Spring 2024: CS5720
Neural Networks and Deep Learning - ICP-7
Yasaswini Majety (700747747)

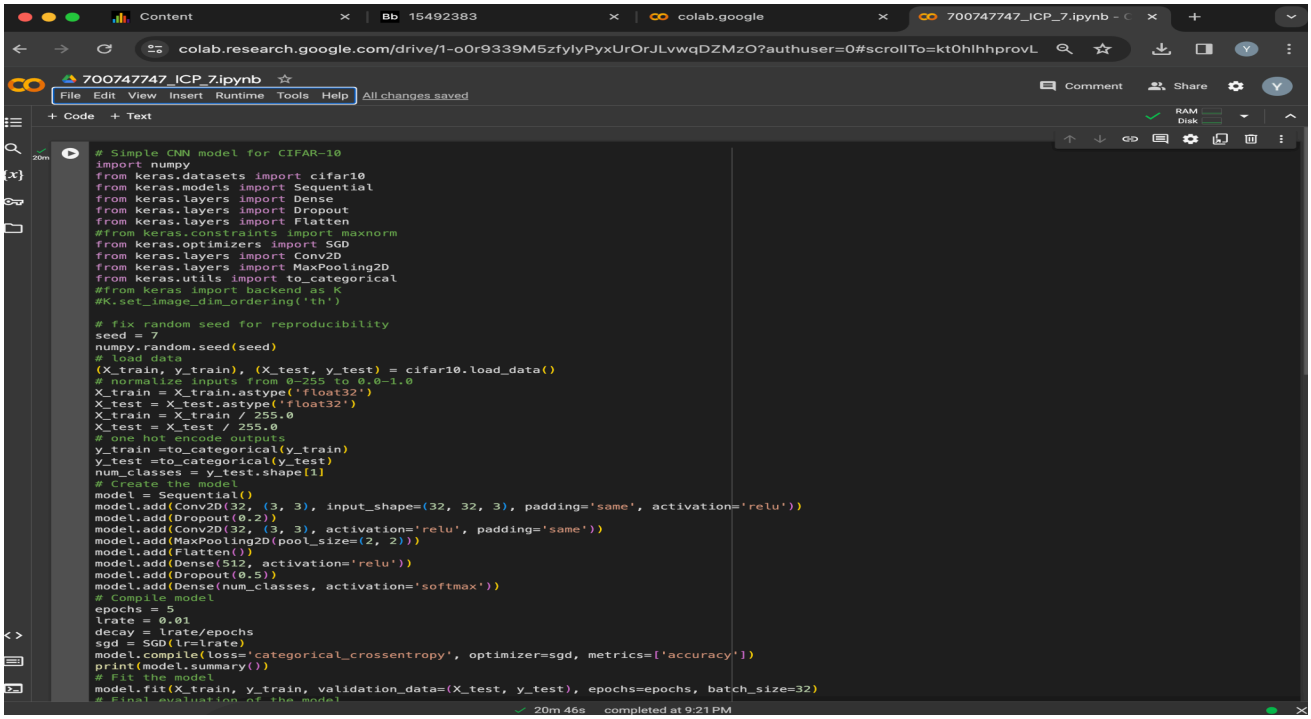
Github Link: https://github.com/yasaswini8777/Neural_ICP_7

Use Case Description:
LeNet5, AlexNet, Vgg16, Vgg19
1. Training the model
2. Evaluating the model

Programming elements:
1. About CNN
2. Hyperparameters of CNN
3. Image classification with CNN

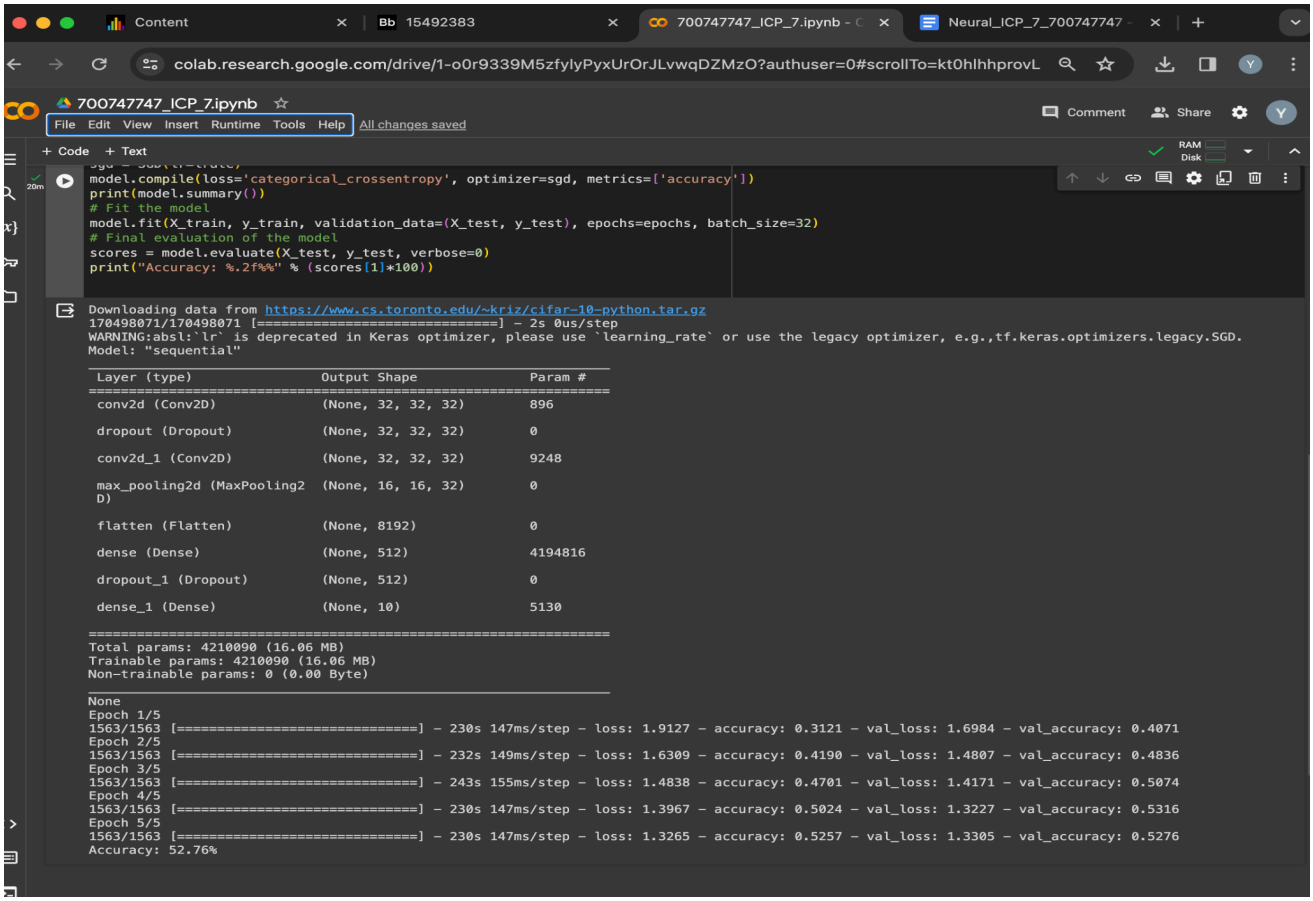
In class programming:

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?
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.
3. Visualize Loss and Accuracy using the history object



```
# Simple CNN model for CIFAR-10
import numpy
from keras.datasets import cifar10
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Dropout
from keras.layers import Flatten
#from keras.constraints import maxnorm
from keras.optimizers import SGD
from keras.layers import Conv2D
from keras.layers import MaxPooling2D
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
numpy.random.seed(seed)
# load data
(X_train, y_train), (X_test, y_test) = cifar10.load_data()
# normalize inputs from 0-255 to 0.0-1.0
X_train = X_train.astype('float32')
X_test = X_test.astype('float32')
X_train = X_train / 255.0
X_test = X_test / 255.0
# one hot encode outputs
y_train =to_categorical(y_train)
y_test =to_categorical(y_test)
num_classes = y_test.shape[1]
# Create the model
model = Sequential()
model.add(Conv2D(32, (3, 3), input_shape=(32, 32, 3), 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
```



```
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))
```

```
Downloading data from https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz
170498071/170498071 [==============================] - 2s 0us/step
WARNING:absl:`lr` is deprecated in Keras optimizer, please use `learning_rate` or use the legacy optimizer, e.g.,tf.keras.optimizers.legacy.SGD.
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 32, 32, 32)        896

 dropout (Dropout)           (None, 32, 32, 32)        0

 conv2d_1 (Conv2D)           (None, 32, 32, 32)        9248

 max_pooling2d (MaxPooling2  (None, 16, 16, 32)        0
 D)

 flatten (Flatten)           (None, 8192)              0

 dense (Dense)               (None, 512)               4194816

 dropout_1 (Dropout)         (None, 512)               0

 dense_1 (Dense)             (None, 10)                5130

=================================================================
Total params: 4210090 (16.06 MB)
Trainable params: 4210090 (16.06 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
None
Epoch 1/5
1563/1563 [==============================] - 230s 147ms/step - loss: 1.9127 - accuracy: 0.3121 - val_loss: 1.6984 - val_accuracy: 0.4071
Epoch 2/5
1563/1563 [==============================] - 232s 149ms/step - loss: 1.6309 - accuracy: 0.4190 - val_loss: 1.4807 - val_accuracy: 0.4836
Epoch 3/5
1563/1563 [==============================] - 243s 155ms/step - loss: 1.4838 - accuracy: 0.4701 - val_loss: 1.4171 - val_accuracy: 0.5074
Epoch 4/5
1563/1563 [==============================] - 230s 147ms/step - loss: 1.3967 - accuracy: 0.5024 - val_loss: 1.3227 - val_accuracy: 0.5316
Epoch 5/5
1563/1563 [==============================] - 230s 147ms/step - loss: 1.3265 - accuracy: 0.5257 - val_loss: 1.3305 - val_accuracy: 0.5276
Accuracy: 52.76%
```