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CS-464 HW2

CS-464 Homework 1

Question1.1

21.12975362816217%	19.437714832600072%	22.447499512436135%
13.323149944838796%	14.09207072408398%	13.456354530068918%
7.368321023651576%	7.446136810465317%	6.875993551104815%
5.274048822738923%	5.275971421491094%	5.281352364091722%
4.179185360846149%	4.179143296720124%	4.301273791158289%
3.6403506125073717%	4.05900223084417%	3.534604450734204%
2.305698268707992%	2.4311590841434567%	2.276645976441961%
2.1348478437310416%	2.050408265458775%	2.0273291492247103%
1.7420578211508393%	1.7206273419731022%	1.630587458874248%
1.6312234635610992%	1.6327779752912626%	1.603184138348351%

Figure 1: Principal Components' Contribution Table

First column is results for Red channel, second column is green channel,and, third channel is blue channel results.

Note that: This results are contribution of one principal to the pve. Other results are pasted below from colab.

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pve for red in 1_th principal is 21.12975362816217%
pve for red for sum of all principals to principal number 1 is
21.12975362816217%
pve for red in 2_th principal is 13.323149944838796%
pve for red for sum of all principals to principal number 2 is
34.45290357300097%
pve for red in 3_th principal is 7.368321023651576%
pve for red for sum of all principals to principal number 3 is
41.82122459665255%
pve for red in 4_th principal is 5.274048822738923%
pve for red for sum of all principals to principal number 4 is
47.09527341939147%
pve for red in 5_th principal is 4.179185360846149%
pve for red for sum of all principals to principal number 5 is
51.27445878023762%
pve for red in 6_th principal is 3.6403506125073717%
pve for red for sum of all principals to principal number 6 is
54.91480939274499%
pve for red in 7_th principal is 2.305698268707992%
pve for red for sum of all principals to principal number 7 is
57.22050766145298%
pve for red in 8_th principal is 2.1348478437310416%
pve for red for sum of all principals to principal number 8 is
59.35535550518403%
pve for red in 9_th principal is 1.7420578211508393%
pve for red for sum of all principals to principal number 9 is
61.097413326334866%
pve for red in 10_th principal is 1.6312234635610992%
pve for red for sum of all principals to principal number 10 is
62.72863678989597%

pve for green in 1_th principal is 19.437714832600072%
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pve for green for sum of all principals to principal number 1 is 19.437714832600072%

pve for green in 2_th principal is 14.09207072408398%

pve for green for sum of all principals to principal number 2 is 33.529785556684054%

pve for green in 3_th principal is 7.446136810465317%

pve for green for sum of all principals to principal number 3 is 40.975922367149366%

pve for green in 4_th principal is 5.275971421491094%

pve for green for sum of all principals to principal number 4 is 46.251893788640466%

pve for green in 5_th principal is 4.179143296720124%

pve for green for sum of all principals to principal number 5 is 50.431037085360586%

pve for green in 6_th principal is 4.05900223084417%

pve for green for sum of all principals to principal number 6 is 54.49003931620476%

pve for green in 7_th principal is 2.4311590841434567%

pve for green for sum of all principals to principal number 7 is 56.92119840034822%

pve for green in 8_th principal is 2.050408265458775%

pve for green for sum of all principals to principal number 8 is 58.97160666580699%

pve for green in 9_th principal is 1.7206273419731022%

pve for green for sum of all principals to principal number 9 is 60.692234007780094%

pve for green in 10_th principal is 1.6327779752912626%

pve for green for sum of all principals to principal number 10 is 62.32501198307136%

pve for blue in 1_th principal is 22.447499512436135%

pve for blue for sum of all principals to principal number 1 is 22.447499512436135%

pve for blue in 2_th principal is 13.456354530068918%

pve for blue for sum of all principals to principal number 2 is 35.903854042505046%

pve for blue in 3_th principal is 6.875993551104815%

pve for blue for sum of all principals to principal number 3 is 42.779847593609865%

pve for blue in 4_th principal is 5.281352364091722%

pve for blue for sum of all principals to principal number 4 is 48.06119995770159%

pve for blue in 5_th principal is 4.301273791158289%

pve for blue for sum of all principals to principal number 5 is 52.36247374885988%

pve for blue in 6_th principal is 3.534604450734204%

pve for blue for sum of all principals to principal number 6 is 55.897078199594084%

pve for blue in 7_th principal is 2.276645976441961%

pve for blue for sum of all principals to principal number 7 is 58.173724176036046%

pve for blue in 8_th principal is 2.0273291492247103%

pve for blue for sum of all principals to principal number 8 is 60.20105332526076%

pve for blue in 9_th principal is 1.630587458874248%

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pve for blue for sum of all principals to principal number 9 is
61.831640784135%
pve for blue in 10_th principal is 1.603184138348351%
pve for blue for sum of all principals to principal number 10 is
63.43482492248334%
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pve for red in 10_th principal is 62.72863678989597%
pve for red in 11_th principal is 64.23350445506513%
pve for red in 12_th principal is 65.60853855064252%
pve for red in 13_th principal is 66.772161613312777%
pve for red in 14_th principal is 67.78347783392108%
pve for red in 15_th principal is 68.74743648485047%
pve for red in 16_th principal is 69.61396012263366%
pve for red in 17_th principal is 70.46913583208429%
pve for red in 17_th principal is 70.46913583208429% which is greater
than 70%
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```
pve for green in 10_th principal is 62.32501198307136%
pve for green in 11_th principal is 63.82996793229497%
pve for green in 12_th principal is 65.19545820465889%
pve for green in 13_th principal is 66.32734352208628%
pve for green in 14_th principal is 67.33331520782293%
pve for green in 15_th principal is 68.29816401501992%
pve for green in 16_th principal is 69.18941778027845%
pve for green in 17_th principal is 70.05110880108388%
pve for green in 17_th principal is 70.05110880108388% which is greater
than 70%
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```
pve for blue in 10_th principal is 63.43482492248334%
pve for blue in 11_th principal is 64.82772599679336%
pve for blue in 12_th principal is 66.1738818056056%
pve for blue in 13_th principal is 67.27712213588735%
pve for blue in 14_th principal is 68.27606582776646%
pve for blue in 15_th principal is 69.19112036327556%
pve for blue in 16_th principal is 70.0579180108481%
pve for blue in 16_th principal is 70.0579180108481% which is greater
than 70%
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Discuss result:

In the result, I observe that, in any increase of principal component gives a higher proportion of variance explained (pve). This was expected because in every increase of principal component it gets closer to original data. If the principal component number equal to 4096, then, the pve should give 100%. First principal's contribution to pve is higher than others. For example, in the red channel first principal component's contribution is 21.13%, and, second principal component is 13.31% and following principal component's contribution is gets lower. Thus, The contribution of principal components' percantage is higher in the first ones and percantage gets lower for following principal components. Also, I obtain different results for different channels, this is an expected ocasion since every channel has different data compared to others. Finally, I get pve higher than 70% in 17_th

principal in both red and green channel, and, 16_th principal in the blue channel. All results are illustrated below.

Question1.2

Principal Component:1

Principal Component:2

Principal Component:3

Principal Component:4

Principal Component:5

Principal Component:6

Principal Component:7

Principal Component:8

Principal Component:9

Principal Component:10
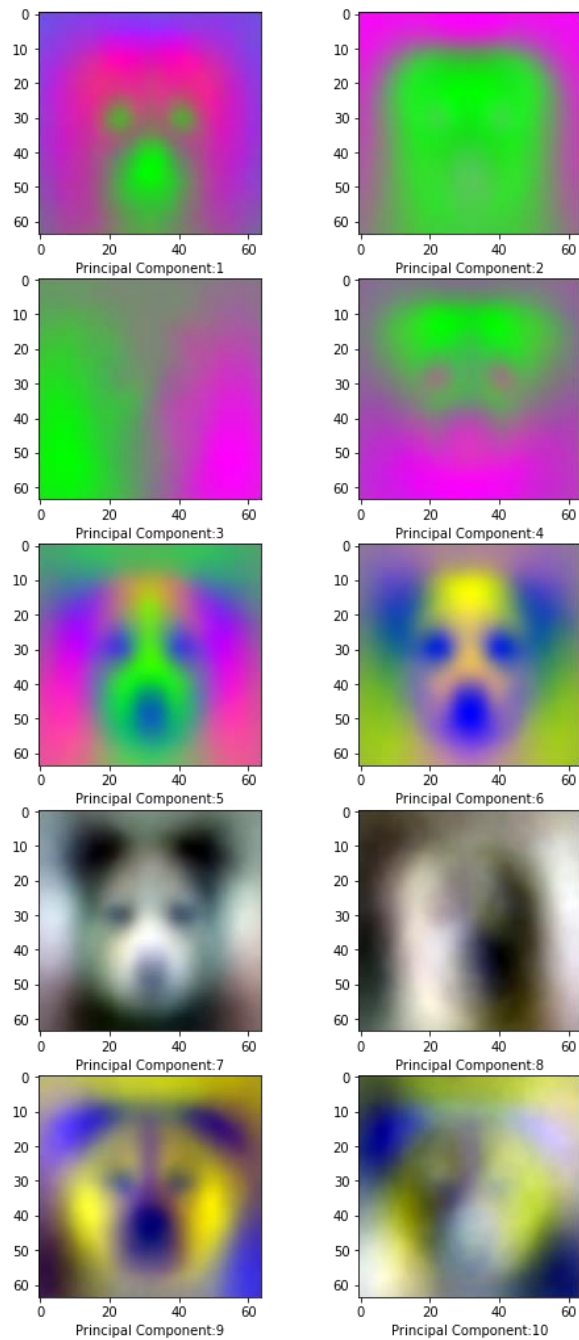
In the figure above, we can observe blurry images. Besides the second principal component, in the figures, images are illustrate dog face silhouettes.

Question1.3

Principal Component:1   Principal Component:50   Principal Component:250

Principal Component:500   Principal Component:1000   Principal Component:4096
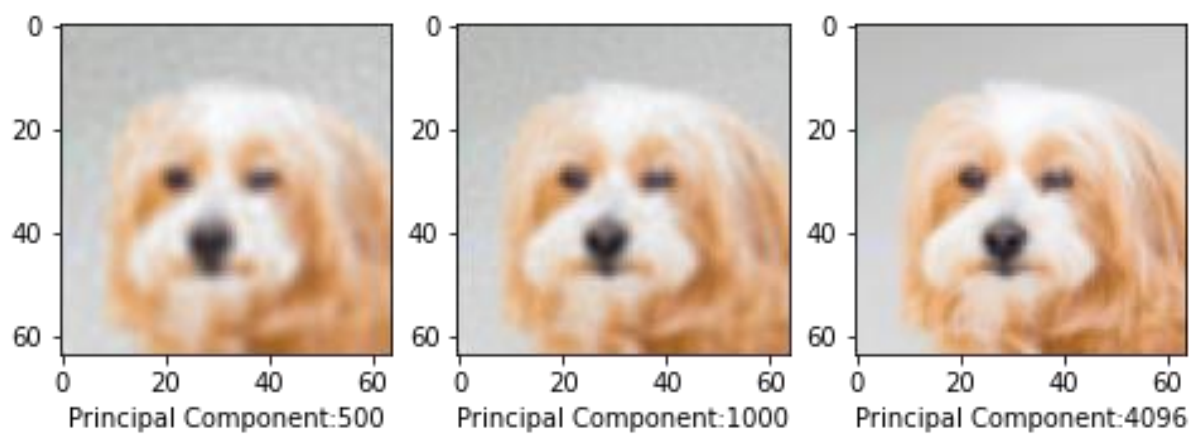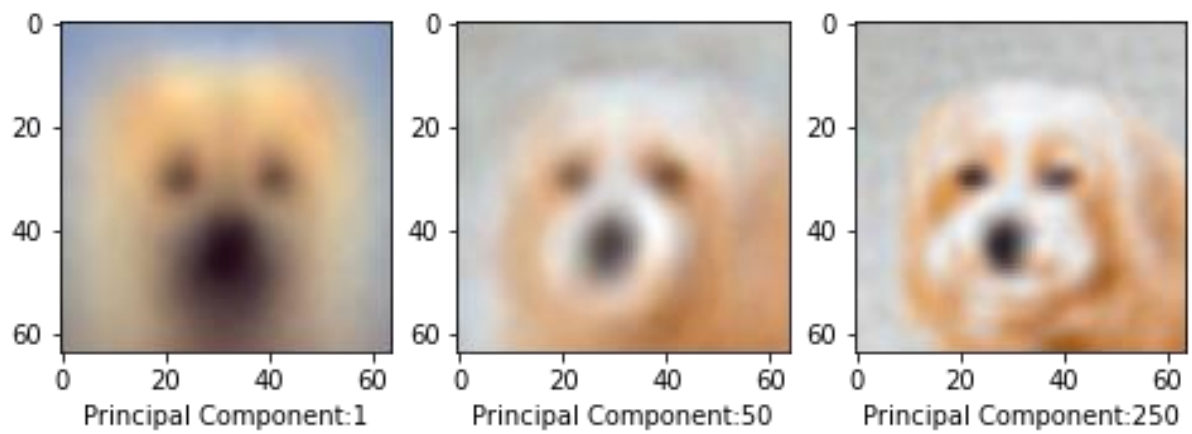
As it can be seen in the figures, when principal component gets larger it gets similar to the original image. With 4096 principal components the reconstructed image is just as the same as the original image but with 1 principal component, it seems hard to understand the similarity.

Question2.1

Provide the confusion matrix for your best model.

plot curves based on validation accuracy at every epoch

Does batch size affect the training time?

Question2.2

Do different initialization techniques make a difference for the Logistic Regression model?

Provide a plot similar to the previous question, where you assess this behavior on the validation set.

Provide the confusion matrix for your best model.

Question2.3

Provide a plot to summarise the change in validation accuracy depending on the learning rate

Provide the confusion matrix for your best model

Which learning rate value would you prefer, considering you should enable continuous learning in the given number of iterations?

How does the learning rate affect the effectiveness of the gradient ascent algorithm? Explain.

Question2.4

report the confusion matrix for that model on the test set

report accuracy, precision, recall, F1-score, F2-score, F0.5-score, and false positive rate (also known as false alarm rate)

Considering that your task was to correctly classify whether a smart grid is unstable, which metrics are most important for you?

Should you consider the relative importance of detecting positives and negatives the same? Explain.