5.3.3 Matrix-matrix multiplication by rows

5.3.3 Matrix-matrix multiplication by rows

Start of transcript. Skip to the end.

Dr. Robert van de Geijn: So let's continue

on with our examination of the different algorithms for computing

matrix-matrix multiplication.

This time we're going to look at how C can be computed one row at a time.

0:00 / 4:34 1.0x

Recall how the ij entry of C is

Video

Download video file

Transcripts

Download SubRip (.srt) file

Download Text (.txt) file

Discussion

Hide Discussion

Topic: Week 5 / 5.3.3

Add a Post

Show all posts by recent activity

There are no posts in this topic yet.

Homework 5.3.3.1

1/1 point (graded)

Let A and B be matrices and AB be well-defined and let A have at least four rows. If the first and fourth rows of A are the same, then the first and fourth rows of AB are the same.

Always ✔ **Answer:** Always

Explanation

Answer: Always

Partition

$$A = \begin{pmatrix} \tilde{a}_0^T \\ \tilde{a}_1^T \\ \tilde{a}_2^T \\ \tilde{a}_3^T \\ A_4 \end{pmatrix}$$

where A_4 represents the part of the matrix below the first four rows. Then

$$AB = \begin{pmatrix} \tilde{a}_0^T \\ \tilde{a}_1^T \\ \tilde{a}_2^T \\ \tilde{a}_3^T \\ A_4 \end{pmatrix} B = \begin{pmatrix} \tilde{a}_0^T B \\ \tilde{a}_1^T B \\ \tilde{a}_2^T B \\ \tilde{a}_3^T B \\ A_4 B \end{pmatrix}.$$

Now, if $\tilde{a}_0^T = \tilde{a}_3^T$ then $\tilde{a}_0^T B = \tilde{a}_3^T B$ and hence the first and fourth rows of AB are equal.

Submit

Answers are displayed within the problem

Homework 5.3.3.2

18/18 points (graded)

Compute each of the following matrix-matrix multiplications:

$$\begin{pmatrix} \overline{\begin{array}{ccc} 1 & -2 & 2 \end{array}} \\ \hline \\ \end{pmatrix} \begin{pmatrix} -1 & 0 & 1 \\ 2 & 1 & -1 \\ 1 & -1 & 2 \end{pmatrix} =$$

-3	-4	7

$$\left(\begin{array}{rrr} 1 & -2 & 2 \\ \hline -1 & 2 & 1 \\ \hline & & \end{array}\right)\left(\begin{array}{rrr} -1 & 0 & 1 \\ 2 & 1 & -1 \\ 1 & -1 & 2 \end{array}\right) =$$

-3	-4	7

6	1	-1

$$\left(\begin{array}{rrr} 1 & -2 & 2 \\ -1 & 2 & 1 \\ \hline 0 & 1 & 2 \\ \hline \end{array}\right)\left(\begin{array}{rrr} -1 & 0 & 1 \\ 2 & 1 & -1 \\ 1 & -1 & 2 \end{array}\right) =$$

-3	-4	7
6	1	-1
4	-1	3

Submit

Correct (18/18 points)

Homework 5.3.3.3

1/1 point (graded)

Algorithm: $C := \text{GEMM\_UNB\_VAR2}(A, B, C)$

Partition $A \rightarrow \left(\begin{array}{c} A_T \\ \hline A_B \end{array}\right)$, $C \rightarrow \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right)$

where A_T has 0 rows, C_T has 0 rows

while $m(A_T) < m(A)$ **do**

Repartition

$$\left(\begin{array}{c} A_T \\ \hline A_B \end{array}\right) \rightarrow \left(\begin{array}{c} A_0 \\ \hline a_1^T \\ \hline A_2 \end{array}\right), \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \rightarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$$

where a_1 has 1 row, c_1 has 1 row

$c_1^T := a_1^T B + c_1^T$

Continue with

$$\left(\begin{array}{c} A_T \\ \hline A_B \end{array}\right) \leftarrow \left(\begin{array}{c} A_0 \\ \hline a_1^T \\ \hline A_2 \end{array}\right), \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \leftarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$$

endwhile

Write the routine

- `[ C_out ] = Gemm_unb_var2( A, B, C )`

that computes $C := AB + C$ using the above algorithm.

Some links that will come in handy:

- Spark (alternatively, open the file `LAFF-2.0xM -> Spark -> index.html`)
- PictureFLAME (alternatively, open the file `LAFF-2.0xM -> PictureFLAME -> PictureFLAME.html`)

The update $c_1^T := a_1^T B + c_1^T$ can be accomplished by the call to

```
laff_gemv( ..., 1, ..., ...., 1, .... )
```

(click on the "laff routines" tab at the top of the page for more info). Hint: Revisit Homework 4.6.1.2

You may want to use the following script to test your implementation:

- test_Gemm_unb_var2.m

☑ Done/Skip ✔

✔

Gemm_unb_var2.m

Submit

Answers are displayed within the problem