

Winter Course Announcement

Stanford University Statistics Department
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Multivariate Analysis

STATS 306A	Sequoia Hall, Room 200	M W F 1:15 – 2:05pm
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Instructor: Bradley Efron

Textbook: *Multivariate Analysis* by Mardia, Kent and Bibby (recommended)

Description: Multivariate analysis is the study of statistical inference when the individual data points are themselves vectors. Classical theory, based on the multivariate normal distribution, motivates a great deal of modern-day data-analytic methodology in genomics, image analysis, economics, etc. I will try to present the key ideas of the classical development in an intuitive way, emphasizing heuristic understanding rather than proofs, with geometric interpretations — correlations as angles, determinants as volumes, conditional distributions as projections — playing an important role. Lectures will be from my own notes (provided to the class), with Mardia-Kent-Bibby recommended as a backup text.

Topics covered will include: projections, Grammians, determinants and volumes, Jacobians and integral Jacobians, the Cauchy-Binet theorem, general metrics, Hsu's lemma, the Wishart distribution, Hotelling's T^2 test, singular value decomposition and pseudo-inverses, Kronecker products and the matrix normal distribution, matrix square roots, Woodbury's theorem, Fisher information, triangular coordinates, Mahalanobis distance, principal components, simultaneous diagonalization, critical angles, canonical correlations, projected volumes and the Cauchy projection formula.
