

Computing the QR by Householder

Note Title

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transformation

Let u, v be vectors with $\|u\|_2 = \|v\|_2$

$\exists H = I - 2ww^T$, where

$$w = \frac{u-v}{\|u-v\|_2}$$

s.t. $Hu = v$ ($H^T \cdot H = I, H = H^T$)

For example. Let

$$A = \begin{bmatrix} * & * & * \\ * & * & * \\ * & * & * \\ * & * & * \end{bmatrix}$$

$$H_1 A = \begin{bmatrix} * & * & * \\ 0 & * & * \\ 0 & * & * \\ 0 & * & * \end{bmatrix}$$

$$H_2 \cdot (H_1 A) = \begin{bmatrix} * & * & * \\ 0 & * & * \\ 0 & 0 & * \\ 0 & 0 & * \end{bmatrix}$$

$$H_2 H_1 A = \begin{bmatrix} * & * & * \\ 0 & * & * \\ 0 & 0 & * \\ 0 & 0 & 0 \end{bmatrix} = R$$

~~$H_3 H_2 H_1 A = H_3 R$~~

~~$H_2 H_1 A = H_2 H_3 R$~~

$$A = \underbrace{H_1 H_2 H_3}_Q R$$

MW: Read "QR decomposition"
on Wikipedia

Construct a 4×4 matrix A
and find Q, R st. $A = QR$