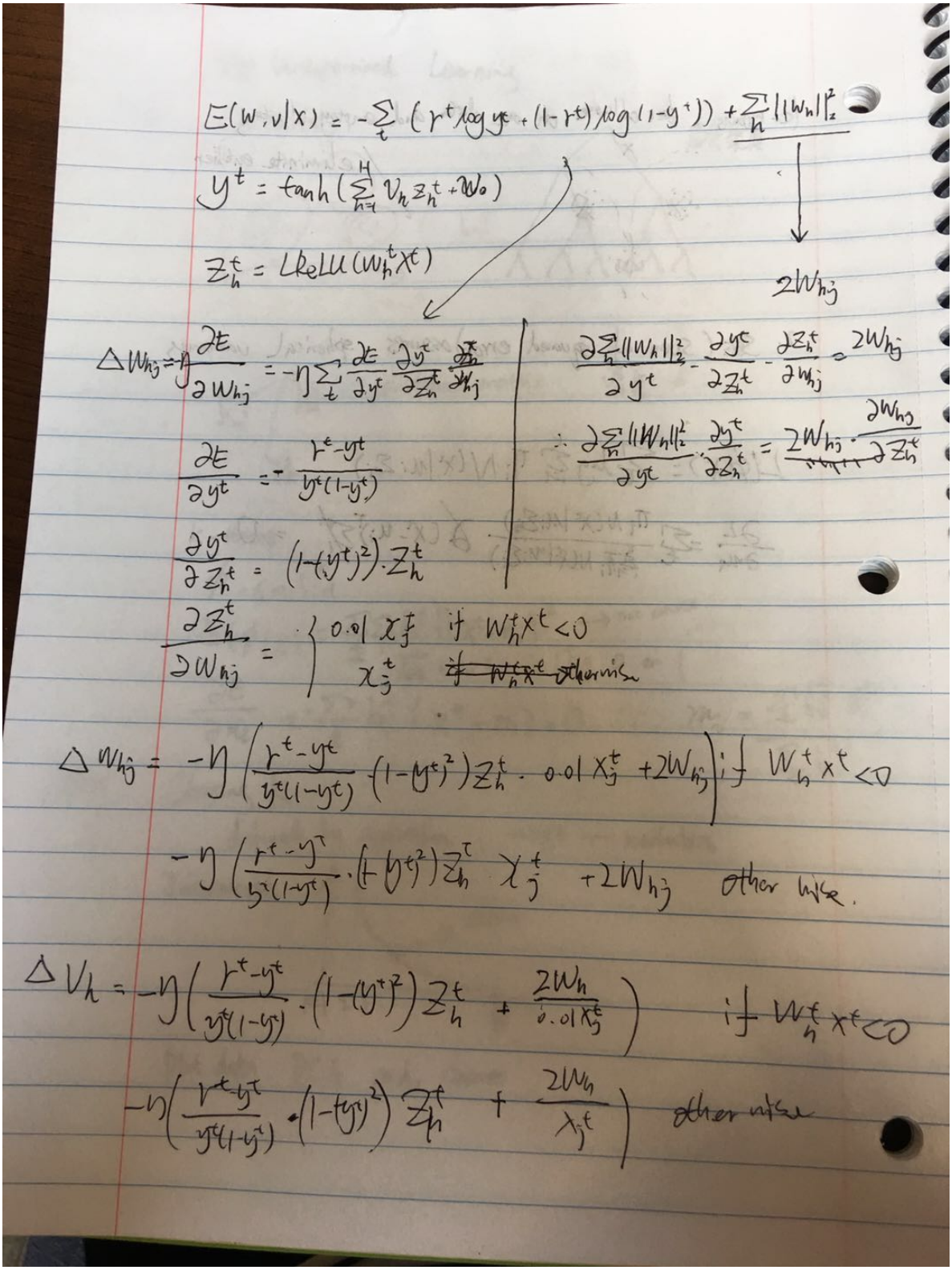
Zhiyue Qiu

Problem1.



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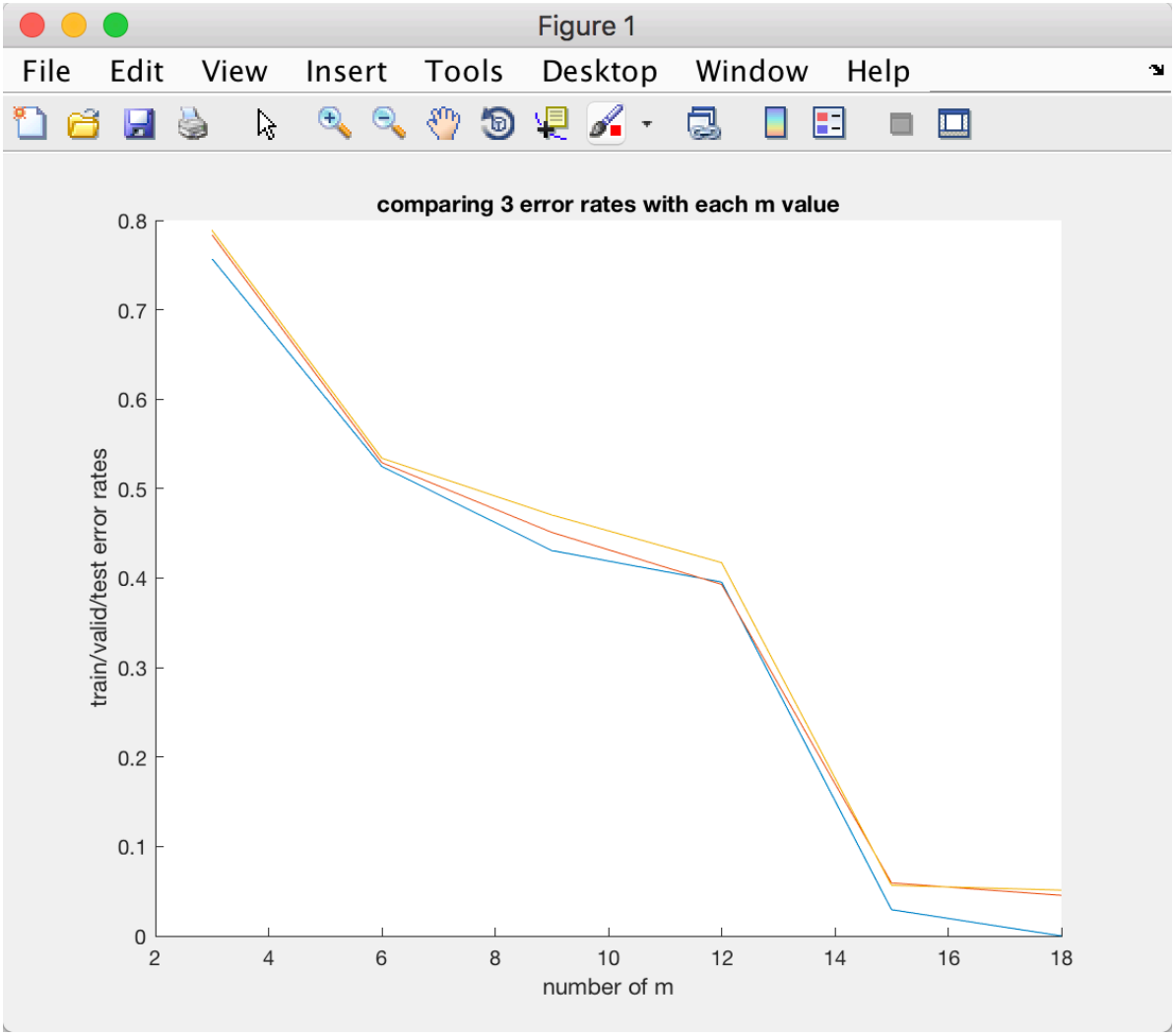
Problem2
a. The code runs pretty slow, the data derived is attached.



This is the result of three

When m = 15 and m = 18, I get the best result regarding training, validation and test error rates. But the training error of m = 18 setting is 0, fearing overfitting and m = 15 setting does not significantly worse than m = 18, so I choose m = 15 in the end.

	M = 3	M = 6	M = 9	M = 12	M = 15	M = 18
Training Error	0.757074212493326	0.524826481580352	0.430859583555793	0.395621996796583	0.0293646556326749	0
Validation Error	0.783769353977576	0.529097704217832	0.451147891083823	0.392952482648158	0.0592632140950347	0.0453817405232248
Test Error	0.788687299893277	0.534151547491996	0.470651013874066	0.417289220917823	0.0565635005336179	0.0512273212379936

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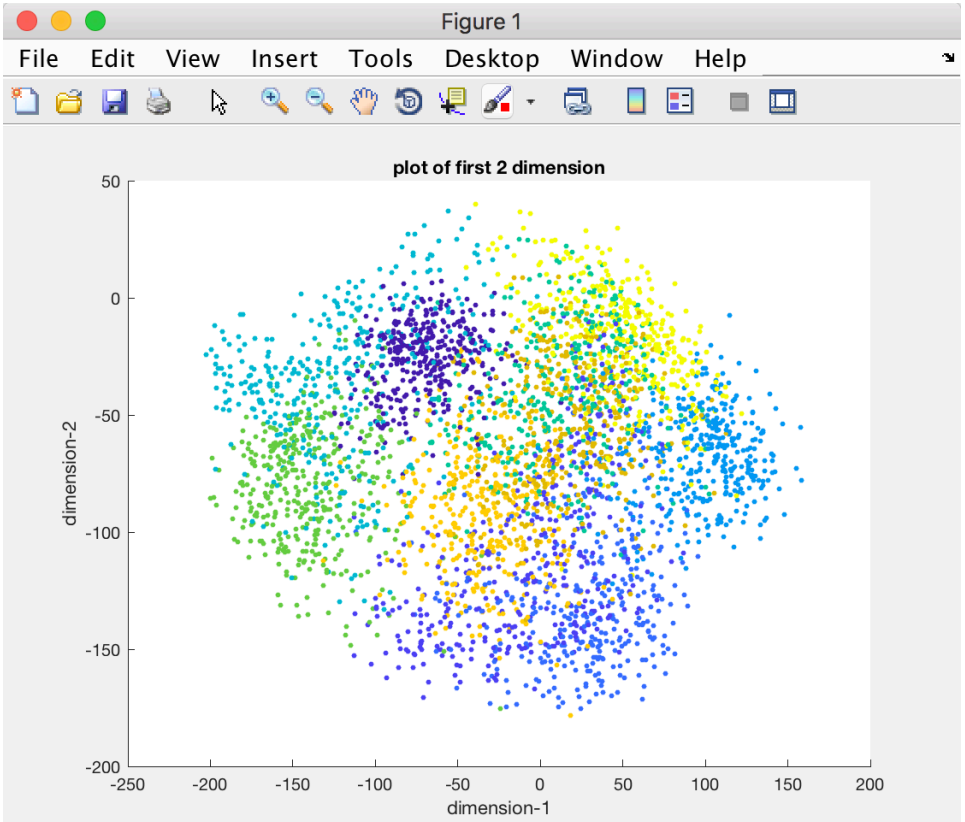
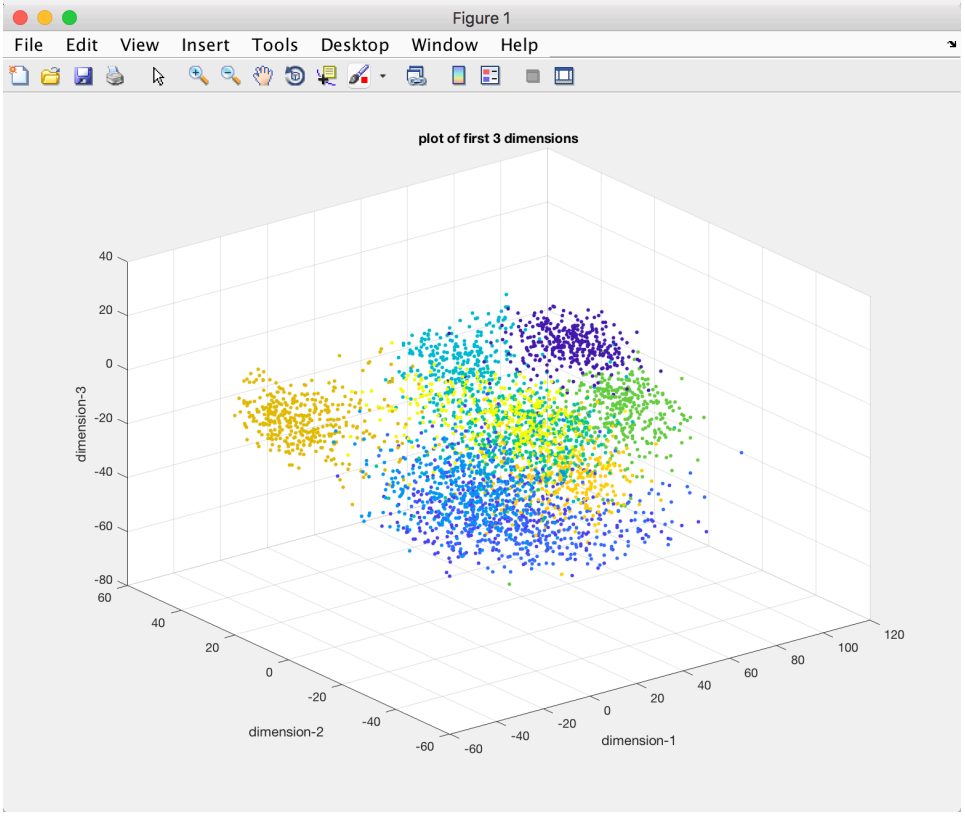
Problem2b





comparing with 2d and 3d plot, I find it is easier to sperate when we separate them in 3d. That is just visulization, but revealed the data is well separated in high dimension space.

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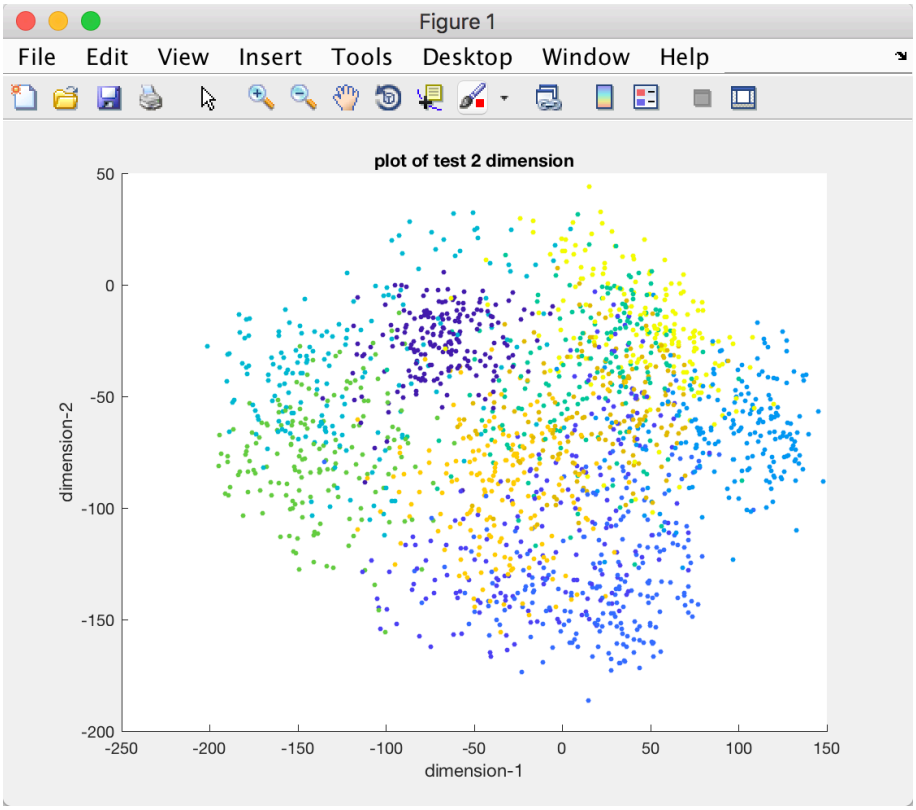
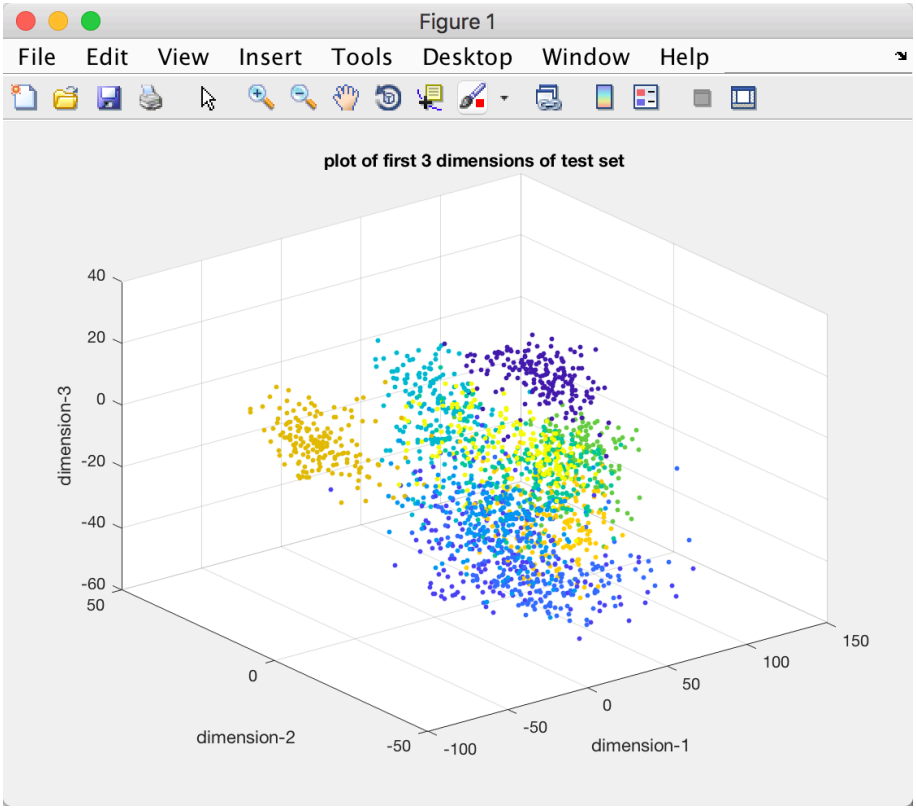
Problem2c





I used the projection vector form previous obtained from training and validation model, and works fine one test data. Data of different tag are separated similar as in training validation data.