

Linear Algebra for Electrical Engineers

Homework V

Due 10/20 23:59

Please checkout the eTL homework announcement for the submission format. Skeleton code is available at this link: <https://github.com/3dvision-snu/linear-algebra-2020-fall>

1. You are given a $n \times m$ matrix A . Write a program that takes matrix A as input and calculates the matrix Q, R , which are QR-decomposition outputs of A . The pseudo-code is given as following:

Algorithm 1: QR decomposition

Input: $n \times m$ matrix A

Output: Q, R , where q_i the i th column of Q and r_{ij} is the (i, j) element of R

$Q \leftarrow A$

$R \leftarrow$ zero matrix

for $0 \leq i < n$ **do**

$r_{ii} = \|q_i\|$

$q_i = q_i / r_{ii}$

for $i < j < n$ **do**

$r_{ij} = q_i^T q_j$

$q_j = q_j - r_{ij} q_i$

end

end

Verify the algorithm by running the `check_qr(Q, R, A)` function, where it checks 1) whether $QR = A$, 2) Q is orthogonal, and 3) R is upper triangular. With the correct algorithm, the program should output **correct!!!**. In this homework, it is important that you should not touch anything besides the `qr_decompose(A)` function (0.7 points).

2. Briefly explain why the algorithm guarantees that R is an upper triangular matrix (0.3 points).