Fall 2025

WEEK 14 STUDY GUIDE

The Big Picture

We study the most important joint distribution in data science. We then see how this is connected with simple regression.

- A random vector with a multivariate normal joint density has a few equivalent definitions, chief among which is that the multivariate normal vector can be represented as an invertible linear transformation of i.i.d. standard normals. Linear combinations of such a random vector are normal; multiple linear combinations are multivariate normal; pairwise uncorrelated multivariate normal variables are independent.
- Simple linear regression predicts Y as a linear function of a single X. No matter what the joint distribution of X and Y, there is always a least squares line. If X and Y are bivariate normal, this line turns out to be the best among all predictors.

Week At a Glance

Mon 11/24	Tue 11/25	Wed 11/26	Thu 11/27	Fri 11/28
	Lecture			
Lab 8 Due				
HW 13 Due HW 14 (Due 5PM Mon 12/1)				
Take it easy	Happy Thanksgiving!			

Reading, Practice, and Class Meetings

Book	Topic	Lectures: Professor	Sections: TAs	Optional Additional Practice
Ch 23	**Multivariate Normal Vectors, contd.** - 23.3 examines the multivariate normal joint density - 23.4 shows that for multivariate normal variables, being pairwise uncorrelated is equivalent to independence	Tuesday 11/25 - Multivariate normal joint density - Independence - Simple regression: general case - Bivariate normal - Regression and the bivariate normal	None	None; focus on the homework.
Ch 24	**Simple Regression** - 24.1 derives the equation of the regression line - 24.2 constructs bivariate normal random variables so that the relation between can be expressed in terms of “linear signal plus noise’ - 24.3 looks at least-squares prediction in the context of the bivariate normal, and the connection with linear regression - 24.4 writes the regression equation in multiple different ways, each one illuminating a different property			