ST505/697R: Applied Regression Analysis. Fall 2012

Oct. 24: Updated Outline of reading and order of coverage as we move into multiple linear regression and the rest of the course. The order is such that we can get to the key fitting and model building things as quickly as possible, so they can be used in the IE projects. I will return to some additional topics after.

The goal here is to extend our earlier results to handle cases with multiple predictors, which might involve functions of other predictors (e.g., squares and products) and to handle grouping variables (e.g., models that allow different coefficients for different groups). To describe these models without matrix-vector notation becomes extremely clumsy. However, for this course our purpose is to only describe the very basics for using matrices to describe models. With the notational changes to accommodate multiple predictors, many of the basic concepts for inference carry over from simple linear regression; we focus on those first.

- An introduction to multiple linear regression models (section 6.1, and look at description of models at very beginning of Sections 8.1 and 8.2)

- Regression models in matrix form. (Sections 5.1-5.4, parts of 5.6 and 5.8, 5.9, 6.2)

  First do a quick read through Sections 5.1-5.4 (but, as you'll see with lecture notes we won't need all of the detail there) , see the definition of an inverse at the beginning of 5.6, look at Sections 5.8 up through page 196, 5.9 and then 6.2.

- Statistical inference for multiple linear regression (Note that the results in Section 5.10-5.13 get repeated in chapter 6 so you can skip going back to them). We'll cover all the rest of Chapter 6 here as itemized below. Read also the detailed example in Section 6.9 (again, you don't need to worry about computing directly using matrix calculations; we'll use lm and proc reg to do the fitting).

  - Estimation of the regression coefficients and error variance (Section 6.3, 6.4 and MSE in Section 6.5).

  - Inferences for the regression coefficients (Section 6.6)

  - Estimating the expected response at a particular x; one-at-a-time and simultaneous confidence intervals, and prediction. (Section 6.7)

  - The Analysis of Variance approach to regression (Section 6.5)

- Model assessment and remedial measures.

  - Assessing model assumptions (Section 6.8. These are the same tools we have used already in SLR. As there we will use Levene's test in place of Brown-Forsythe and assess variance models as we did for SLR rather than through use of Breusch-Pagan test).

  - Accommodating unequal variances. Weighted least squares and White's estimator (Section 11.1)

- The problem of multicollinearity (Section 7.6)

- Fitting polynomial models and/or models with products/interactions. (Sections 8.1 and 8.2).

- Fitting models with qualitative/categorical factors (Section 8.3, other sections to be designated.)

- Model building/variable selection (Ch. 9)

After this we'll cover some selected topics out of
i) More advanced diagnostics and tests for assessing model assumptions with some on measures to accommodate violations of usual assumptions. (Parts of Chapters 10 and 11).
ii) Autocorrelation in time series data. (Parts of Ch. 12)
ii) An introduction to nonlinear regression models. (Parts of Chapters 13 and 14)