

orth(*) Pseudocode

- Make matrix $S \leftarrow \text{matrix } Z' * \text{matrix } Z$
- SVD decomposition for matrix S :
matrix U , Singular values, matrix V
- Check singular values with a threshold
and set rank.
- Truncate matrix V with a new rank.
- Make matrix $Y \leftarrow \text{matrix } Z * \text{matrix } V_{\text{trnc}}$
- Normalize $Y == \text{orth}(*)$
- Check orthogonality:
 $\text{matrix } I \leftarrow \text{matrix } Y' * \text{matrix } Y$

CUDA

~~mtxZ~~

1.000000 5.000000 9.000000
2.000000 6.000000 10.000000
3.000000 7.000000 11.000000
4.000000 8.000000 12.000000

~~mtxS ~~

30.000000 70.000000 110.000000
70.000000 174.000000 278.000000
110.000000 278.000000 446.000000

~~mtxU ~~

-0.206736 0.889152 0.408250
-0.518289 0.254384 -0.816496
-0.829842 -0.380391 0.408247

MATLAB

~~mtxZ~~

1 5 9
2 6 10
3 7 11
4 8 12

~~mtxS~~

30 70 110
70 174 278
110 278 446

~~mtxU~~

-0.2067 0.8892 0.4083
-0.5183 0.2544 -0.8165
-0.8298 -0.3804 0.4082

CUDA

~~sngVals ~~

647.032593

2.967391

0.000005

~~mtxVT ~~

-0.206736 -0.518289 -0.829842

0.889153 0.254383 -0.380390

-0.408250 0.816496 -0.408248

~~mtxV ~~

-0.206736 0.889153 -0.408250

-0.518289 0.254383 0.816496

-0.829842 -0.380390 -0.408248

~~ new rank = 2 ~~

~~mtxV_Trnc ~~

-0.206736 0.889153

-0.518289 0.254383

-0.829842 -0.380390

MATLAB

~~sngVals~~

647.0327 0 0

0 2.9674 0

0 0 0.0000

~~mtxVT~~

-0.2067 -0.5183 -0.8298

0.8892 0.2544 -0.3804

0.4082 -0.8165 0.4082

~~mtxV~~

-0.2067 0.8892 0.4082

-0.5183 0.2544 -0.8165

-0.8298 -0.3804 0.4082

Current Rank = 2

~~mtxV Trancated~~

-0.2067 0.8892

-0.5183 0.2544

-0.8298 -0.3804

CUDA

~~mtxY ~~

-10.266754 -1.262444

-11.821620 -0.499299

-13.376486 0.263847

-14.931353 1.026992

~~mtxY hat <- orth(*) ~~

-0.403618 -0.732866

-0.464744 -0.289850

-0.525871 0.153167

-0.586997 0.596183

~~~~Orthogonality Check (should be close to  
identity matrix)~~

1.000000 0.000000

0.000000 1.000000

## MATLAB

~~mtxY~~

-10.2668 -1.2624

-11.8216 -0.4993

-13.3765 0.2638

-14.9314 1.0270

~~mtxY hat <-orth(\*)~~

-0.4036 -0.7329

-0.4647 -0.2899

-0.5259 0.1532

-0.5870 0.5962

~~Orthogonality Check  
(should be close to identity matrix)~~

1.0000 0.0000

0.0000 1.0000