

Orthogonal projections in multiple regression

stats545.2 545.2 The multivariate normal distribution and projections in the linear model

Gunnar Stefansson

September 5, 2022

Background to projections

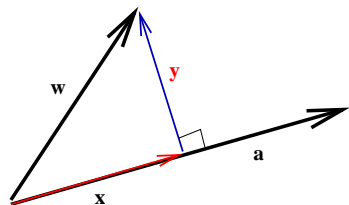
If a is a vector then we can write a general vector w in the form $w = x + y$ where $x = ka$ and $a'y = a \cdot y = 0$.

In the general case,

$$k = \frac{w \cdot a}{\|a\|^2},$$

and for unit vectors a we obtain

$$k = w \cdot a.$$



Projections and bases

The Gram-Schmidt technique uses projections to iteratively build an orthonormal basis, u_1, \dots, u_r which spans the same space as a sequence of arbitrary starting vectors, a_1, a_2, \dots, a_p .

In linear regression, the starting vectors are typically the columns of the X-matrix. r above is then the rank of the matrix.

Copyright 2022, Gunnar Stefansson

This work is licensed under the Creative Commons Attribution-ShareAlike License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-sa/1.0/> or send a letter to Creative Commons, 559 Nathan Abbott Way, Stanford, California 94305, USA.