Fall 2024

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 11/25	Tue 11/26	Wed 11/27	Thu 11/28	Fri 11/29
	Lecture			
Lab 8 Due				
HW 13 Due HW 14 (Due 5PM Mon 12/2)				
Take it easy	Happy Thanksgiving!			

Reading, Practice, and Class Meetings

<table>
<tr><th>Book</th><th>Topic</th><th>Lectures: Prof. A.</th><th>Sections: TAs</th><th>Optional Additional Practice</th></tr>
<tr><td>Ch 23</td><td>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</td><td rowspan="2">Tuesday 11/26

- Multivariate normal joint density
- Independence

- Simple regression: general case
- Bivariate normal
- Regression and the bivariate normal</td><td rowspan="2">None</td><td rowspan="2">None; focus on the homework.</td></tr>
<tr><td>Ch 24</td><td>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</td></tr>
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