ASSIGNMENT – 2

1. TEXT CLASSIFICATION

(a) (i) Accuracy over Train Data: **94.152 %**
Accuracy over Test Data: **82.586 %**
(ii) Word Clouds

Figure 1: Negative Word Cloud

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Figure 2: Positive Word Cloud

(b) (i) Accuracy over Test Data for Random Prediction: **49.68 %**
(ii) Accuracy over Test Data if all classes are predicted Positive: **57.386 %**
(iii) The model created by me is 66.236 % better than Random Prediction Baseline and 43.913 % better than Positive Baseline.

(c) (i) Confusion Matrix for Test Data for My Model: **[[7998, 2002], [610, 4390]]**
Confusion Matrix for Test Data for Random Model: **[[4346, 3178], [4262, 3214]]**
Confusion Matrix for Test Data if all classes are predicted positive: **[[8608, 6392], [0, 0]]**

(ii) For Prediction using My Model, the max value in Confusion Matrix is for True Positive Predictions. It should be because our test set has 10000 positive comments out of which (according to accuracy) lot of them are classified correctly.

For Random Prediction, the max value in Confusion Matrix is for True Positive Predictions. The total number of positively classified comments appears similar to negatively classified comments.

For Positive Baseline, the max value in Confusion Matrix is for True Positive Predictions. The True Negative and False Negative Predictions are 0 as expected.

(iii) The only pattern that seems to be visible is that for every model, the value of True Positive Predictions is highest.

(d) (i) Performed in the code.

(ii) Word Clouds

Figure 3: Negative WordCloud - After Stemming and Removing StopWords

Figure 4: Positive WordCloud: After performing Stemming and removing StopWords

(iii) Accuracy over Test Data: **84.933 %**

(iv) Accuracy increased around **2.35 %** when stemming was performed.

(e) (i) Accuracy over Test Data: **87.393 %**

(ii) I added tri-grams as well as tetra-grams to my model to further increase the efficiency. Accuracy over Test Data: **89.273 %**

(iii) The accuracy in part (a) was 82.586 % and accuracy in part (d) was 84.933 % which significantly improved when bi-grams were introduced to 87.393 % and further improved to 89.273 % when tri-grams and tetra-grams were improved.

(f) (i) The required metrics for best performing model:

POSITIVE:

Precision = **0.8915**
Recall = **0.94448**
F1 Score = **0.91722**

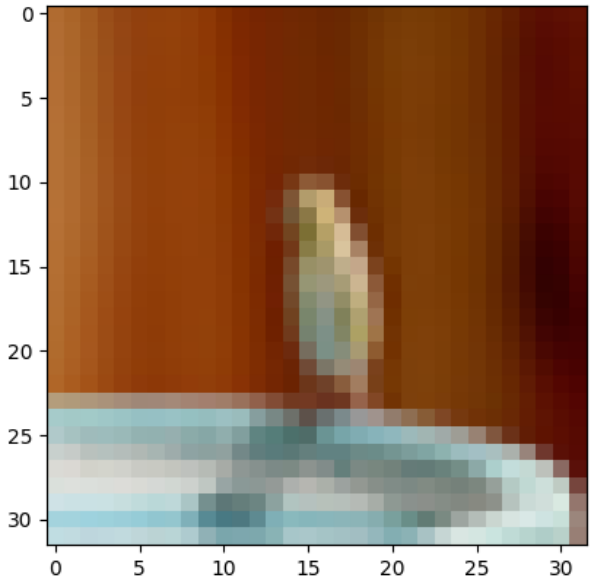
NEGATIVE:

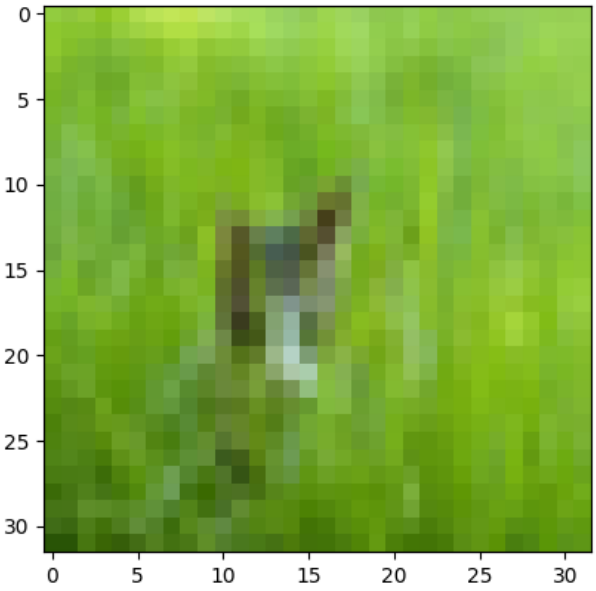
Precision = **0.8952**
Recall = **0.80489**
F1 Score = **0.84764**

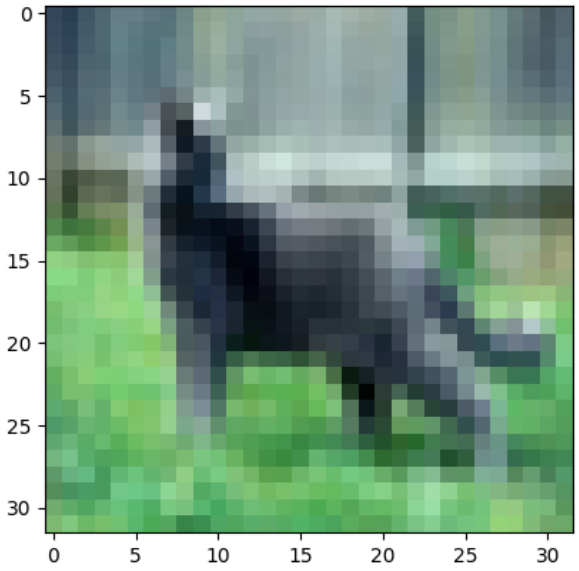
(ii)

2. BINARY IMAGE CLASSIFICATION

(a) (i) No. of Support Vectors: **4000**, Percentage of Training Samples = **100 %**
(ii) Test Set Accuracy = **63.95%**
(iii) Images corresponding to top 5 co-efficients:



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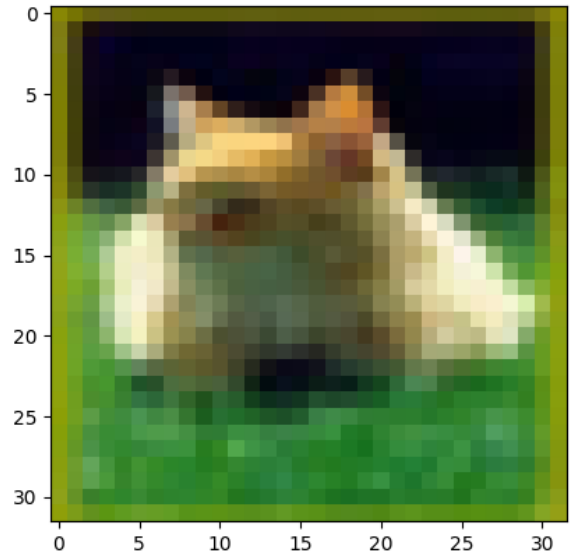
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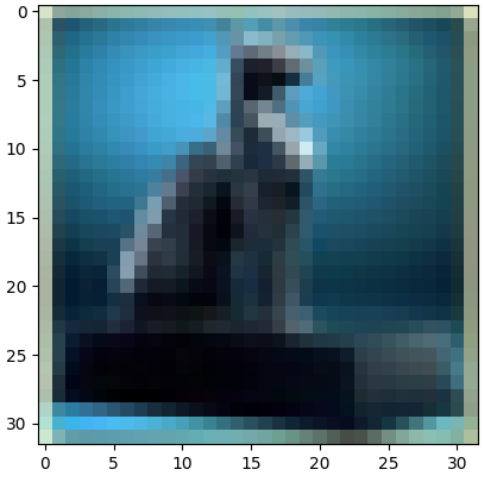
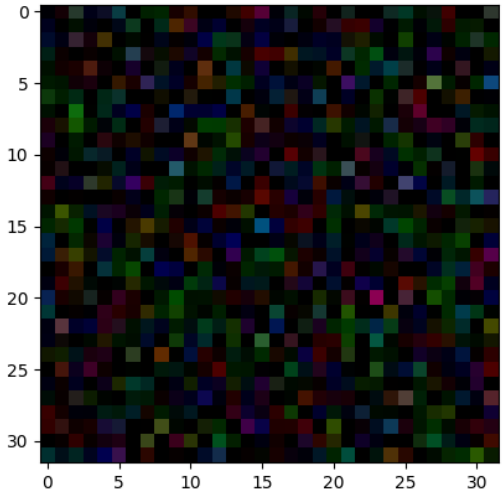
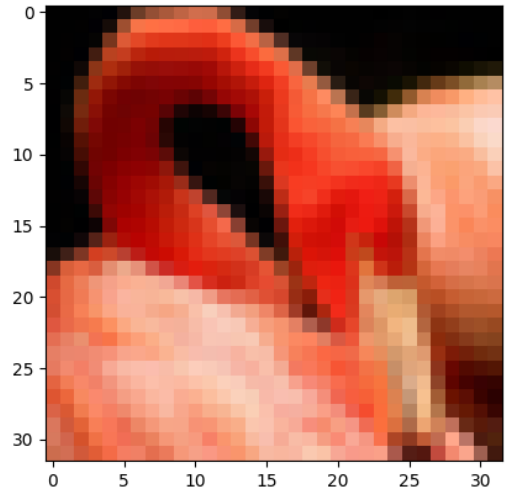


Image corresponding to reshaping W:



(b) (i) No. of Support Vectors: **4000**, compared to 4000 for part (a), this number is same.
(ii) Test Set Accuracy = **76.1%**
(iii) Images corresponding to top 5 co-efficients: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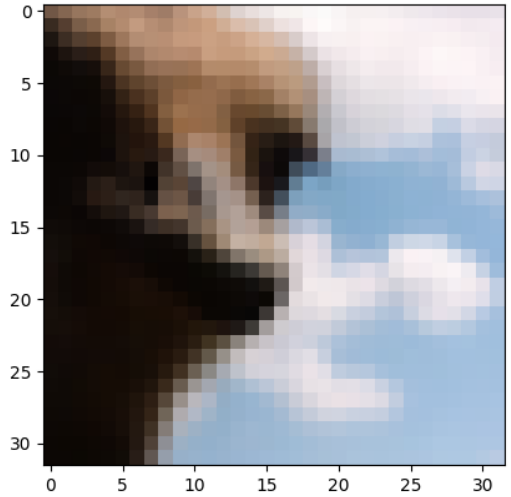
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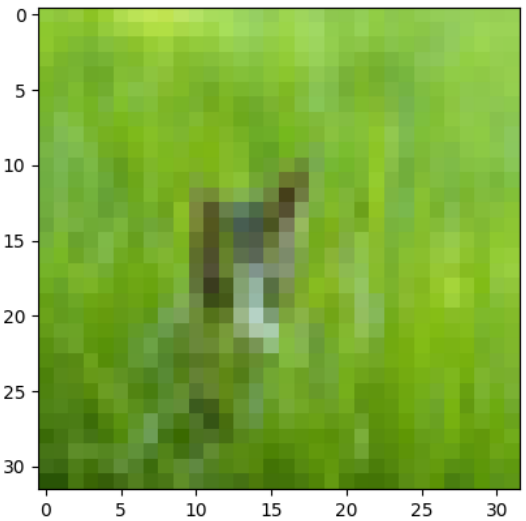
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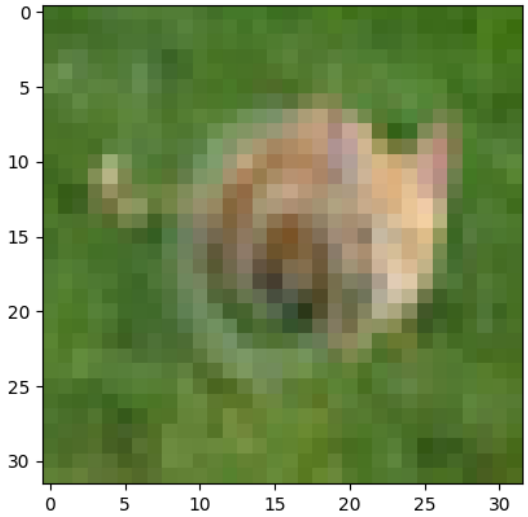

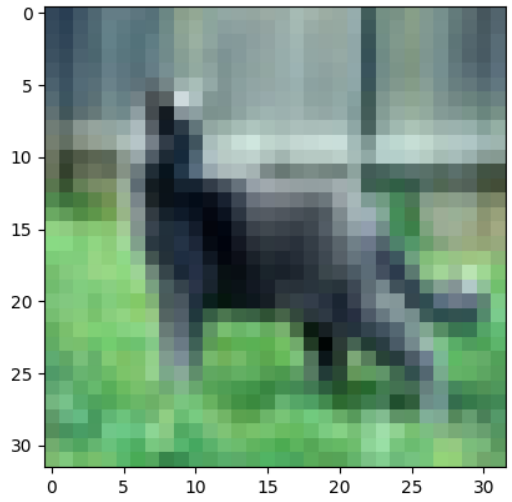

(iv) Test Set Accuracy decreased when Gaussian Kernel Model is used compared to Linear Kernel Model.

(c) (i) nSV for Linear Model = **2332**
nSV for Gaussian Model = **2756**
(ii) RMS Error in W = **0.014446**
Absolute Error in B = **0.18755**
(iii) LINEAR MODEL: Test Data Accuracy: **64.05 %**
GAUSSIAN MODEL: Test Data Accuracy: **76.15 %**
(iv) CVXOPT Models:
Linear Model: Time taken: **38.51448**
Gaussian Model: Time taken: **167.35019**
SK-LEARN Models:
Linear Model: Time taken: **50.68936**
Gaussian Model: Time taken: **15.03073**

3. MULTI-CLASS IMAGE CLASSIFICATION

(a) Correct: 2952
Incorrect: 2048
Accuracy = **59.04 %**

(b) (i) Test Data Accuracy = **59.3%**
Time Taken by SK-LEARN: **301.14669 sec**
Time Taken by CVXOPT: **1656.95358 sec**

(c) Confusion Matrix for Linear Model:
[683 404]
[317 596]
Confusion Matrix for Gaussian Model:
[753 231]
[247 769]

Observation(s):
According to the Confusion Matrices above, the classification into True Positive and True Negative classes is similar. Also, the classification into False Positive and False Negative is automatically coming out to be the same.
The mis-classification is almost same for both the classes.
The True Positive class for my case consists of photos of birds whereas the True Positive class for my case consists of photos of cats.
One distinctive feature that seems to be optimal for classification is that all the cats that are facing towards the camera and face view is visible whereas in case of birds, it seems that most of the birds classified as birds are facing sideways or whole of their bodies are visible from side view.

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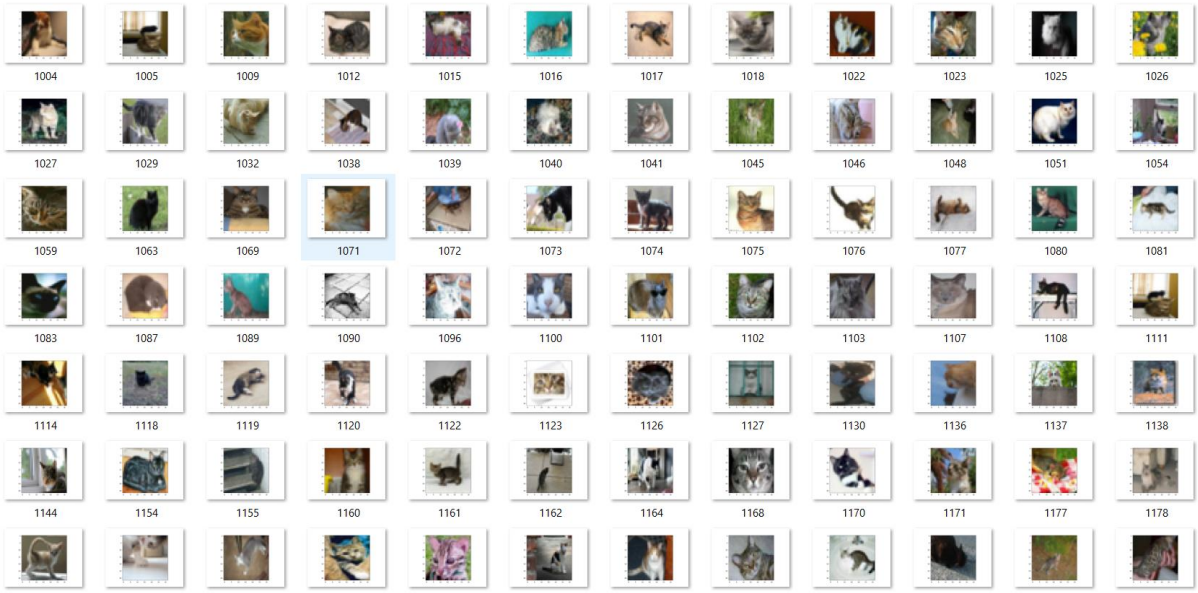

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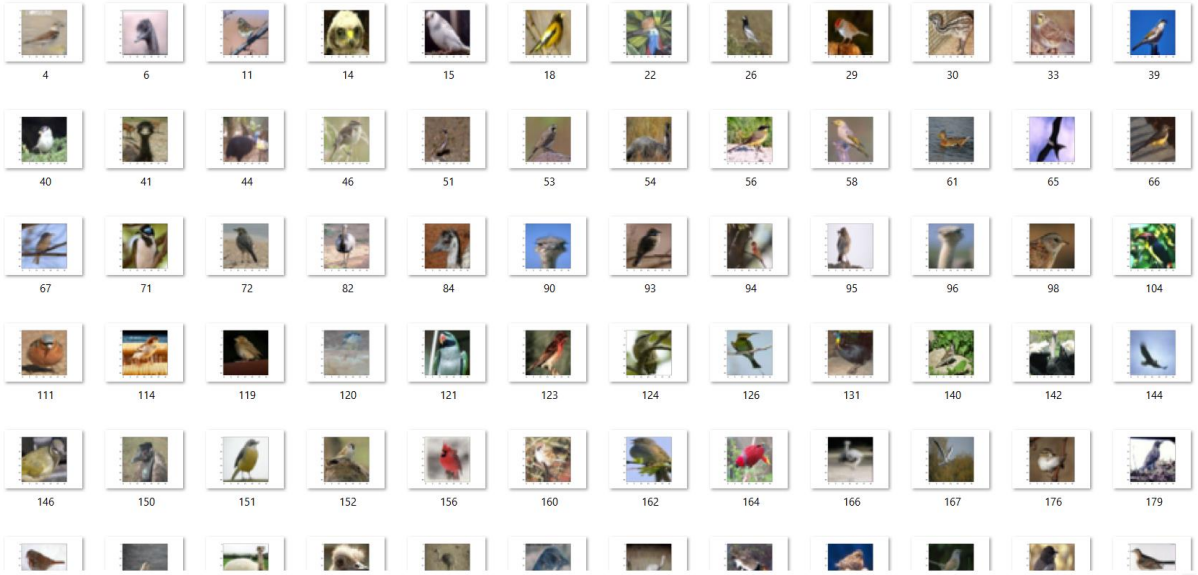
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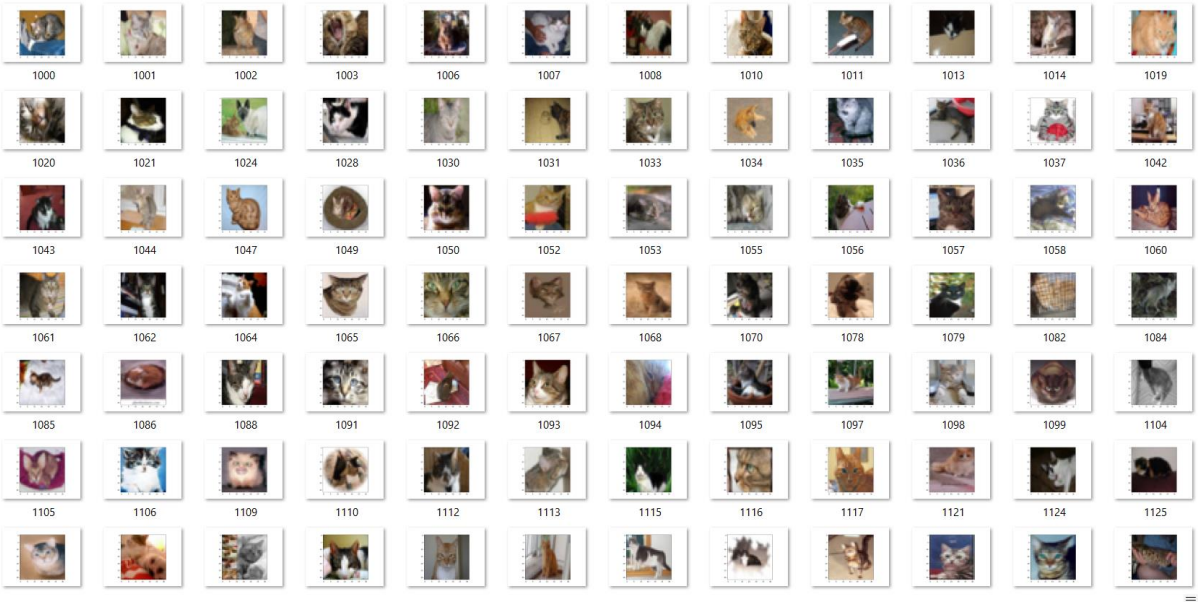
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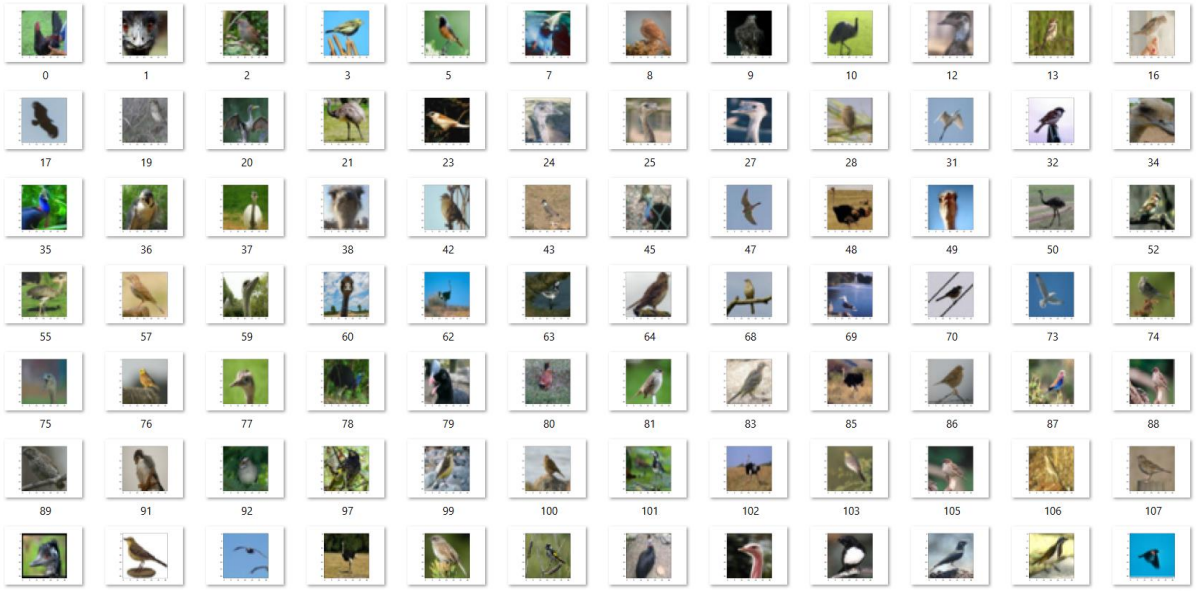
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