

Linear Algebra Assignment – 2

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1) Algorithm used for eigen-values and eigen vectors : QR Algorithm

This algorithm transforms matrix into tridiagonal form and end result is eigen values on principle diagonal elements.

Let Q_i , R_i be QR-factorization of matrix A_i at i th iteration and n be no of iterations -

FUNCTION qr_algorithm(A,n):

 a=A

 U = give_me_identity(len(A))

 for i = 0 to n-1

 q,r = grahm_sch(a) //QR factorization using Grahm-Schmidt process

 U = matrix_mul(U,q)

 a_1 = matrix_mul(r,q)

 a=a_1

 return a,U

Diagonals of returned matrix A = eigen-values of A

Columns of U = eigen vectors of A

2) Centrality measures for train el-classico graph -

-----a) Degree Centrality-----

Stegan=4.0

Roberto=5.0

Pique=7.0

Lenglet=6.0

Alba=5.0

Dejong=3.0

Busquets=4.0

Arthur=3.0

Messi=10.0

Suarez=3.0

Griezmann=5.0

Courtois=4.0

Marcelo=4.0

Ramos=8.0

Varan=6.0

Nacho=4.0

Isco=4.0

Casemiro=5.0

Modric=4.0

Ronaldo=6.0

Benzama=6.0

Bale=4.0

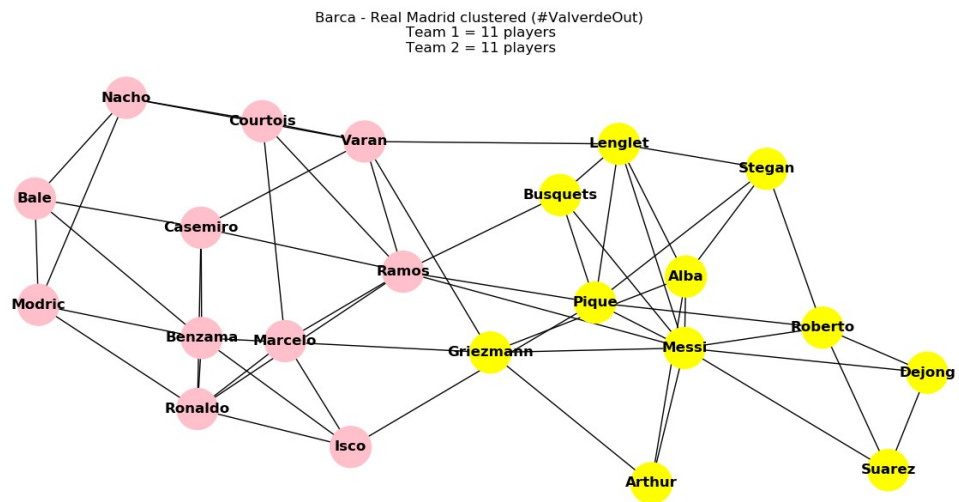
-----b) Closeness Centrality (lesser the value, closer to others & hence more central)-----

Stegan=48.0
Roberto=49.0
Pique=38.0
Lenglet=41.0
Alba=45.0
Dejong=52.0
Busquets=42.0
Arthur=47.0
Messi=35.0
Suarez=52.0
Griezmann=38.0
Courtois=45.0
Marcelo=47.0
Ramos=34.0
Varan=40.0
Nacho=51.0
Isco=44.0
Casemiro=43.0
Modric=52.0
Ronaldo=43.0
Benzama=43.0
Bale=53.0

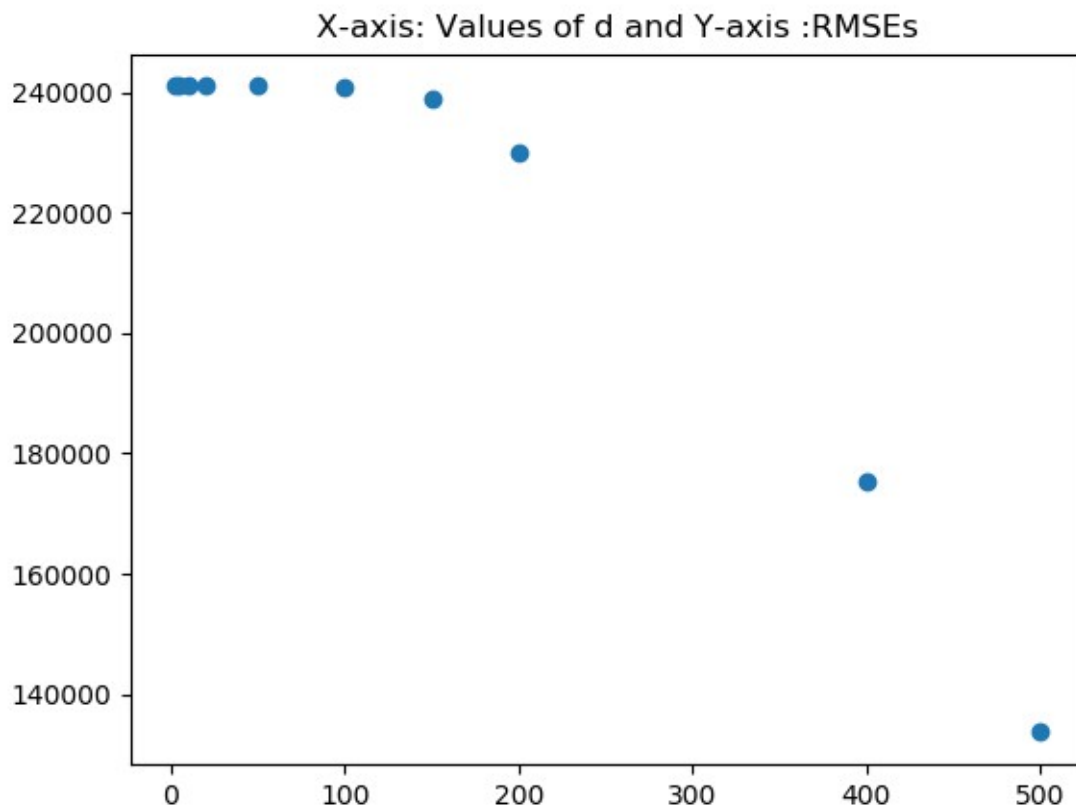
-----c) Eigenvector Centrality (influential neighbours)-----

Stegan=0.18766469447457443
Roberto=0.21237096340004152
Pique=0.32558605384923806
Lenglet=0.2878249947378583
Alba=0.22173842700127813
Dejong=0.1343915242800445
Busquets=0.242083473417908
Arthur=0.14949611699262644
Messi=0.4033938802362691
Suarez=0.1343915242800445
Griezmann=0.20933600291065227
Courtois=0.14520213276461078
Marcelo=0.14749653569171597
Ramos=0.334474269892616
Varan=0.2261360057146156
Nacho=0.10239317300895148
Isco=0.14956771669811314
Casemiro=0.18303201729746627
Modric=0.10094181688993517
Ronaldo=0.1940629466845778
Benzama=0.16772258371408613

3) Spectral clustering result for lclassico train graph -

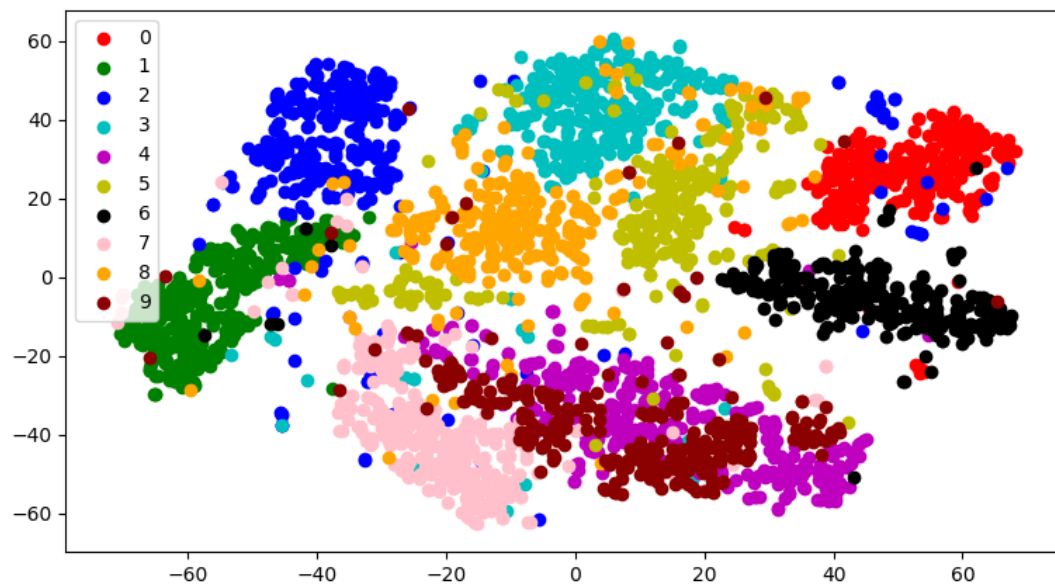


4a) RMSE Plot for truncated SVD



4b) t-SNE plot for MNIST

Plot is for 3000 samples



We observe that every number is getting clustered together (approximately) to its unique cluster and hence digit recognition problem is quite feasible here.