Mathematica SVD

The built in Mathematica command works as expected. It returns a dense middle matrix unless the input is sparse.

In[97]:=
```
{n, m} = {4, 5};
A = RandomReal[{-1, 1}, {n, m}];
{U, Dia, V} = SingularValueDecomposition[A];
MatrixForm[Dia]
Norm[A - U.Dia.Transpose[V]]
Map[Dimensions, {U, Dia, V}]
```

Out[100]//MatrixForm=

$$\begin{pmatrix} 1.70409 & 0. & 0. & 0. & 0. \\ 0. & 1.10738 & 0. & 0. & 0. \\ 0. & 0. & 0.771461 & 0. & 0. \\ 0. & 0. & 0. & 0.477362 & 0. \end{pmatrix}$$

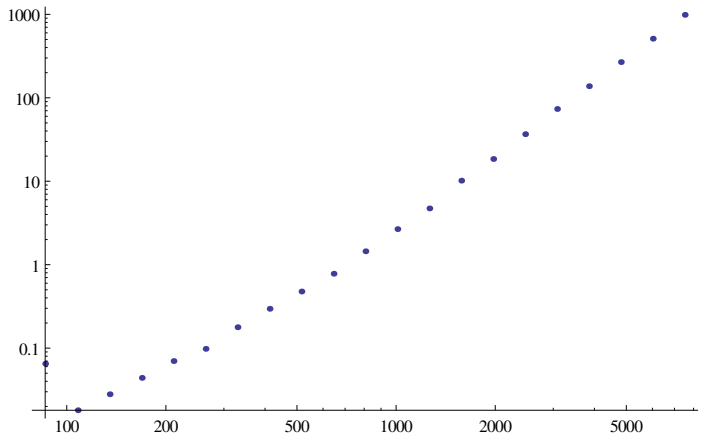
Out[101]= 1.32141×10^{-15}

Out[102]= {{4, 4}, {4, 5}, {5, 5}}

On my 4 core 8Gig machine the time grows a bit above quadratically. It does flash all 4 cores to 100%.

In[123]:=
```
Data = Table[
   n = Floor[1.25^p];
   A = RandomReal[{-1, 1}, {n, n}];
   {n, Timing[{U, Dia, V} = SingularValueDecomposition[A];][[1]]},
   {p, 20, 40}];
ListLogLogPlot[Data]
Fit[Log[Data], {1, t}, t]
```

Out[124]=

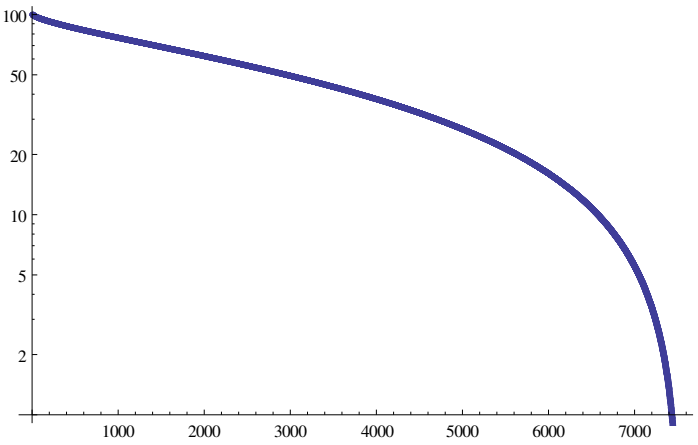


Out[125]= $-15.691 + 2.46771\, t$

The singular values of a random matrix are not all that interesting.

In[126]:=
```
ListLogPlot[ Diagonal[Dia] ]
```

Out[126]=



Our plan is to work out. What are SVDs good for then work out how to compute them.