

Q1

Alice4D: [[-93.44723347 -7.16843011 -0.87392732 -0.68148247]]

Alice2D: [[-0.62562864 -0.295158]]

prediction: 5.354514697523497

Q2

U:

[[-0.33306893 -0.73220483 0.57543613 -0.1476971]

[-0.48640367 -0.34110504 -0.56984703 0.56774394]

[-0.79307315 0.44109455 -0.0055891 -0.42004684]

[-0.15333474 0.39109979 0.58661434 0.69239659]]

S:

[1.10528306e+01 9.13748280e-01 5.00674393e-16]

V:

[[-0.41903326 -0.56492763 -0.71082199]

[0.81101447 0.11912225 -0.57276996]

[0.40824829 -0.81649658 0.40824829]]

A = UDV

Q3

The Rank2 matrix is still too large to display due to one of the sides being 1401

Norm: 7.317532201210154e-13

Q4

Running the file q4.py generates the following table:

Values of x	Number of Iterations
-----	-----
[-0.22772539 0.24097484 0.16749401]	554
Could Not Converge (step size too large)	215
Could Not Converge (step size too large)	145
Could Not Converge (step size too large)	123
Could Not Converge (step size too large)	111
Could Not Converge (step size too large)	104
Could Not Converge (step size too large)	86

You can see that for step sizes greater than 0.01, the gradient descent algorithm was not able to converge.

Q5

independent vectors of null space

$[-2, 7/2, 1, 0]$

$[-3, 5/2, 0, 1]$

Row Echelon form of A:

$[1, 0, 2, 3],$

$[0, 1, -7/2, -5/2],$

$[0, 0, 0, 0]$

Row Echelon form of A transpose:

$[1, 0, -1],$

$[0, 1, 1],$

$[0, 0, 0],$

$[0, 0, 0]$

Null Space:

$[0.81786391 \ -0.14262416]$

$[-0.41787061 \ -0.77606481]$

$[0.1438269 \ -0.48813724]$

$[-0.3685059 \ 0.37296621]$

pseudoinverse:

$[0.06507304 \ 0.01460823 \ -0.05046481]$

$[0.03984064 \ -0.03187251 \ -0.07171315]$

$[-0.00929615 \ 0.14077025 \ 0.1500664]$

$[0.09561753 \ 0.12350598 \ 0.02788845]$

A * A pseudoinverse which should be like the identity matrix:

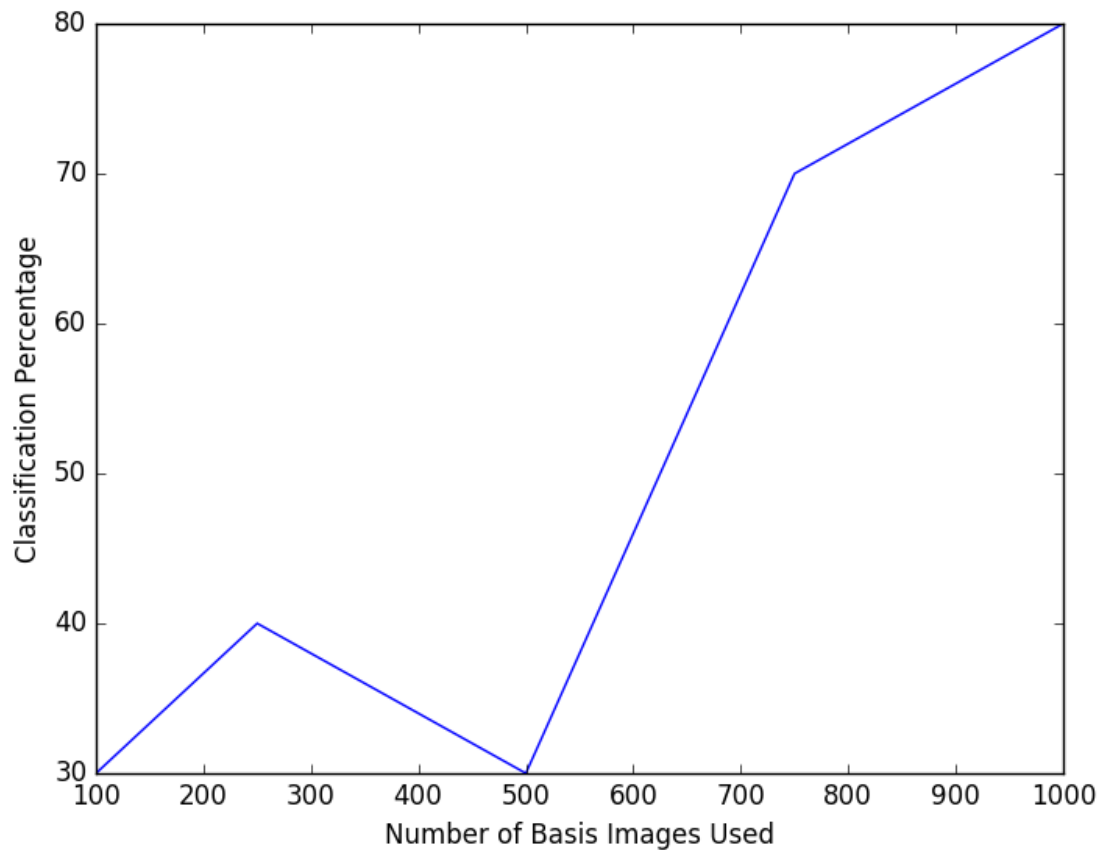
$[0.66666667 \ 0.33333333 \ -0.33333333]$

$[0.33333333 \ 0.66666667 \ 0.33333333]$

$[-0.33333333 \ 0.33333333 \ 0.66666667]$

Q6

Chart showing the predictive accuracy in respect to the number of basis images used
We were not able to get the same accuracy as the results in Reading 4 but our algorithm still follows the same trajectory.



Q7

Red, Green, Blue are values for $x=0.8, 0.5, 0.2$

Chart showing Y as MAE and X as Basis Sizes

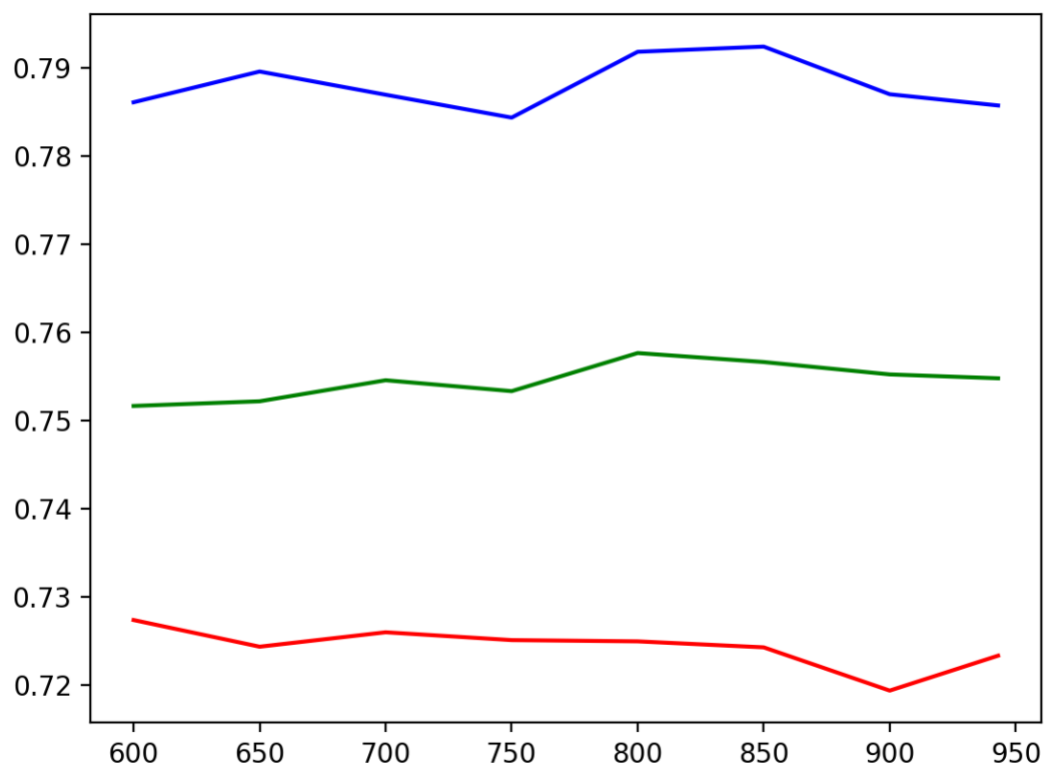


Chart showing Y = predictions per second and X = starting Basis size

