Angel Reddy Nakkala

700748217

ICP7

```
import numpy as np
from keras.datasets import cifar10
from keras.models import Sequential
from keras.layers import Dense, Dropout, Flatten, Conv2D, MaxPooling2D
#from keras.constraints import maxnorm
from keras.optimizers import SGD
from keras.utils import to_categorical
#from keras import backend as K
#K.set_image_dim_ordering('th')
# fix random seed for reproducibility
seed = 7
np.random.seed(seed)

# load data
(X_train, y_train), (X_test, y_test) = cifar10.load_data()

# convert from int to float and normalize inputs from 0-255 to 0.0-1.0
X_train = X_train.astype('float32') / 255.0
X_test = X_test.astype('float32') / 255.0

# one hot encode outputs
y_train = to_categorical(y_train)
y_test = to_categorical(y_test)
num_classes = y_test.shape[1]

# transpose the dimensions of the input data
X_train = np.transpose(X_train, (0, 3, 1, 2))
X_test = np.transpose(X_test, (0, 3, 1, 2))

# Create the model
model = Sequential()
model.add(Conv2D(32, (3, 3), input_shape=(3, 32, 32), padding='same',
activation='relu'))
model.add(Dropout(0.2))
model.add(Conv2D(32, (3, 3), activation='relu', padding='same'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Flatten())
model.add(Dense(512, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(num_classes, activation='softmax'))
```

```
# Compile model
epochs = 5
lrate = 0.01
decay = lrate/epochs
sgd = SGD(lr=lrate)
model.compile(loss='categorical_crossentropy', optimizer=sgd,
metrics=['accuracy'])
print(model.summary())
# Fit the model
model.fit(X_train, y_train, validation_data=(X_test, y_test),
epochs=epochs, batch_size=32)
# Final evaluation of the model
scores = model.evaluate(X_test, y_test, verbose=0)
print("Accuracy: %.2f%%" % (scores[1]*100))
```

Output:

In class programming:

1. Follow the instruction below and then report how the performance changed.(apply all at once)

- Convolutional input layer, 32 feature maps with a size of 3×3 and a rectifier activation function.
- Dropout layer at 20%.
- Convolutional layer, 32 feature maps with a size of 3×3 and a rectifier activation function.
- Max Pool layer with size 2×2.
- Convolutional layer, 64 feature maps with a size of 3×3 and a rectifier activation function.
- Dropout layer at 20%.
- Convolutional layer, 64 feature maps with a size of 3×3 and a rectifier activation function.
- Max Pool layer with size 2×2.
- Convolutional layer, 128 feature maps with a size of 3×3 and a rectifier activation function.
- Dropout layer at 20%.
- Convolutional layer,128 feature maps with a size of 3×3 and a rectifier activation function.
- Max Pool layer with size 2×2.
- Flatten layer.
- Dropout layer at 20%.
- Fully connected layer with 1024 units and a rectifier activation function.
- Dropout layer at 20%.
- Fully connected layer with 512 units and a rectifier activation function.
- Dropout layer at 20%.
- Fully connected output layer with 10 units and a Softmax activation function

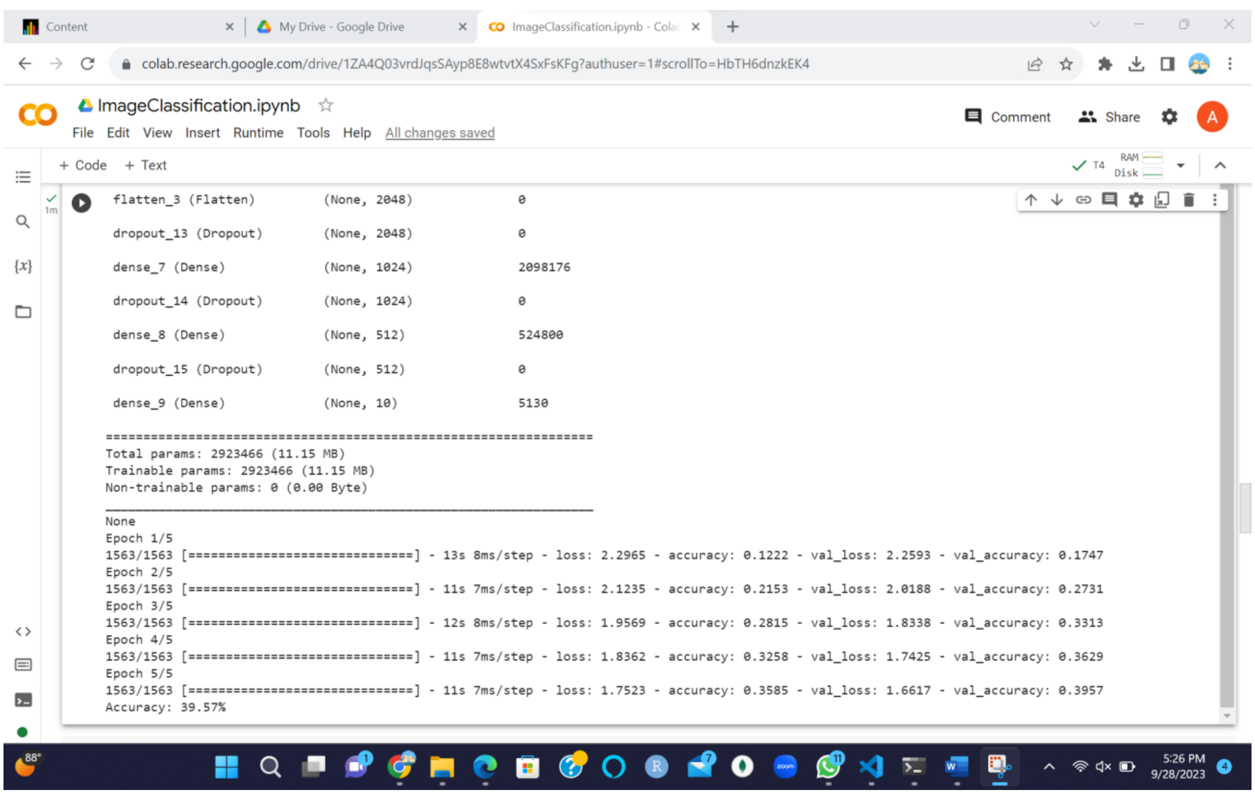
Did the performance change?

```
import numpy as np
from keras.datasets import cifar10
from keras.models import Sequential
```

```
from keras.layers import Dense, Dropout, Flatten, Conv2D, MaxPooling2D
#from keras.constraints import maxnorm
from keras.optimizers import SGD
from keras.utils import to_categorical
# from keras import backend as K
# K.tensorflow_backend.set_image_dim_ordering('th')
# fix random seed for reproducibility
seed = 7
np.random.seed(seed)

# load data
(X_train, y_train), (X_test, y_test) = cifar10.load_data()

# convert from int to float and normalize inputs from 0-255 to 0.0-1.0
X_train = X_train.astype('float32') / 255.0
X_test = X_test.astype('float32') / 255.0

# one hot encode outputs
y_train =to_categorical(y_train)
y_test =to_categorical(y_test)
num_classes = y_test.shape[1]

# transpose the dimensions of the input data
X_train = np.transpose(X_train, (0, 3, 1, 2))
X_test = np.transpose(X_test, (0, 3, 1, 2))

# Create the model
model = Sequential()
model.add(Conv2D(32, (3, 3), input_shape=(3, 32, 32), padding='same',
activation='relu'))
model.add(Dropout(0.2))
model.add(Conv2D(32, (3, 3), activation='relu', padding='same'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Conv2D(64, (3, 3), padding='same', activation='relu'))
model.add(Dropout(0.2))
model.add(Conv2D(64, (3, 3), activation='relu', padding='same'))
model.add(MaxPooling2D(pool_size=(1, 1)))
model.add(Conv2D(128, (3, 3), padding='same', activation='relu'))
model.add(Dropout(0.2))
model.add(Conv2D(128, (3, 3), activation='relu', padding='same'))
model.add(MaxPooling2D(pool_size=(1, 1)))
model.add(Flatten())
model.add(Dropout(0.2))
model.add(Dense(1024, activation='relu'))
model.add(Dropout(0.2))
```

```
model.add(Dense(512, activation='relu'))
model.add(Dropout(0.2))
model.add(Dense(num_classes, activation='softmax'))

# Compile model
epochs = 5
lrate = 0.01
decay = lrate/epochs
sgd = SGD(lr=lrate)
model.compile(loss='categorical_crossentropy', optimizer=sgd,
metrics=['accuracy'])
print(model.summary())
# Fit the model
history=model.fit(X_train, y_train, validation_data=(X_test, y_test),
epochs=epochs, batch_size=32)
# Final evaluation of the model
scores = model.evaluate(X_test, y_test, verbose=0)
print("Accuracy: %.2f%%" % (scores[1]*100))
```

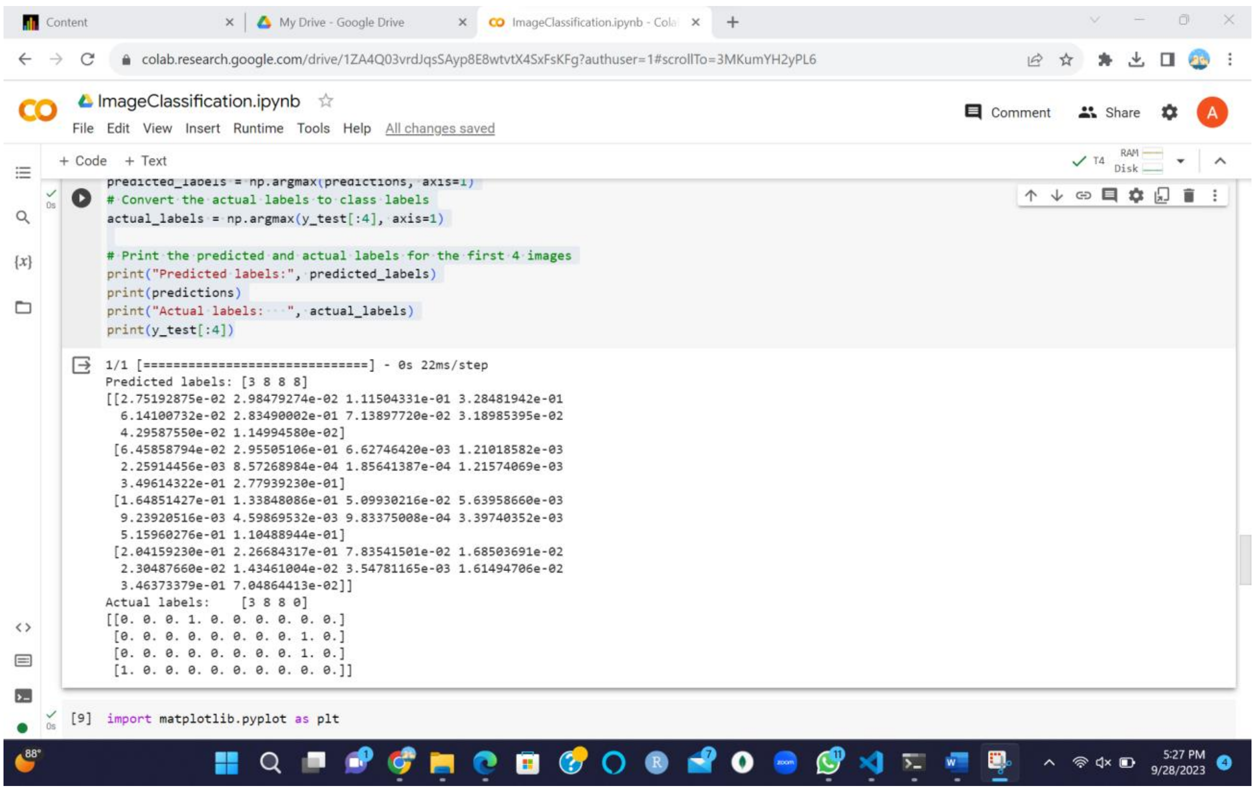
Output:



2. Predict the first 4 images of the test data using the above model. Then, compare with the actual label for those 4 images to check whether or not the model has predicted correctly

```python
# Predict the first 4 images of the test data
predictions = model.predict(X_test[:4])
# Convert the predictions to class labels
predicted_labels = np.argmax(predictions, axis=1)
# Convert the actual labels to class labels
actual_labels = np.argmax(y_test[:4], axis=1)

# Print the predicted and actual labels for the first 4 images
print("Predicted labels:", predicted_labels)
print(predictions)
print("Actual labels:    ", actual_labels)
print(y_test[:4])
```

Output:

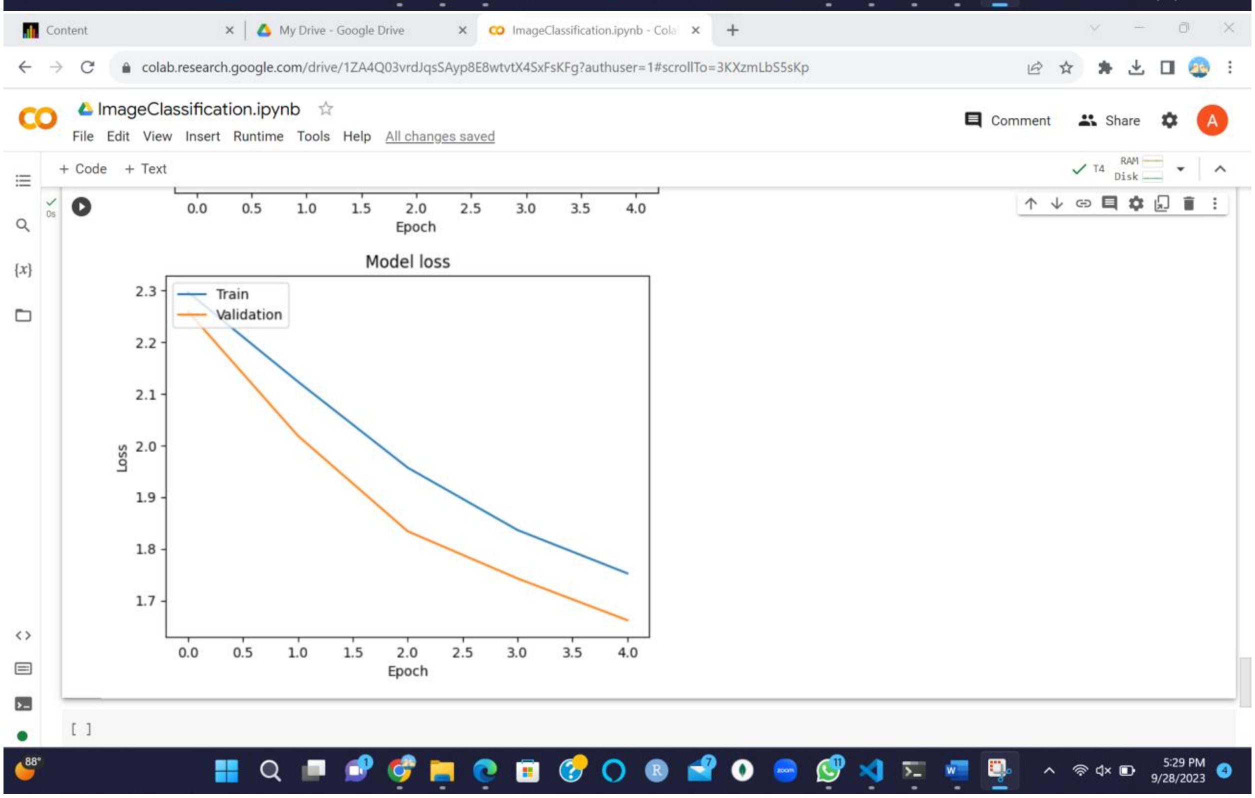


3. Visualize Loss and Accuracy using the history object

```python
import matplotlib.pyplot as plt

# Plot training & validation accuracy values
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.title('Model accuracy')
plt.ylabel('Accuracy')
```

```
plt.xlabel('Epoch')
plt.legend(['Train', 'Validation'], loc='upper left')
plt.show()

# Plot training & validation loss values
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('Model loss')
plt.ylabel('Loss')
plt.xlabel('Epoch')
plt.legend(['Train', 'Validation'], loc='upper left')
plt.show()
```

Output:



GitHub :

https://github.com/angelreddy09/DNN/tree/main/ICP7