Re: Eigenvalues/eigenvectors for a matrix of the form (A^T)A

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- *From*: "Rusty" <rusty@xxxxxxxxxxxxxxx>

- *Date*: Thu, 18 Aug 2005 22:25:15 +0100

<jcooper@xxxxxxxxxxx> wrote in message
news:1124398905.689060.309190@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
>I have an m−dimensional real−valued symmetric matrix M which arises
> from the product (A^T)A where A is an nxm real−valued matrix which is
> not generally sparse. 'n' is much greater that 'm'. I would like to
> determine the eigenvalues and eigenvectors of M.
>
> The straightforward method would be to calculate M, then solve the
> eigenproblem. My problem is that M is strongly ill−conditioned, so
> that there are quantization problems in determining the eigenvalues.
> In the past, I have used the fact that the EVD (ie, eigenvalue
> decomposition) of 'M' is easily derived from the SVD of 'A' (but with
> the singular values of A being the square root of the eigenvalues of M
> −− goodbye quantization problems). Since n >> m, however, this results
> in an intermediate nxn matrix that I never really use anyway.
>
> It seems to me that this structure should lend itself to an efficient
> determination of the EVD of M without calculating M itself. Is there a
> good way to go about this without producing large, unused intermediate
> matrices?

One method is to do a QR decomposition by Householder or rotations: A = QR
where Q is orthogonal and R is an mxm upper triangular. Then EV's of R are
the same as EV's of A.

rusty.

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- ***References***:

- ***Eigenvalues/eigenvectors for a matrix of the form (A^T)A***
  - *From:* jcooper

- Prev by Date: ***Eigenvalues/eigenvectors for a matrix of the form (A^T)A***
- Next by Date: ***Re: orthogonal polynomials relative to measures with mass point***
- Previous by thread: ***Eigenvalues/eigenvectors for a matrix of the form (A^T)A***
- Next by thread: ***Re: Eigenvalues/eigenvectors for a matrix of the form (A^T)A***
- Index(es):
  - ***Date***
  - ***Thread***