STAT 3690 Lecture 23

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Application of (sample) PCA

- Image compression: `mnist` is a list with two components: `train` and `test`. Each of these is a list with two components: images and labels.
  - The `images` component is a matrix with each row for one image consisting of 28*28 = 784 entries (pixels). Their value are integers between 0 and 255 representing grey scale.
  - The `labels` components is a vector representing the digit shown in the image.

- PC regression (PCR): regression on PC scores
  1. Perform PCA on the observed data matrix of explanatory variables, usually centered
  2. Regress the outcome vector(s) on the selected PCs as covariates using linear regression to get a vector of estimated regression coefficients
  3. Transform this coefficient vector back to the scale of the actual covariates

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- Example of PCR: dataset `Prostate` comes from a study that examined the correlation between the level of prostate-specific antigen and a number of clinical measures in men who were about to receive a radical prostatectomy; see Stamey et al, 1989, Journal of Urology 141(5), 1076–1083.
  - `lcavol`: log(cancer volume)
  - `lweight`: log(prostate weight)
  - `age`: patient age
  - `lbph`: log(benign prostatic hyperplasia amount)
  - `svi`: seminal vesicle invasion
  - `lcp`: log(capsular penetration)
  - `gleason`: Gleason score
  - `pgg45`: percentage Gleason scores 4 or 5
  - `lpsa`: log(prostate specific antigen)
