104 Lab 7 Documentation

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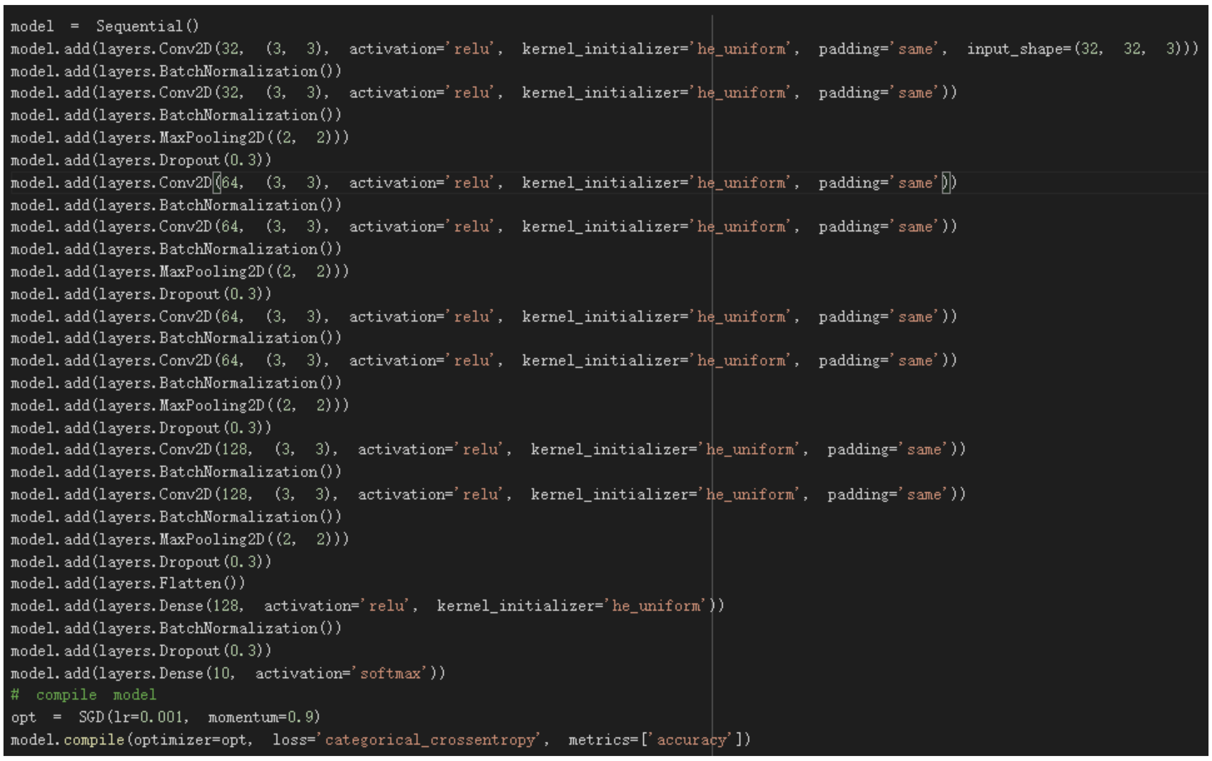
Video Link:
GitHub Link:

# CNN Model Creation

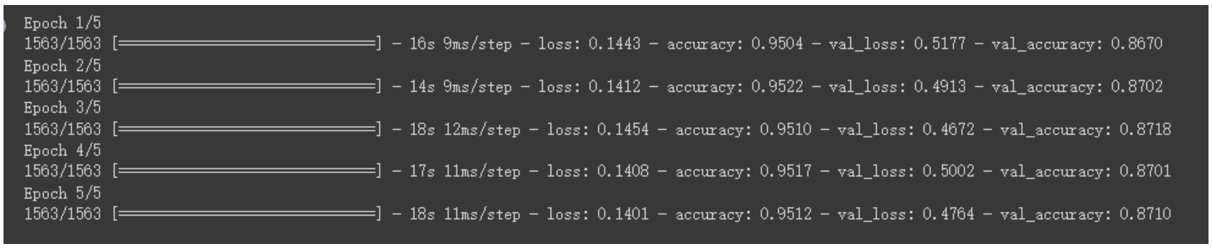
The model used for the CIFAR-10 dataset consisted of 60000 32x32 color images in 10 classes, with 6000 images per class. The CIFAR-10 dataset has a total number of 50000 training images and 10000 test images.

The VGG architecture contains piling convolutional layers with 3×3 filters along with a max pooling layer, the combination of which can be repeated where the number of filters in each block is increased with the depth of the network such as 32, 64, 128, 256. After we first develop a CNN Baseline Model by increasing the number of the VGG block we are able to increase the accuracy of the CNN model. The first VGG block will result in an accuracy of 67.070% while with two VGG we have a value of 71.080% for the third VGG, the value of accuracy is increased to 73.500%.



```
model = Sequential()
model.add(layers.Conv2D(32, (3, 3), activation=’relu’, kernel_initializer=’he_uniform’, padding=’same’, input_shape=(32, 32, 3)))
model.add(layers.BatchNormalization())
model.add(layers.Conv2D(32, (3, 3), activation=’relu’, kernel_initializer=’he_uniform’, padding=’same’))
model.add(layers.BatchNormalization())
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Dropout(0.3))
model.add(layers.Conv2D(64, (3, 3), activation=’relu’, kernel_initializer=’he_uniform’, padding=’same’))
model.add(layers.BatchNormalization())
model.add(layers.Conv2D(64, (3, 3), activation=’relu’, kernel_initializer=’he_uniform’, padding=’same’))
model.add(layers.BatchNormalization())
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Dropout(0.3))
model.add(layers.Conv2D(64, (3, 3), activation=’relu’, kernel_initializer=’he_uniform’, padding=’same’))
model.add(layers.BatchNormalization())
model.add(layers.Conv2D(64, (3, 3), activation=’relu’, kernel_initializer=’he_uniform’, padding=’same’))
model.add(layers.BatchNormalization())
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Dropout(0.3))
model.add(layers.Conv2D(128, (3, 3), activation=’relu’, kernel_initializer=’he_uniform’, padding=’same’))
model.add(layers.BatchNormalization())
model.add(layers.Conv2D(128, (3, 3), activation=’relu’, kernel_initializer=’he_uniform’, padding=’same’))
model.add(layers.BatchNormalization())
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Dropout(0.3))
model.add(layers.Flatten())
model.add(layers.Dense(128, activation=’relu’, kernel_initializer=’he_uniform’))
model.add(layers.BatchNormalization())
model.add(layers.Dropout(0.3))
model.add(layers.Dense(10, activation=’softmax’))
# compile model
opt = SGD(lr=0.001, momentum=0.9)
model.compile(optimizer=opt, loss=’categorical_crossentropy’, metrics=[’accuracy’])
```

Figure 1: CNN Model Cionstrcution

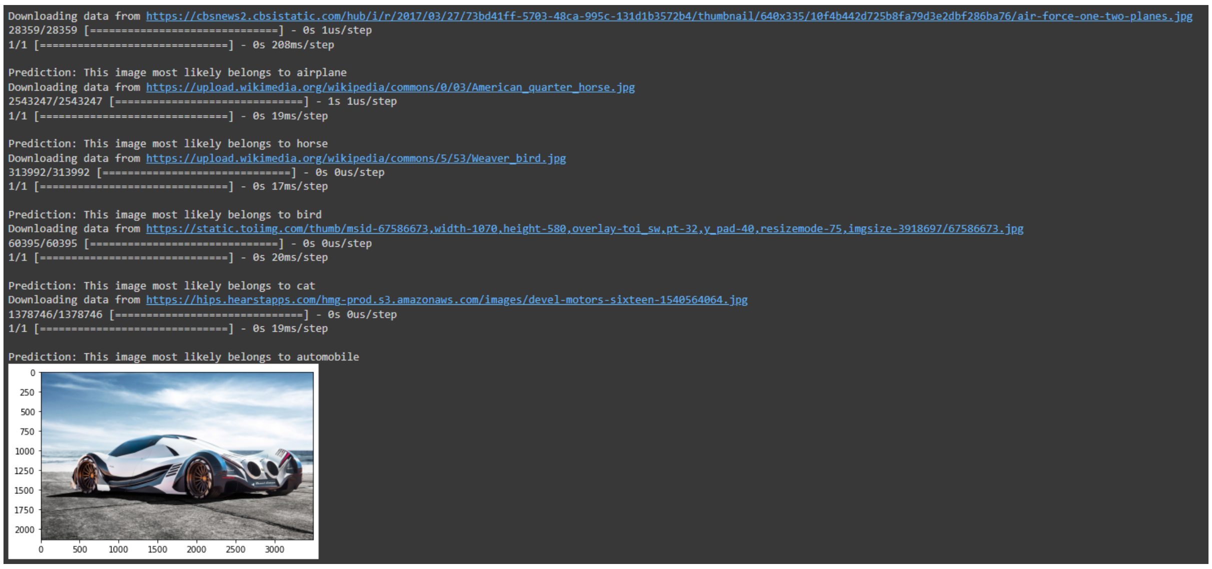


```
Epoch 1/5
1563/1563 [==============================] - 16s 9ms/step - loss: 0.1443 - accuracy: 0.9504 - val_loss: 0.5177 - val_accuracy: 0.8670
Epoch 2/5
1563/1563 [==============================] - 14s 9ms/step - loss: 0.1412 - accuracy: 0.9522 - val_loss: 0.4913 - val_accuracy: 0.8702
Epoch 3/5
1563/1563 [==============================] - 18s 12ms/step - loss: 0.1454 - accuracy: 0.9510 - val_loss: 0.4672 - val_accuracy: 0.8718
Epoch 4/5
1563/1563 [==============================] - 17s 11ms/step - loss: 0.1408 - accuracy: 0.9517 - val_loss: 0.5002 - val_accuracy: 0.8701
Epoch 5/5
1563/1563 [==============================] - 18s 11ms/step - loss: 0.1401 - accuracy: 0.9512 - val_loss: 0.4764 - val_accuracy: 0.8710
```

Figure 2: CNN Model Accuracy Result

# CNN Challenge Test

Besides adding VGG blocks to the code we can add different techniques to raise the accuracy of the CNN model including Weight Decay, Data Augmentation, Dropout, and Batch Normalization. With these techniques, we are able to create infinite CNN models for our own preferences. Once the highest CNN has finished its training with decent Echo time we will generate the test image code and see its final image identification outcomes.



```
Downloading data from https://cbsnews2.cbsistatic.com/hub/i/r/2017/03/27/73bd41ff-5703-48ca-995c-131d1b3572b4/thumbnail/640x335/10f4b442d725b8fa79d3e2dbf286ba76/air-force-one-two-planes.jpg
28359/28359 [==============================] - 0s 1us/step
1/1 [==============================] - 0s 208ms/step

Prediction: This image most likely belongs to airplane
Downloading data from https://upload.wikimedia.org/wikipedia/commons/0/03/American_quarter_horse.jpg
2543247/2543247 [==============================] - 1s 1us/step
1/1 [==============================] - 0s 19ms/step

Prediction: This image most likely belongs to horse
Downloading data from https://upload.wikimedia.org/wikipedia/commons/5/53/Weaver_bird.jpg
313992/313992 [==============================] - 0s 0us/step
1/1 [==============================] - 0s 17ms/step

Prediction: This image most likely belongs to bird
Downloading data from https://static.toiimg.com/thumb/msid-67586673,width-1070,height-580,overlay-toi_sw,pt-32,y_pad-40,resizemode-75,imgsize-3918697/67586673.jpg
60395/60395 [==============================] - 0s 0us/step
1/1 [==============================] - 0s 20ms/step

Prediction: This image most likely belongs to cat
Downloading data from https://hips.hearstapps.com/hmg-prod.s3.amazonaws.com/images/devel-motors-sixteen-1540564064.jpg
1378746/1378746 [==============================] - 0s 0us/step
1/1 [==============================] - 0s 19ms/step

Prediction: This image most likely belongs to automobile
```

Figure 3: CNN Model Image Training Result

# Balloon Game Development

In the balloon game assignment, we are required to modify the game. The modifications are involved within the following options including more recorded high scores in the text file, number lives, speed up value, a different way of scoring, file handling, adding in multiples of obstacles, and leveling Up or spacing out the obstacles. In our own modifications, we choose to add lives, add multiples of birds, adjust the live decreasing, more recorded high scores, moving trees, and bird velocity.

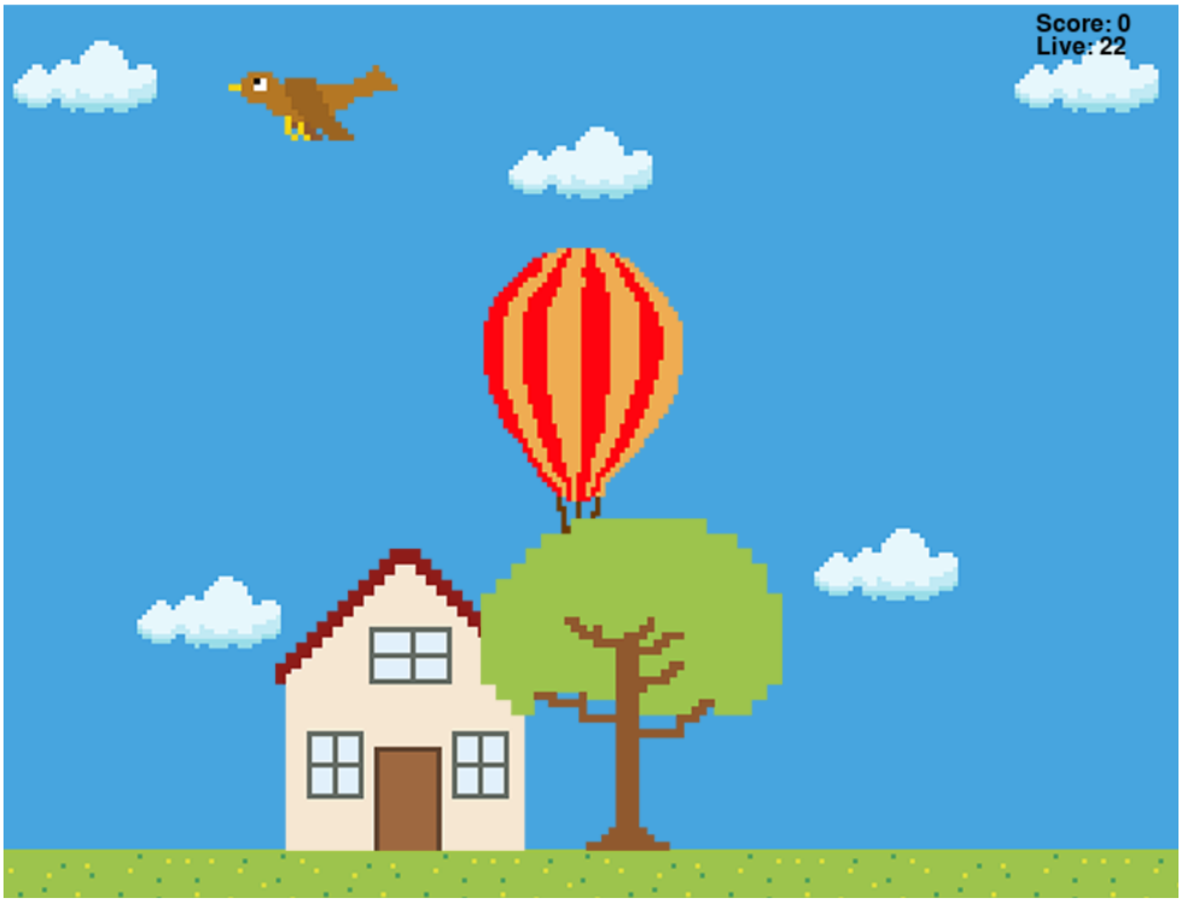


Figure 3: Balloon Game Initiated Screen