11.3.3 Orthogonal Bases

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11.3.3 Orthogonal Bases

Video 11.3.3 Part 1

Start of transcript. Skip to the end.

Dr. Robert van de Geijn: Now we arrive at the very important topic

of Gram-Schmidt orthogonalization.

This is also known as the Gram-Schmidt process.

It starts with a set of linearly independent vectors,

and it results in a set of mutually

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You MAY Want to download the PDF for the visualization.

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Reading Assignment

0 points possible (ungraded)
Read Unit 11.3.3 of the notes. [LINK]

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Video 11.3.3 Part 2 cuts off

Video cuts off at 5:32. Complete video on youtube [here][1] [1]: https://www.youtube.com/watch?v=H7DGGzdqSBg

2

The final slide in this video has a few errors in it, involving the "perpendicular symbol" that is missing in one place, and shouldn't be there in another. Here is the corrected slide:

Gram-Schmidt process

- Compute q_0:
  - Normalize a_0:
    - $\rho_{0,0} = \|a_0\|_2$.
    - $q_0 = a_0 / \rho_{0,0}$.
- Compute q_1:
  - Let $a_1^\perp$ equal the component of a_1 orthogonal to q_0:
    - $\rho_{0,1} = q_0^T a_1$.
    - $a_1^\perp = a_1 - \rho_{0,1} q_0$.
  - Normalize $a_1^\perp$:
    - $\rho_{1,1} = \|a_1^\perp\|_2$.
    - $q_1 = a_1^\perp / \rho_{1,1}$.
- Compute q_2:
  - Let $a_2^\perp$ equal the component of a_2 orthogonal to q_0 and q_1:
    - $\rho_{0,2} = q_0^T a_2$.
    - $\rho_{1,2} = q_1^T a_2$.
    - $a_2^\perp = a_2 - \rho_{0,2} q_0 - \rho_{1,2} q_1$.
  - Normalize $a_2^\perp$:
    - $\rho_{2,2} = \|a_2^\perp\|_2$.
    - $q_2 = a_2^\perp / \rho_{2,2}$.
- Compute q_3:
  - ...

Video 11.3.3 Part 2

except up

that they are mutually orthonormal.

If we now rotate this picture some more and rotate it into this position right

here, then what we see here is that a 2 is definitely not in the plane

spanned by q 0 and q 1.

We can compute the projection of a 2 onto the space spanned by q 0

and q 1 by creating a matrix, Q super 2 here, that has as its columns

the vectors q 0 and q 1.

And then this was the formula for the projection

onto the space spanned by these two orthonormal columns.

If we take that dashed vector that we

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Video

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