

Normalize X, Y

Do principal component analysis on X to get p_i
Do principal component analysis on Y to get q_i

$$u_1 = X^* p_1$$
$$v_1 = Y^* q_1$$

$$X = u_1 c_1^T + E$$
$$Y = v_1 d_1^T + G$$

E, G is the residual matrix

least square method

$$c_1 = \frac{X^T u_1}{\|u_1\|^2}$$
$$d_1 = \frac{Y^T v_1}{\|v_1\|^2}$$
$$r_1 = \frac{Y^T u_1}{\|u_1\|^2}$$

Use u_1 to perform regression on Y
Regression on Y using the principal components of X

$$Y = u_1 r_1^T + F$$

Treat remaining E as new X
The remaining F is treated as the new Y
Follow the previous steps to find p_2, q_2

$$u_2 = E p_2$$
$$v_2 = F q_2$$

Get the second set of
regression coefficients

$$p_i, q_i, \dots$$
$$c_i, d_i, r_i, \dots$$
$$u_i, v_i, \dots$$

$$E = u_2 c_2^T + E'$$
$$F = u_2 r_2^T + F'$$

get the regression equation

$$c_2 = \frac{E^T u_2}{\|u_2\|}$$
$$r_2 = \frac{F^T u_2}{\|u_2\|}$$

$$X = u_1 c_1^T + u_2 c_2^T + u_3 c_3^T + \dots + u_n c_n^T + E$$
$$Y = u_1 r_1^T + u_2 r_2^T + u_3 r_3^T + \dots + u_n r_n^T + F$$