Subject: Re: SVD and Other things Linear
Posted by J.D. Smith on Thu, 18 Feb 1999 08:00:00 GMT
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Lykoan wrote:
>
> Hellu,
> I am trying to find the non trivial solution for the equation Ax=0 where A
> is a known nxm matrix, and x is an unknown 1 x n (or 1xm, I get that
> confused) vector. I was using SVD and SVSOL to get the answer, but then I
> got to this case, and all I get is x = [0, ..., 0]. Does anyone know if I
> can get SVD and SVSOL to find the non-trivial solution, or of any other way
> to do this linearly. I have tried to do it nonlinearly, with BROYDEN, but I
> keep running into local minimums(maximums), or it not even being able to
> converge.
>
> Thank You,
> David Borland
> dborland@egi.com

There may, in fact, only be the trivial solution. The null space of a matrix with more columns than rows (underdetermined -- fewer equations than unknowns) is always finite. The spanning vectors of this nullspace are just the columns of V corresponding to the zeroes on the diagonal of the diagonal matrix W as returned by SVDC. For non-singular square or over-determined matrices, the null space is Z, the zero space... i.e. just x=[0,......,0].

So, the question becomes do you have fewer or more equations than unknowns? Is A short and wide or tall and skinny?

If you are not expecting a unique solution to begin with (short and wide), or if you have a singular square matrix, just examine the columns of the output matrix V corresponding to *small* diagonals in W (they won't be exactly 0). These will be the set of orthonormal vector(s) which span A's nullspace.

If you are overdetermined, then really this becomes a least-squares problem for which the null space is the zero space by definition, since if there were an non-trivial x as a solution to Ax=0, then this could be added to any solution of Ax=b for which x was the *best* solution and change that solution. Another way of seeing that is noting that the vector which will best approximate a solution of Ax=0 is indeed x=[0,.....,0], which solves it exactly!

Good Luck,

JD

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