ICP-8 Neural Networks & Deep Learning

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GitHub link: https://github.com/niryarjessy22/ICP-8-assign.git

Video link: https://drive.google.com/file/d/198kUWE8NXfYzyVubGZNnpOc86ZjZllf8/view?usp=share_link

1. Tune hyperparameter and make necessary addition to the baseline model to improve validation accuracy and reduce validation loss.
2. Provide logical description of which steps lead to improved response and what was its impact on architecture behavior.
3. Create at least two more visualizations using matplotlib (Other than provided in the source file)
4. Use dataset of your own choice and implement baseline models provided.
5. Apply modified architecture to your own selected dataset and train it.
6. Evaluate your model on testing set.

```
import keras
from keras.models import Sequential
from keras.layers import Activation,Dense,Dropout,Conv2D,Flatten,MaxPooling2D
from keras.datasets import cifar10
from keras import optimizers
from keras.optimizers import SGD
from matplotlib import pyplot as plt
```

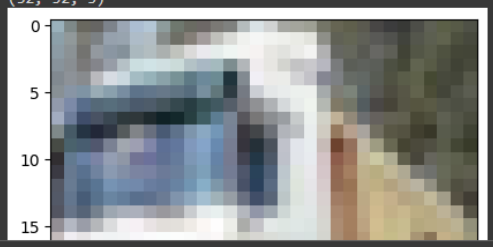
```
# generate cifar10 data
(x_train,y_train),(x_test,y_test) = cifar10.load_data()
```

```
# config parameters
num_classes = 10
input_shape = x_train.shape[1:4]
# Compile the model
sgd = SGD(lr=0.01, decay=1e-6, momentum=0.9, nesterov=True)
```

```
# convert label to one-hot
one_hot_y_train = keras.utils.to_categorical(y_train,num_classes=num_classes)
one_hot_y_test = keras.utils.to_categorical(y_test,num_classes=num_classes)
```

```
# check data
plt.imshow(x_train[1])
print(x_train[1].shape)
```

```
(32, 32, 3)
```



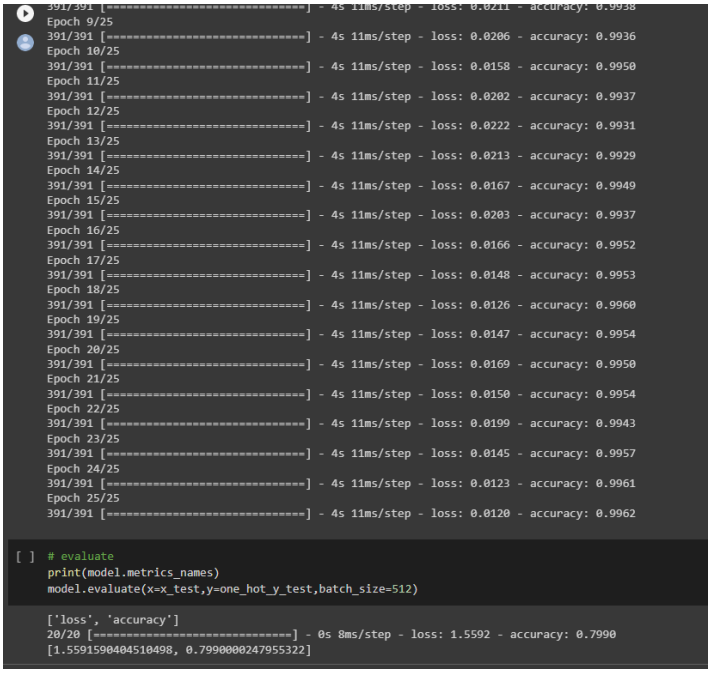
```
[ ]  # build model(similar to VGG16, only change the input and output shape)
     model = Sequential()
     model.add(Conv2D(64,(3,3),activation='relu',input_shape=input_shape,padding='same'))
     model.add(Conv2D(64,(3,3),activation='relu',padding='same'))
     model.add(MaxPooling2D(pool_size=(2,2),strides=(2,2)))
     model.add(Conv2D(128,(3,3),activation='relu',padding='same'))
     model.add(Conv2D(128,(3,3),activation='relu',padding='same'))
     model.add(MaxPooling2D(pool_size=(2,2),strides=(2,2)))
     model.add(Conv2D(256,(3,3),activation='relu',padding='same'))
     model.add(Conv2D(256,(3,3),activation='relu',padding='same'))
     model.add(Conv2D(256,(3,3),activation='relu',padding='same'))
     model.add(MaxPooling2D(pool_size=(2,2),strides=(2,2)))
     model.add(Conv2D(512,(3,3),activation='relu',padding='same'))
     model.add(Conv2D(512,(3,3),activation='relu',padding='same'))
     model.add(Conv2D(512,(3,3),activation='relu',padding='same'))
     model.add(MaxPooling2D(pool_size=(2,2),strides=(2,2)))
     model.add(Conv2D(512,(3,3),activation='relu',padding='same'))
     model.add(Conv2D(512,(3,3),activation='relu',padding='same'))
     model.add(Conv2D(512,(3,3),activation='relu',padding='same'))
     model.add(MaxPooling2D(pool_size=(2,2),strides=(2,2)))
     model.add(Flatten())
     model.add(Dense(4096,activation='relu'))
     model.add(Dense(4096,activation='relu'))
     model.add(Dense(num_classes))
     model.add(Activation('softmax'))
```

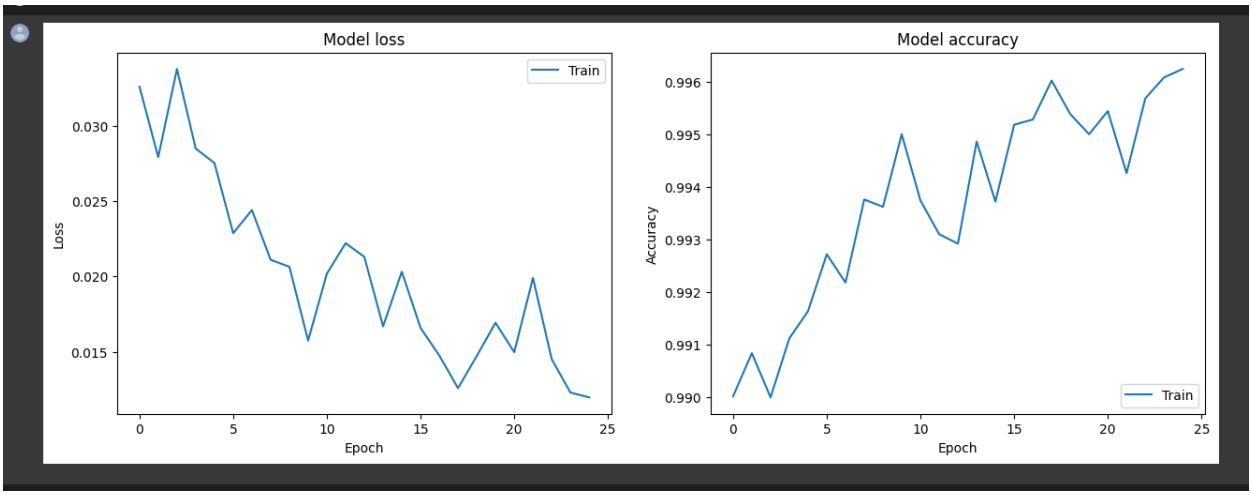
```
[ ]
     model.compile(optimizer=sgd, loss='categorical_crossentropy', metrics=['accuracy'])
```

```
[ ]  # check model
     model.summary()
```

```
 Layer (type)                 Output Shape              Param #
=================================================================
 conv2d_52 (Conv2D)           (None, 32, 32, 64)        1792

 conv2d_53 (Conv2D)           (None, 32, 32, 64)        36928

 max_pooling2d_20 (MaxPoolin  (None, 16, 16, 64)        0
```

7. Save the improved model and use it for prediction on testing data
8. Provide plot of confusion matric
9. Provide Training and testing Loss and accuracy plots in one plot using subplot command and history object.
10. Provide at least two more visualizations reflecting your solution.
11. Provide logical description of which steps lead to improved response for new dataset when compared with baseline model and enhance architecture and what was its impact on architecture behavior.



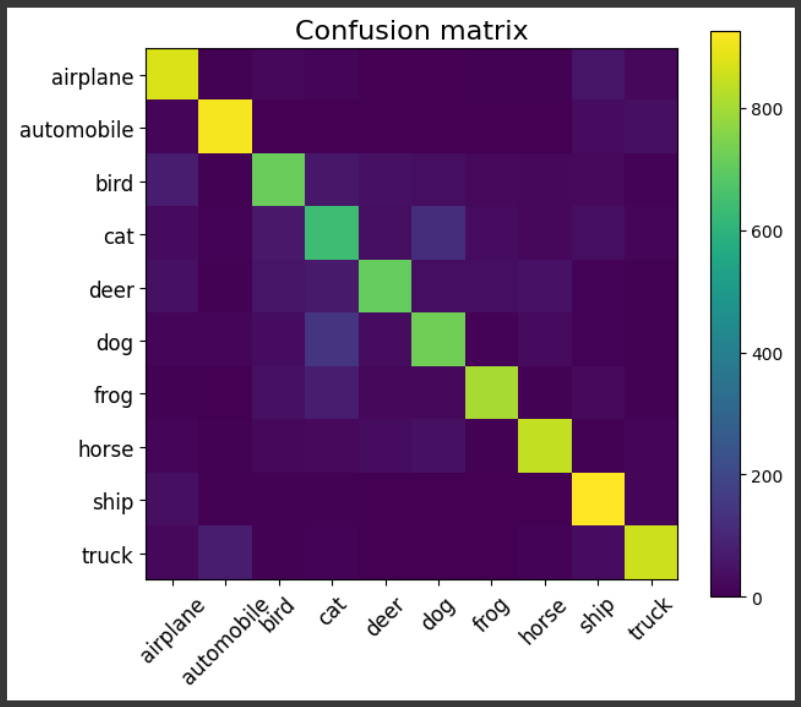


make necessary addition to the baseline model to improve validation accuracy and reduce validation loss.

```
[ ]  import numpy as np
     y_predictions1 = model.predict(x_test)
     y_predictions1.reshape(-1,)
     y_predictions1= np.argmax(y_predictions1, axis=1)
     from sklearn.metrics import classification_report, confusion_matrix
     confusion_matrix(y_test, y_predictions1)
```

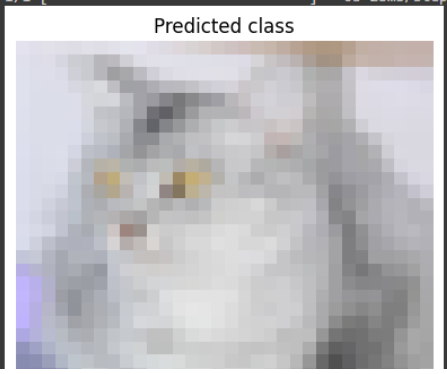
```
313/313 [==============================] - 1s 3ms/step
array([[874,   7,  20,  11,   2,   2,   5,   6,  53,  20],
       [ 12, 914,   1,   0,   0,   1,   1,   0,  32,  39],
       [ 71,   5, 714,  58,  41,  35,  22,  19,  25,  10],
       [ 28,  10,  65, 636,  36, 122,  30,  21,  35,  17],
       [ 42,   7,  51,  66, 706,  34,  35,  44,  10,   5],
       [ 12,  11,  32, 141,  31, 723,   8,  28,   8,   6],
       [  7,   3,  40,  72,  19,  20, 803,   6,  25,   5],
       [ 17,   4,  21,  24,  29,  40,   4, 839,   7,  15],
       [ 37,   5,   5,   4,   2,   2,   2,   3, 925,  15],
       [ 21,  70,   4,   8,   0,   1,   3,   8,  29, 856]])
```

```
[ ]  # confusion matrix and accuracy
     from sklearn.metrics import confusion_matrix, accuracy_score
     plt.figure(figsize=(7, 6))
     plt.title('Confusion matrix', fontsize=16)
     plt.imshow(confusion_matrix(y_test, y_predictions1))
     classes = ["airplane","automobile","bird","cat","deer","dog","frog","horse","ship","truck"]
     plt.xticks(np.arange(10), classes, rotation=45, fontsize=12)
     plt.yticks(np.arange(10), classes, fontsize=12)
     plt.colorbar()
     plt.show()
```



```
[ ]  # Define the class names for CIFAR-10
     class_names = ['airplane', 'automobile', 'bird', 'cat', 'deer', 'dog', 'frog', 'horse', 'ship', 'truck']

     # Choose a random image from the test set
     index = np.random.randint(0, x_test.shape[0])
     image = x_test[index]

     # Make a prediction on the image using the pre-trained model
     prediction = model.predict(np.expand_dims(image, axis=0))
     import tensorflow as tf

     class_index = tf.argmax(prediction, axis=1)
     class_name = tf.keras.utils.to_categorical(class_index, num_classes=10)
     actual_class = y_test[index]

     # Visualize the image and the predicted and actual classes
     plt.imshow(image)
     plt.title(f"Predicted class")
     plt.axis('off')
     plt.show()
```

```
1/1 [==============================] - 0s 28ms/step
```



```
[ ]  from keras.models import load_model
     model = load_model('keras-VGG16-cifar10.h5')
     # predict
     plt.imshow(x_test[1000])

     result = model.predict(x_test[1000:1001]).tolist()
     predict = 0
     expect = y_test[1000][0]
     for i,_ in enumerate(result[0]):
         if result[0][i] > result[0][predict]:
             predict = i
     print("predict class:",predict)
     print("expected class:",expect)
```

```
1/1 [==============================] - 0s 156ms/step
predict class: 5
expected class: 5
```