Homework 2

Gesture Recognition

Scissor, Rock and Paper game

ECE 510 Intelligence Robotics
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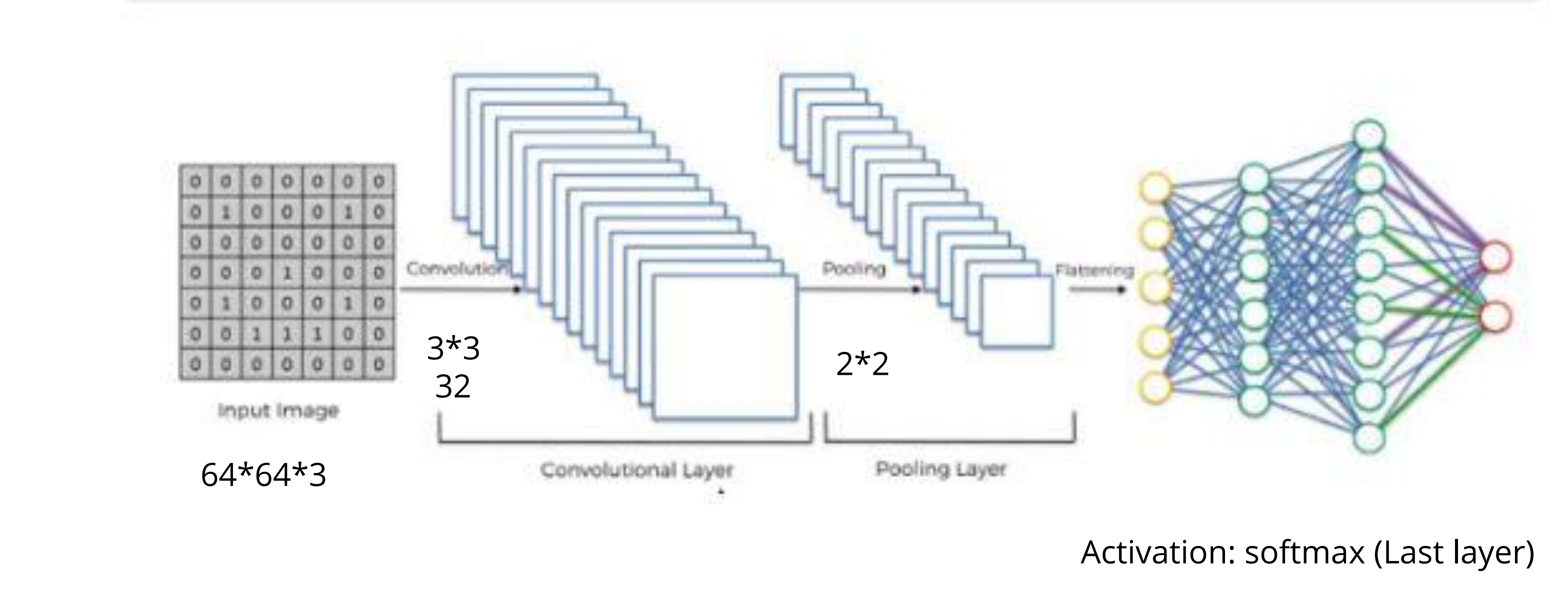
Motivation:

Our robot for final project is Greeting Robot, who can interact with people. He can show different emotion face, play music for people and answer people's questions NOW. It seems to be a good idea that he can play a funny game with people. Therefore, in this homework, we are going to achieve a simple game interaction with the Robot: **Scissor, Rock and Paper game**

Introduction:

The robot can detect the user's gesture from camera and recognize which gesture it is. Then, it produces a random gesture among scissor, rock and paper. Finally, it can show up the game result according to the game rule：Rock beats Scissor; Paper beats Rock; Scissor beats Paper.

Model



0	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	1	0	0	0	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0

64*64*3

3*3
32

2*2

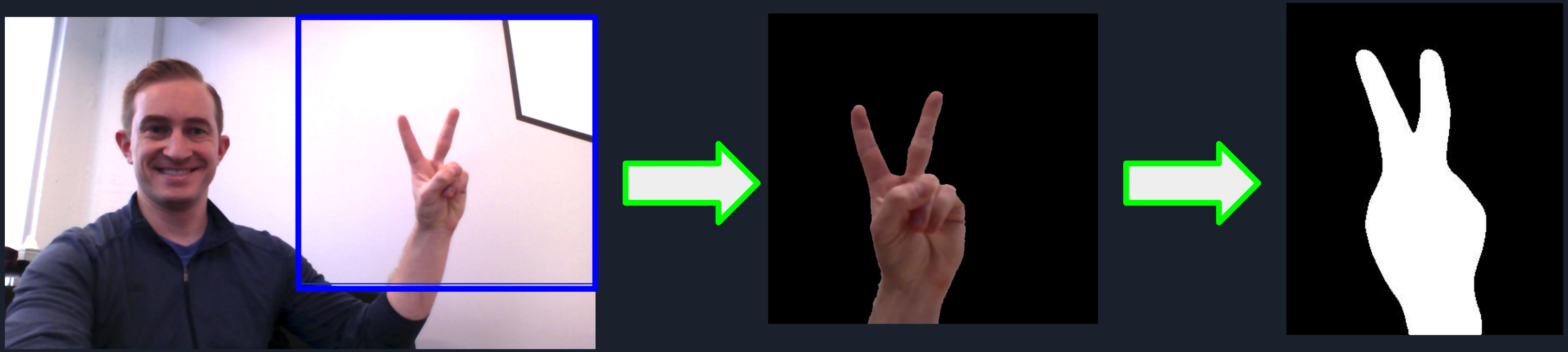
Activation: softmax (Last layer)

Result: [[0.4, 0.5, 0.6]]

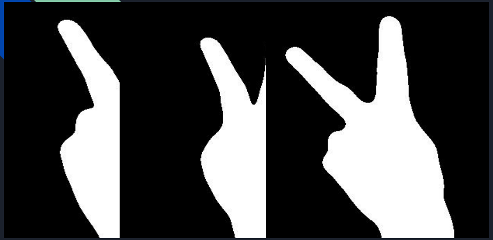
https://medium.com/nybles/create-your-first-image-recognition-classifier-using-cnn-keras-and-tensorflow-backend-6eaab98d14dd

Training

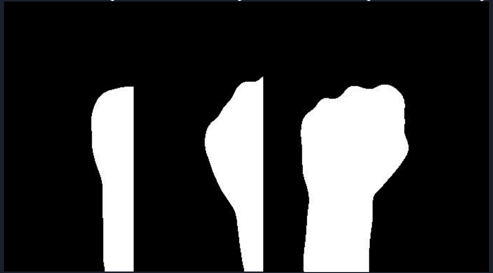
- Based on others' project: https://github.com/athena15/project_kojak
- Created a region of interest (ROI) box
- Take photo of background, create a background mask
- Use binary thresholding to isolate the hand (threshold value = 255; the object is white)



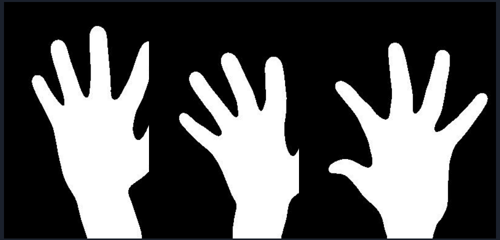
Training



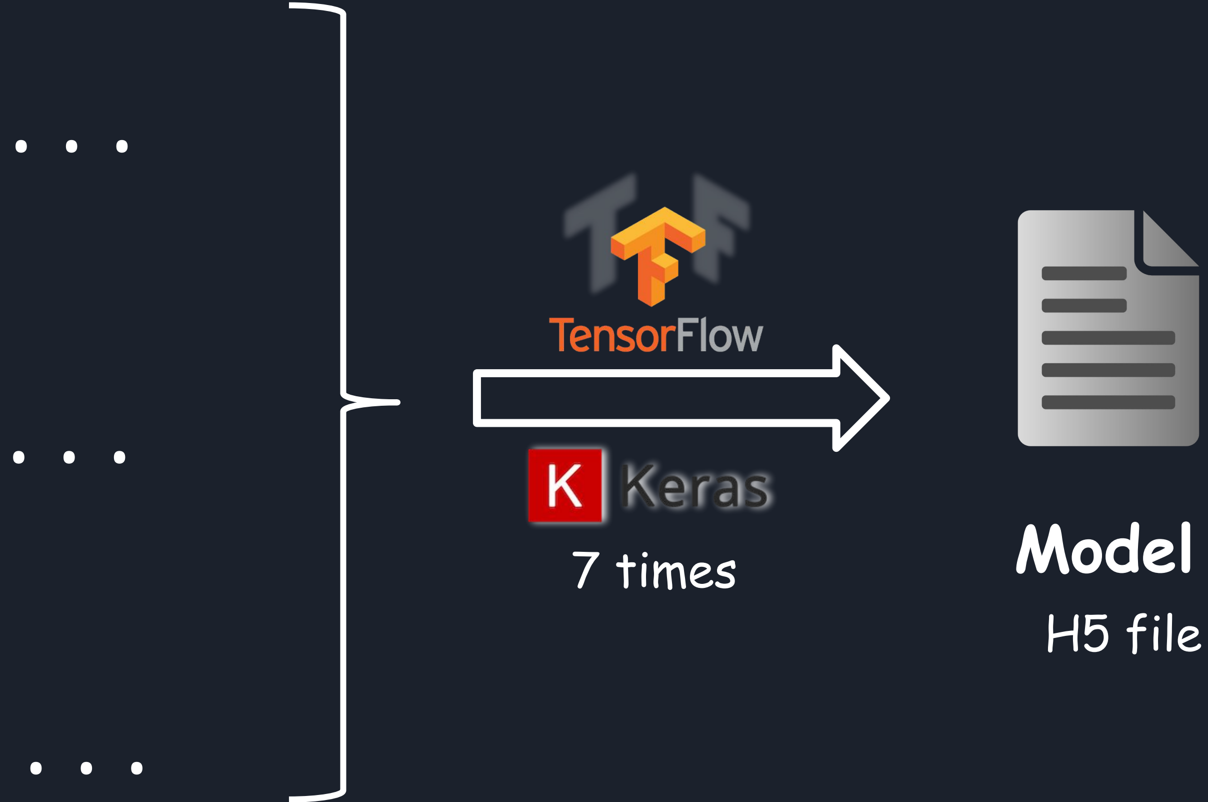
1000(Train) 200(Test)



1000(Train) 200(Test)



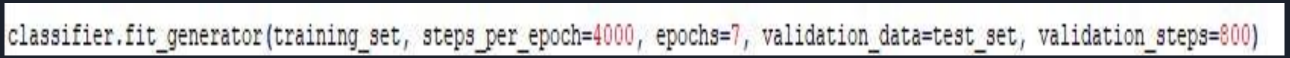
1000(Train) 200(Test)



7 times

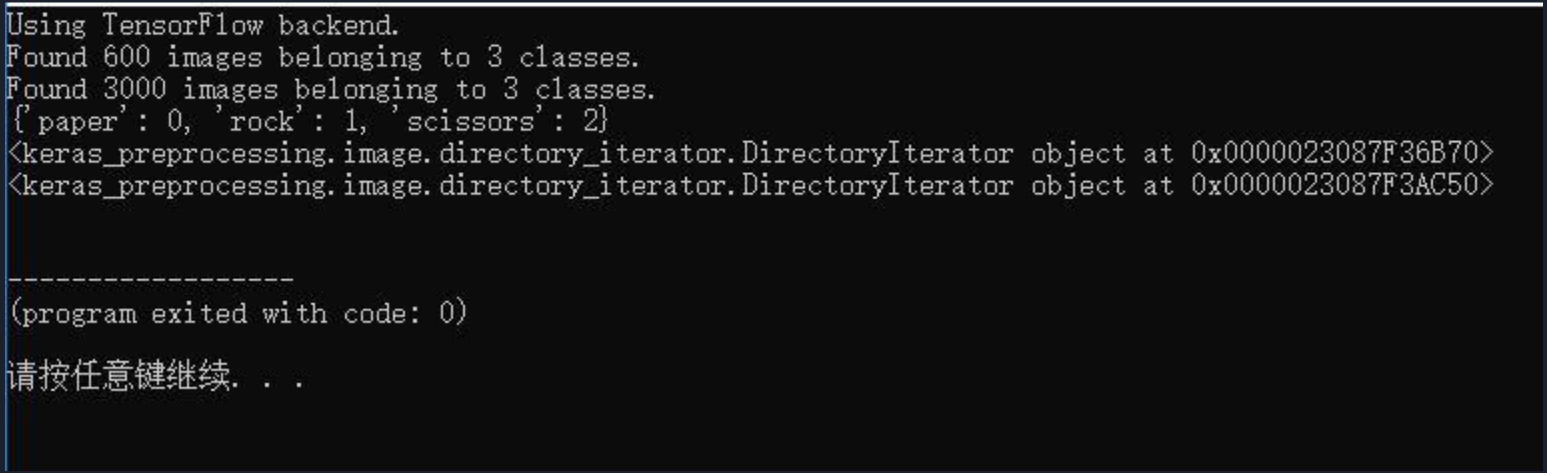
Model

H5 file



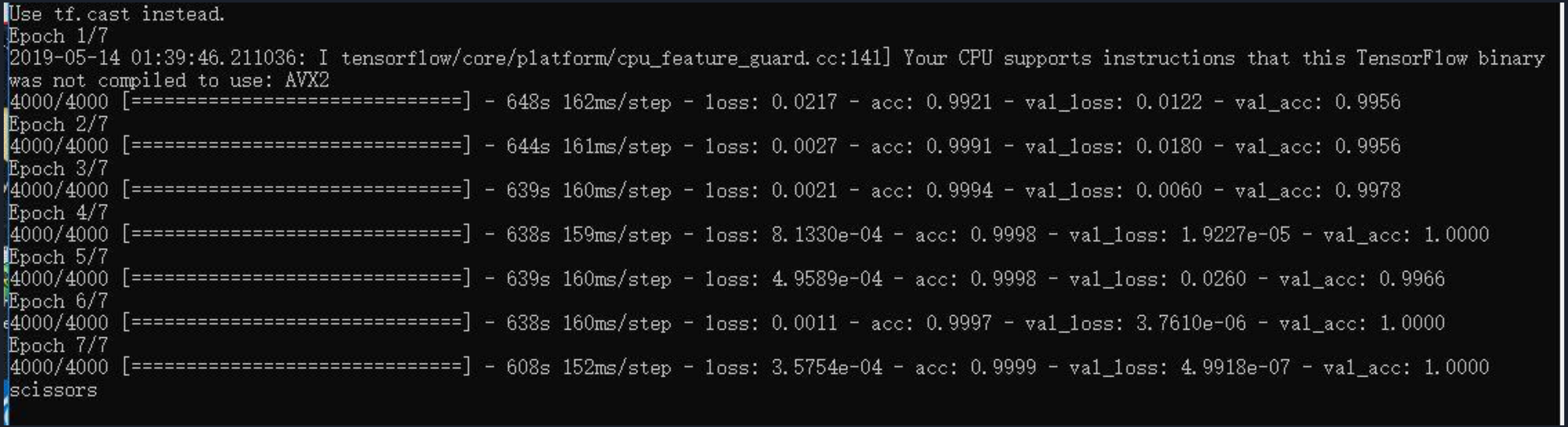
```
classifier.fit_generator(training_set, steps_per_epoch=4000, epochs=7, validation_data=test_set, validation_steps=800)
```

Preprocessing Image(Keras)-flow_from_directory



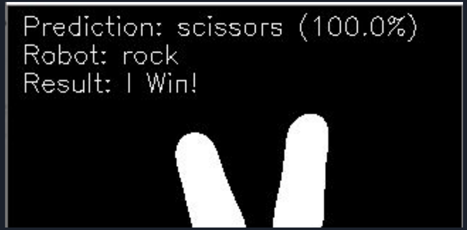
```
Using TensorFlow backend.
Found 600 images belonging to 3 classes.
Found 3000 images belonging to 3 classes.
{'paper': 0, 'rock': 1, 'scissors': 2}
<keras_preprocessing.image.directory_iterator.DirectoryIterator object at 0x0000023087F36B70>
<keras_preprocessing.image.directory_iterator.DirectoryIterator object at 0x0000023087F3AC50>


------------------
(program exited with code: 0)

请按任意键继续. . .
```

Train Model



```
Use tf.cast instead.
Epoch 1/7
2019-05-14 01:39:46.211036: I tensorflow/core/platform/cpu_feature_guard.cc:141] Your CPU supports instructions that this TensorFlow binary
was not compiled to use: AVX2
4000/4000 [==============================] - 648s 162ms/step - loss: 0.0217 - acc: 0.9921 - val_loss: 0.0122 - val_acc: 0.9956
Epoch 2/7
4000/4000 [==============================] - 644s 161ms/step - loss: 0.0027 - acc: 0.9991 - val_loss: 0.0180 - val_acc: 0.9956
Epoch 3/7
4000/4000 [==============================] - 639s 160ms/step - loss: 0.0021 - acc: 0.9994 - val_loss: 0.0060 - val_acc: 0.9978
Epoch 4/7
4000/4000 [==============================] - 638s 159ms/step - loss: 8.1330e-04 - acc: 0.9998 - val_loss: 1.9227e-05 - val_acc: 1.0000
Epoch 5/7
4000/4000 [==============================] - 639s 160ms/step - loss: 4.9589e-04 - acc: 0.9998 - val_loss: 0.0260 - val_acc: 0.9966
Epoch 6/7
4000/4000 [==============================] - 638s 160ms/step - loss: 0.0011 - acc: 0.9997 - val_loss: 3.7610e-06 - val_acc: 1.0000
Epoch 7/7
4000/4000 [==============================] - 608s 152ms/step - loss: 3.5754e-04 - acc: 0.9999 - val_loss: 4.9918e-07 - val_acc: 1.0000
scissors
```

Design

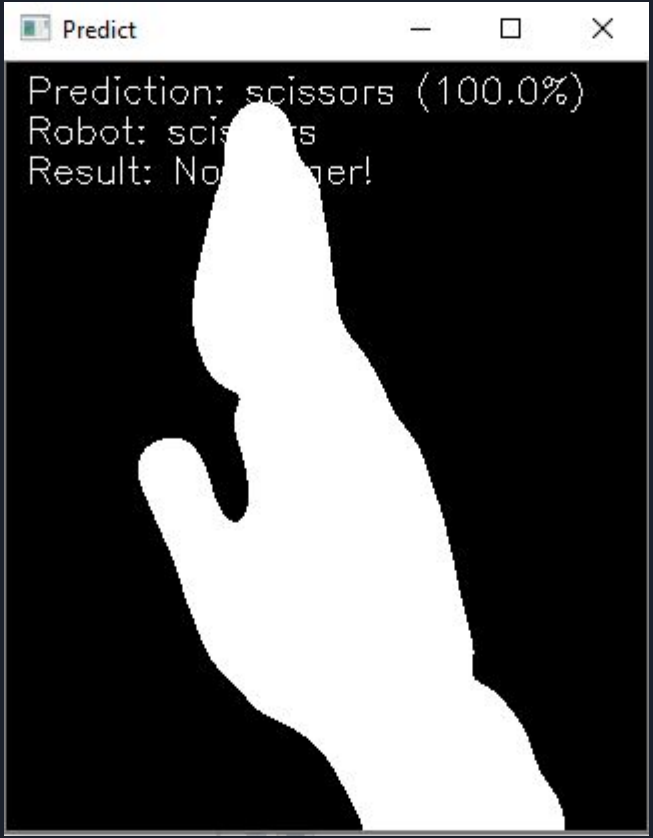


```
Prediction: scissors (100.0%)
Robot: rock
Result: I Win!
```

- Load trained model
- Open camera
- Press 'b' key to capture the background
- Press 'space' key to deal with background masking and binary thresholding.
- Predict the operated picture with trained model
- Robot generates a random gesture
- Compare the random gesture and prediction result
- Show up Game result
- Press 'Esc' key to exit the game and release spaces.

Problems

- The input for our trained model is the thresholding picture. So, we need save the picture in the located folder. When the user press the 'Esc' key to exit the program, the pictures will be deleted.
- When the paper rotates to a profile(side), the machine will treat it as a scissor.



```
Prediction: scissors (100.0%)
Robot: scis     s
Result: No     ger!
```

Demo

Thank You