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| [Machine Learning]  [2021-1] |  |
| Homework 4  Lec 11, 12, 13 |  |
| [Date] 2020.06.04  Student ID :  Name :  Professor : Juntae Kim | logo-placeholder |

1. Explain the differences between *K-means* and *DBSCAN,* and discuss the advantages and disadvantages. (10pts)

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| Your Answer |
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2. Explain what the dropout is in deep neural network model, and what kind of effect you can expect by applying dropout. (10pts)

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| Your Answer |
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3. Describe how the convolution layer works in CNN. Compute the total number of parameters in CNN with following architecture. Stride=1, no padding. Show how you calculate it. (10pts)

- input: 32 x 32 x 3 image

- conv layer 1: 8 filters of 3 x 3 size + 2 x 2 max pooling

- conv layer 2: 16 filters of 3 x 3 size + 2 x 2 max pooling

- dense layer: 10 outputs

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| Your Answer |
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4. Describe how the backpropagation learning works in RNN. Explain the main problem of the RNN, and how LSTM can solve the problem. (10pts)

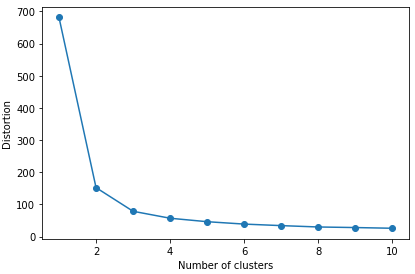
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| Your Answer |
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5. Unsupervised Learning (30pts)

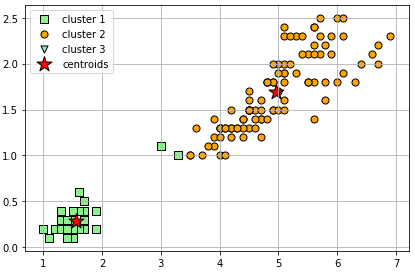
5-1. Perform k-means clustering on the iris dataset. You should choose features [2,3] – Petal length and Petal width.

Expected Output

* Distortions Plotting



* Clustering Result

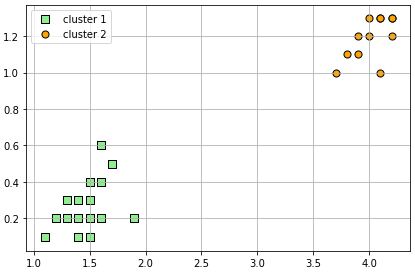


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| Code |
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| Result(Captured images) |
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| Description |
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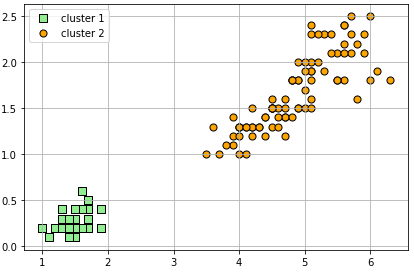
5-2. Perform DBSCAN clustering on the iris dataset. Consider what hyperparameters (epsilon, minPts) you should choose to get results similar to the above K-means results.

Expected Output

* Case example : Wrong hyperparameters are selected



* Case example : Good hyperparameters are selected



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| Code |
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| Result(Captured images) |
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| Description |
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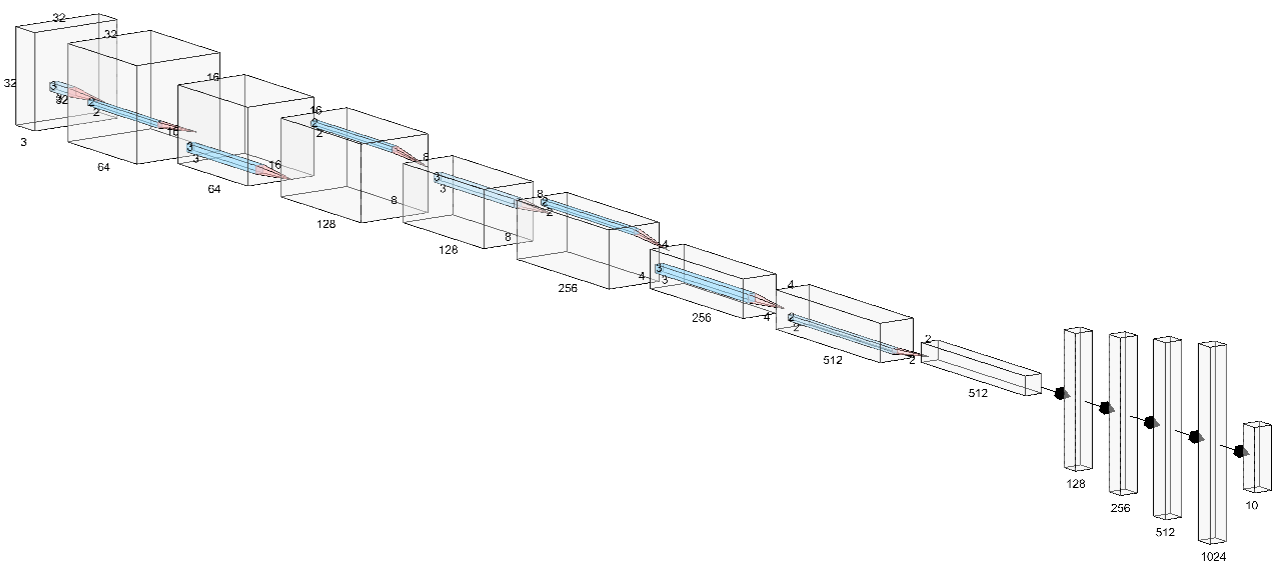
6. Training CNN (30pts)

Build the following CNN model and train it using the CIFAR-10 dataset. Also, build a dropout model and see how the train accuracy and test accuracy differ. Finally, test the 10 new images given with the dropout model.

CIFAR-10(Plotting) : <https://www.cs.toronto.edu/~kriz/cifar.html>

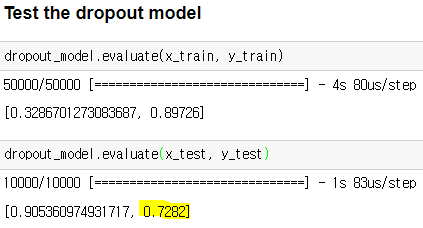
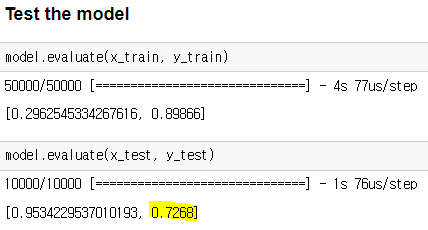
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| import tensorflow as tf  import numpy as np  cifar10 = tf.keras.datasets.cifar10  (x\_train, y\_train),(x\_test, y\_test) = cifar10.load\_data()  x\_train, x\_test = x\_train / 255.0, x\_test / 255.0  num\_classes = 10  print("Number of train images: {}".format(len(x\_train)))  print("Number of train labels: {}".format(len(y\_train)))  print("Number of test images: {}".format(len(x\_test)))  print("Number of test labels: {}".format(len(y\_test))) |
|  |
| %matplotlib inline  import matplotlib  import matplotlib.pyplot as plt  from IPython.core.pylabtools import figsize  matplotlib.rc('font', family='NanumGothic') # Linumx  def display\_cifar(images, size):  n = len(images)  plt.figure()  plt.gca().set\_axis\_off()  im = np.vstack([np.hstack([images[np.random.choice(n)] for i in range(size)])  for i in range(size)])  plt.imshow(im)  plt.show()    figsize(15, 7)  display\_cifar(x\_train, 10) |
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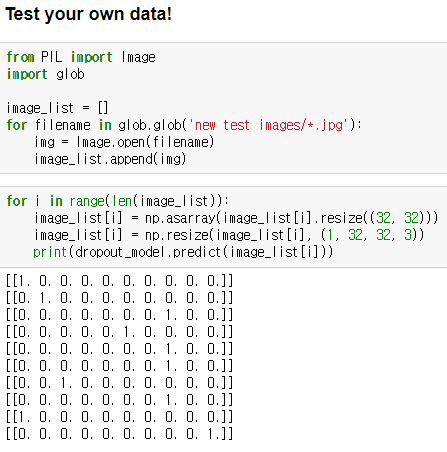
Architecture



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| Layer | Output Shape | Parameters # |
| Conv2D(3x3 filter) | (None, 32, 32, 64) | 1792 |
| MaxPooling2D(2x2) | (None, 16, 16, 64) | 0 |
| Conv2D(3x3 filter) | (None, 16, 16, 128) | 73856 |
| MaxPooling2D(2x2) | (None, 8, 8, 128) | 0 |
| Conv2D(3x3 filter) | (None, 8, 8, 256) | 295168 |
| MaxPooling2D(2x2) | (None, 4, 4, 256) | 0 |
| Conv2D(3x3 filter) | (None, 4, 4, 512) | 1180160 |
| MaxPooling2D(2x2) | (None, 2, 2, 512) | 0 |
| Flatten | (None, 2048) | 0 |
| Dense | (None, 128) | 262272 |
| Dense | (None, 256) | 33024 |
| Dense | (None, 512) | 131584 |
| Dense | (None, 1024) | 525312 |
| Dense(softmax) | (None, 10) | 10250 |

Expected Output





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| Code |
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| Result(Captured images) |
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| Description |
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**Note**

1. Summit the file to e-class as pdf.

2. Specify your pdf file name as “hw4\_<StudentID>\_<Name>.pdf”