**Some Observations and Plots for the report: *Ideas for ReLU Matrix Completion* by Prof. Balzano**

A picture containing implement

Description automatically generated1. Gap b/w r+1 and r+2 singular values for non-Gaussian matrices may not be prominent. Check the following figure. Plot on left shows singular value distribution & plot on right shows matrix value distribution for different ranks. These are just some arbitrary non-Gaussian distributions.

For above 10 plots, here are the portions of positive entries that passed through ReLU:

rank = 1, 50.0

rank = 2, 50.5

rank = 3, 50.0

rank = 4, 50.0

rank = 5, 50.0

rank = 6, 50.5

rank = 7, 50.3

rank = 8, 50.1

rank = 9, 50.1

rank = 10, 50.5

2. The gap b/w the first and the next singular values seems to be proportional to two factors:

1. rank of the underlying matrix

2. number of positive entries (elements that made through the ReLU gate).

A screenshot of a cell phone

Description automatically generatedContrast the next figure with above figure for less number of entries allowed through ReLU:

rank = 1, elements through ReLU (%) = 34.0

rank = 2, elements through ReLU (%) = 38.0

rank = 3, elements through ReLU (%) = 37.7

rank = 4, elements through ReLU (%) = 34.5

rank = 5, elements through ReLU (%) = 37.2

rank = 6, elements through ReLU (%) = 36.8

rank = 7, elements through ReLU (%) = 36.6

rank = 8, elements through ReLU (%) = 38.1

rank = 9, elements through ReLU (%) = 38.9

rank = 10, elements through ReLU (%) = 36.6

3. Property -2 seems to be a general property for a matrix with non-negative values:

Three experiments are carried out to check singular value distribution:

3A.: Consider a 10x10 square matrix with all entries uniformly sampled from (0,1). Then, randomly make some entries zero and check singular value distribution.





3B.: Make the interval of uniform distribution and size of the matrix larger.

100x100 matrix sampled from U(100,200). Singular values Displayed on log10 scale.





3C.: Gaussian Distribution with variance = 1 and all non-negative values, 10x10 matrix.



