Multivariate Statistical Techniques
CLPS 2908

Spring 2019
Tue and Thu 10:30–11:50 a.m.
Instructor: Bertram F. Malle

Teaching assistant: Youtao Lu

Administratives First

1: Thu Jan 24 Basic multivariate concepts, exploratory data analysis | HW1 posted: EDA
» Dillon & Goldstein (1984). Overview of multivariate techniques (pp. 19-22)
» Tabachnick & Fidell (2006). ch. 1 + ch. 2.
» Tabachnick & Fidell (2006). ch. 4

Optional

SPSS EXAMINE complete chapter and SPSS EXAMINE syntax reference
Tabachnick & Fidell (2006). Excerpts about transformations
SPSS Syntax command reference

2: Tue Jan 29 Matrix algebra (Introduction)
» [very basic, slow pace, for beginners] Cliff, N. (1987). Elements of matrix algebra for statistical applications (ch. 1), Vectors (ch. 3).
» [faster pace, for intermediates] Dillon & Goldstein (1984). Vector and matrix operations and selected statistical concepts (pp. 521-539).

Optional

Tabachnick & Fidell (2006). Appendix A

3: Thu Jan 31 Matrix algebra for statistics | HW2 posted: Matrix
» [faster pace] Dillon & Goldstein (1984). Statistical concepts and vector and matrix operations (pp. 6-18).
» [slower pace, thorough] Cliff, N. (1987). Statistical formulas in matrix form (ch. 2), Variances and covariances of linear combinations (ch. 4), The inverse (ch. 5).

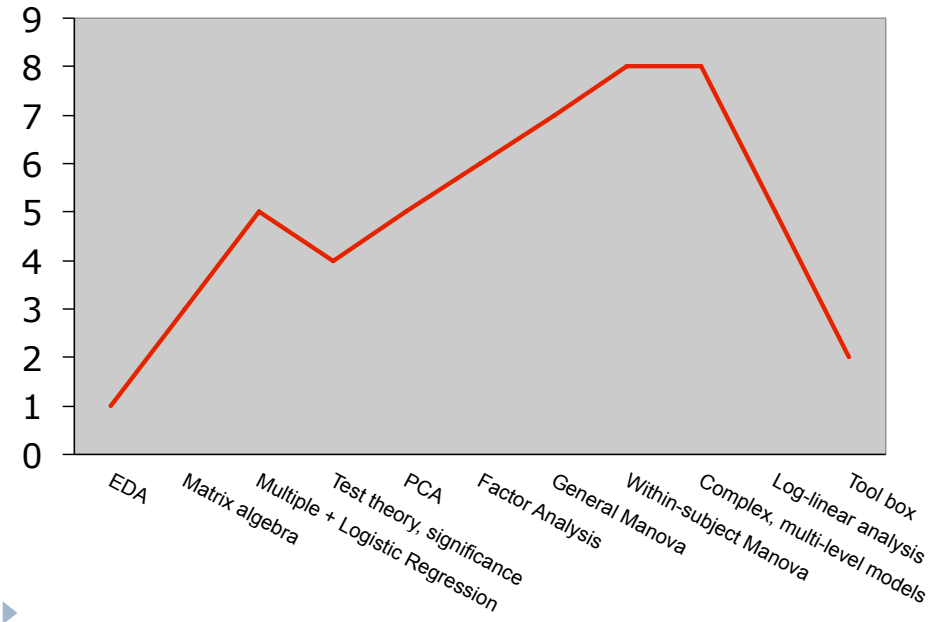
Optional

Handout on determinants and inverses [advanced]

What Awaits You

- **A lot of work**
  - Many techniques in 14 weeks
  - Complexity of techniques
  - Software is imperfect
- **Therefore**:
  - Keep up with readings
  - Lectures are best chance to get things explained; lab/office hours to get them re-explained
  - Repeat and practice. Repeat and practice.

Difficulty Levels



Course Learning Goals

- Have a conceptual and statistical **understanding** of each technique;
- **Apply** the correct technique to any given data set;
- Properly **interpret the output** of statistical computer packages;
- **Critically evaluate** scientific papers that use these techniques.

Redundancy

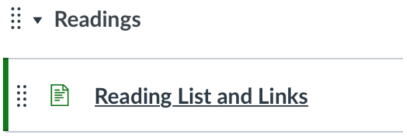
- ***Read*** the assigned readings: At least skim before lecture; study carefully after lecture
- ***Attend lectures***, which introduce material from a conceptual, statistical, and computer angle. Preview videos from last year; review new videos from this year.
- ***Attend shared or individual office hours***, reviewing the material of the week and preparing for the current homework.
- ***Reserve lots of time for homeworks***, in which you run analyses on provided data sets and write up the results as you would for a journal article.
- ***Dig into the exams*** that test conceptual understanding.

Study the Syllabus

On canvas.brown.edu

Homeworks, exams, grading, lateness deductions, **topics and readings**

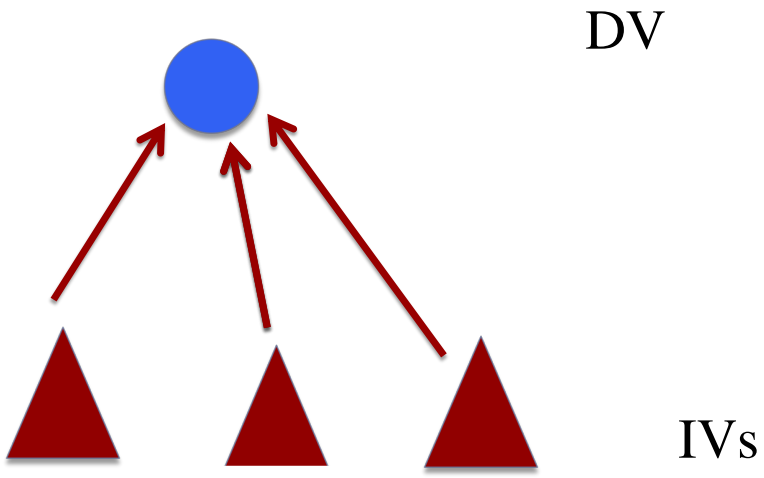
Readings are linked on canvas from Reading Page



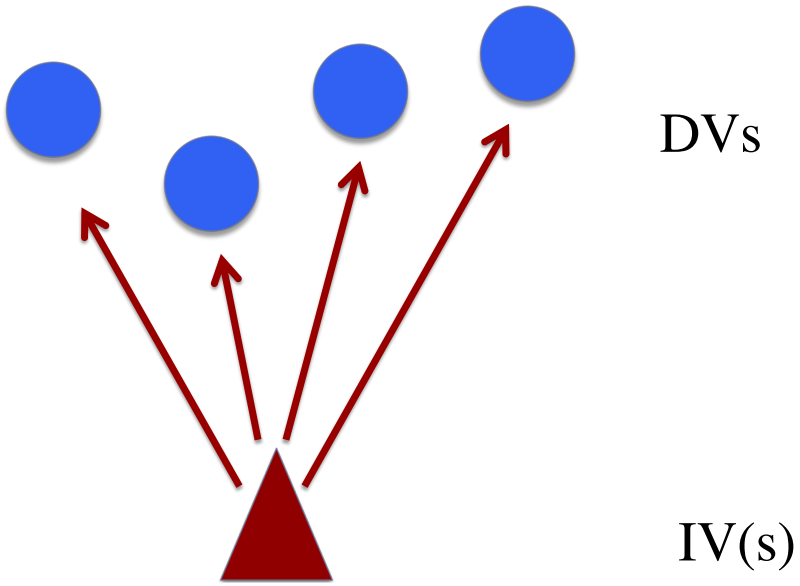
What is Multivariate Analysis?

- Univariate = *uni* variate/variable on DV side
  - Multiple regression as a unique case

(Multiple) Regression



Other MV Techniques



What is Multivariate Analysis?

- Univariate = *uni* variate/variable on DV side
  - Multiple regression vs. others
- Simultaneous relationships among variables = covariances
- Data reduction via linear combinations
  - *Many* variables become *few* (or one)
  - = "canonical variates"

$$Y = \left(X_1 w_1\right) + \left(X_2 w_2\right) + \left(X_3 w_3\right)$$

$$Y = \sum_{j=1}^{p} X_j w_j$$