4.2.3 Matrix-Vector Multiplication, again...

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Week 4 due Oct 24, 2023 19:42 IST

4.2.3 Matrix-Vector Multiplication, again...

Errata

In the video "4.2.3 Matrix Vector Multiplication Again..." there is a typo at minute 3:16.

Vector $\begin{pmatrix} 1 \\ -2 \\ 0 \\ -3 \\ 1 \end{pmatrix}$ should it be $\begin{pmatrix} -1 \\ -2 \\ 0 \\ -3 \\ 1 \end{pmatrix}$. The answer in red in that slide is correct though.

In the video "4.2.3 Matrix Vector Multiplication Again..." there is a mistake at 3:50. On the line for y_0^{next}, the second vector which corresponds to y_0^{cur} should be $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$ instead of $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$. (Sorry, videos are hard to correct.)

Video

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Transcripts

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Reading Assignment

0 points possible (ungraded)

Read Unit 4.2.3 of the notes. [LINK]

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? Symmetric Matrix ? 6

Homework 4.2.3.1

1/1 point (graded)

Write routines

- `[ y_out ] = Mvmult_n_unb_var1B( A, x, y )`
- `[ y_out ] = Mvmult_n_unb_var2B( A, x, y )`

that compute $y := Ax + y$ using the below algorithms

Algorithm: $y := \text{MVMULT\_N\_UNB\_VAR1B}(A,x,y)$

Partition $A \rightarrow \left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right)$,

$x \rightarrow \left(\begin{array}{c} x_T \\ \hline x_B \end{array}\right)$, $y \rightarrow \left(\begin{array}{c} y_T \\ \hline y_B \end{array}\right)$

where A_{TL} is 0×0, x_T, y_T are 0×1

while $m(A_{TL}) < m(A)$ **do**

Repartition

$$\left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline a_{10}^T & \alpha_{11} & a_{12}^T \\ \hline A_{20} & a_{21} & A_{22} \end{array}\right),$$

$$\left(\begin{array}{c} x_T \\ \hline x_B \end{array}\right) \rightarrow \left(\begin{array}{c} x_0 \\ \hline \chi_1 \\ \hline x_2 \end{array}\right), \left(\begin{array}{c} y_T \\ \hline y_B \end{array}\right) \rightarrow \left(\begin{array}{c} y_0 \\ \hline \psi_1 \\ \hline y_2 \end{array}\right)$$

$$\psi_1 := a_{10}^T x_0 + \alpha_{11}\chi_1 + a_{12}^T x_2 + \psi_1$$

Continue with

$$\left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline a_{10}^T & \alpha_{11} & a_{12}^T \\ \hline A_{20} & a_{21} & A_{22} \end{array}\right),$$

$$\left(\begin{array}{c} x_T \\ \hline x_B \end{array}\right) \leftarrow \left(\begin{array}{c} x_0 \\ \hline \chi_1 \\ \hline x_2 \end{array}\right), \left(\begin{array}{c} y_T \\ \hline y_B \end{array}\right) \leftarrow \left(\begin{array}{c} y_0 \\ \hline \psi_1 \\ \hline y_2 \end{array}\right)$$

endwhile

Algorithm: $y := \text{MVMULT\_N\_UNB\_VAR2B}(A,x,y)$

Partition $A \rightarrow \left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right)$,

$x \rightarrow \left(\begin{array}{c} x_T \\ \hline x_B \end{array}\right)$, $y \rightarrow \left(\begin{array}{c} y_T \\ \hline y_B \end{array}\right)$

where A_{TL} is 0×0, x_T, y_T are 0×1

while $m(A_{TL}) < m(A)$ **do**

Repartition

$$\left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline a_{10}^T & \alpha_{11} & a_{12}^T \\ \hline A_{20} & a_{21} & A_{22} \end{array}\right),$$

$$\left(\begin{array}{c} x_T \\ \hline x_B \end{array}\right) \rightarrow \left(\begin{array}{c} x_0 \\ \hline \chi_1 \\ \hline x_2 \end{array}\right), \left(\begin{array}{c} y_T \\ \hline y_B \end{array}\right) \rightarrow \left(\begin{array}{c} y_0 \\ \hline \psi_1 \\ \hline y_2 \end{array}\right)$$

$$y_0 := \chi_1 a_{01} + y_0$$
$$\psi_1 := \chi_1 \alpha_{11} + \psi_1$$
$$y_2 := \chi_1 a_{21} + y_2$$

Continue with

$$\left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline a_{10}^T & \alpha_{11} & a_{12}^T \\ \hline A_{20} & a_{21} & A_{22} \end{array}\right),$$

$$\left(\begin{array}{c} x_T \\ \hline x_B \end{array}\right) \leftarrow \left(\begin{array}{c} x_0 \\ \hline \chi_1 \\ \hline x_2 \end{array}\right), \left(\begin{array}{c} y_T \\ \hline y_B \end{array}\right) \leftarrow \left(\begin{array}{c} y_0 \\ \hline \psi_1 \\ \hline y_2 \end{array}\right)$$

endwhile

Calculator

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`)

Note: Spark will not put in the "B" in "var1B". You will have to add that manually after you generate the code skeleton.

You may want to use the following scripts to test your implementations:

- test_Mvmult_unb_var1B.m

  If you get an error that `laff_dots( ... )` is missing, move the file laff_dots.m into directory `LAFF-2.0xM -> Programming -> laff -> vecvec`

- test_Mvmult_unb_var2B.m

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✔

View document with most algorithms and implementations for this week.

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