Q1

Since matrix follows RIP of order with RIC , for any s-sparse vector ,

Let . Then we have,

where

Note that in the above equation can be any general s-size vector since we can then fill zeros and make a to be used with the first equation.

Note that

We have for all non-zero , .

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Claim1: *The nonzero singular values of A are the square roots of the nonzero eigenvalues of A\*A.*

Proof:

square of magnitudes of singular values of .

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For every eigenvector of with which implies (using the claim)

Here

Therefore . Since

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# Proof :

Let . Then,

By Claim1, all

This is because maximum/minimum of for a unit vector v occurs at max/min absolute value eigenvalue.

Similiarly for minimum.

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Consider which has then eigenvalues in the range with at least one eigenvalue with absolute value . (since is achieving atleast one bound (either the left or the right) both of which

Also since each element in is a dot product between two distinct columns in or zero.

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Claim2:

Proof:

where

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If .

We have thus