x_i = x_i - \bar{x}$  or  $x_i = (x_i - \bar{x})/sd(x)$  etc.

Interaction Regression models: e.g.

$E(Y/x) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_1 x_2$ . Graphical Illustrations.

General form:  $E(Y/x) = f_1(x_1) + f_2(x_2) + f_3(x_1, x_2)$

Interpretation of parameters

Numerical stable, practically interpretable and flexible









## Math form

$$E(Y|X) = \mu_0 + \beta_1 X_1 + \beta_2 X_2$$

$$E(Y|A, B) = \mu + \alpha + B$$

### Qualitative vs. Quantitative

Picture (FTfigure 16.1, KNNL)

Factor, Factor Level ("Value" of the factor)

Spectrum from Quantitative–Qualitative variables. Categorical Variables.

Single factor versus Multifactor



# Single Factor ANOVA

Cell Means Model

$$Y_{ij} = \mu_i + \epsilon_{ij}, i = 1, \dots, I, j = 1, \dots, J_i$$

# 1

# Regression vs. ANOVA

Design Matrices for GLM

Typical Question of interest:

$\beta_j = 0$ ? vs  $\beta_j^2 = 0$ ? Ind ordering in .

Calculation glm vs. lm

## Choice of models

Quantitative predictor: Resolution, Precision vs. Robustness

Qualitative predictor: type of ordering. scoring.