

# 古画yolov3物体检测

## 下载数据集

```
!mkdir tarfile
from modelarts.session import Session
sess = Session()
for i in range(100):
    sess.download_data(bucket_path=F"gg-image/task/tarfile/{i}.tar.gz",
path=F"tarfile/{i}.tar.gz")
```

```
Successfully download file gg-image/task/tarfile/0.tar.gz from OBS to local
tarfile/0.tar.gz
Successfully download file gg-image/task/tarfile/1.tar.gz from OBS to local
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```





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tarfile/99.tar.gz
```

## 解压数据集

```
import os, tarfile  
path = 'tarfile'  
savefolder = 'data'  
for filename in os.listdir(path):  
    filepath = os.path.join(path, filename)  
    tf = tarfile.open(filepath)  
    tf.extractall(savefolder)  
    tf.close()  
    os.remove(filepath)
```

## 下载代码

```
# !rm yolov3.tar.gz
sess.download_data(bucket_path="gg-image/task/notebook/yolov3.tar.gz",
path=f"./yolov3.tar.gz")
```

```
rm: cannot remove 'yolov3.tar.gz': No such file or directory
Successfully download file gg-image/task/notebook/yolov3.tar.gz from OBS to
local ./yolov3.tar.gz
```

## 解压代码

```
!tar -zxf yolov3.tar.gz
!rm yolov3.tar.gz
```

## 显示图片

```
# 生成标签对应的颜色
from src.util import produceColors, classes, path
colors = produceColors(classes)
print('classes:', classes)
print('colors:', colors)
print('path:', path)
```

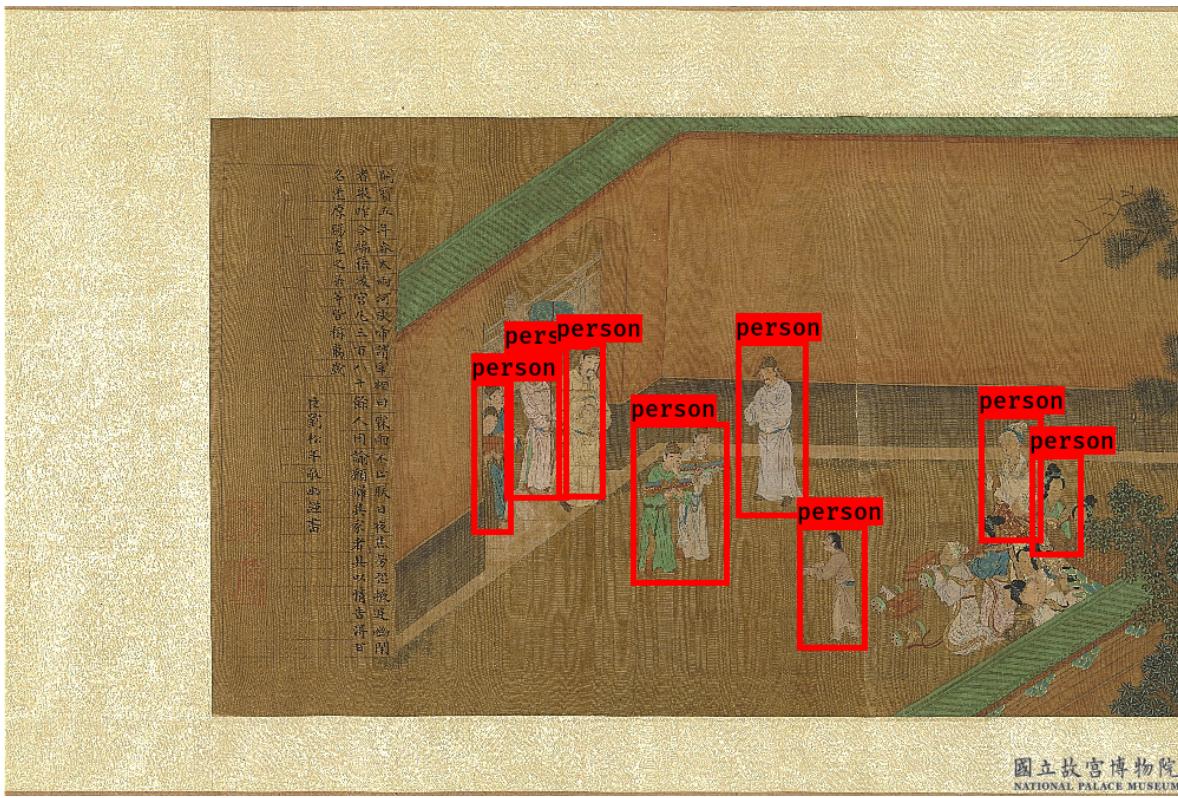
```
classes: ['person', 'bird', 'flower']
colors: {'person': (255, 0, 0), 'bird': (0, 255, 0), 'flower': (0, 0, 255)}
path: /home/ma-user/work/data
```

```
import os
from IPython.display import display
from src.util import getFiles, getImageFile, draw_image
# 随机选3张标注文件并显示
for xml_file in getFiles(path, 3):
    img_file = getImageFile(xml_file)
    display(draw_image(img_file, colors))
```



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将数据分成训练集和测试集

```

# 数据分成训练集和测试集时并不改变数据源的位置，而是通过建立trainFile和testFile2个文件来区分
# trainFile记录了所有训练集图片的路径和标注结果，testFile记录了所有测试集图片的路径和标注结果
from src.util import divide, saveAsText
trainFile = 'oldDrawingTrain.txt'
testFile = 'oldDrawingTest.txt'
# 在src.util给了个训练集和测试集使用的标准方法divide()
##### 对于需要进行拓展工作的，不满足以divide()默认方式分开训练集和验证集方式的可更改divide()的参数
##### divide接受2个参数：ratio：训练集所占的比例，seed：随机种子（一个整数或None），值为None时为随机生成
##### 比如需要取训练集为随机300个图片，剩余为测试集，考虑所有图片数为7939，可以写作
##### train, test = divide(300/7939, None)
train, test = divide()
saveAsText(train, trainFile)
saveAsText(test, testFile)

```

## 2. yolov3训练

### 指定训练相关的文件路径等参数

```

from oldDrawingTrain import get_anchors
from src.util import classes
annotation_path = 'oldDrawingTrain.txt'
weights_path = './model_data/yolo_weights.h5'
log_dir = 'logs/'
anchors_path = 'model_data/yolo_anchors.txt'
class_names = classes
num_classes = len(class_names)
anchors = get_anchors(anchors_path)
num_anchors = len(anchors)

```

Using TensorFlow backend.

### 构建YOLO模型

```

import keras.backend as K
from yolo3.model import preprocess_true_boxes, yolo_body, yolo_loss
from keras.layers import Input, Lambda
from keras.models import Model

K.clear_session()

input_shape = (416, 416)
image_input = Input(shape=(None, None, 3))
h, w = input_shape

y_true = [Input(shape=(h//{0:32, 1:16, 2:8}[l], w//{0:32, 1:16, 2:8}[l],
                  num_anchors//3, num_classes+5))
          for l in range(3)]
model_body = yolo_body(image_input, num_anchors//3, num_classes)

model_body.load_weights(weights_path, by_name=True, skip_mismatch=True)

model_loss = Lambda(yolo_loss, output_shape=(1,), name='yolo_loss',

```

```

        arguments={'anchors': anchors, 'num_classes': num_classes, 'ignore_thresh': 0.5})(

model = Model([model_body.input, *y_true], model_loss)

```

WARNING:tensorflow:From /home/ma-user/anaconda3/envs/TensorFlow-1.13.1/lib/python3.6/site-packages/tensorflow/python/framework/op\_def\_library.py:263: colocate\_with (from tensorflow.python.framework.ops) is deprecated and will be removed in a future version.  
 Instructions for updating:  
 Colocations handled automatically by placer.

```

/home/ma-user/anaconda3/envs/TensorFlow-1.13.1/lib/python3.6/site-
packages/keras/engine/saving.py:1009: UserWarning: Skipping loading of weights
for layer conv2d_59 due to mismatch in shape ((1, 1, 1024, 24) vs (255, 1024, 1,
1)).  

    weight_values[i].shape))  

/home/ma-user/anaconda3/envs/TensorFlow-1.13.1/lib/python3.6/site-
packages/keras/engine/saving.py:1009: UserWarning: Skipping loading of weights
for layer conv2d_59 due to mismatch in shape ((24,) vs (255,)).  

    weight_values[i].shape))  

/home/ma-user/anaconda3/envs/TensorFlow-1.13.1/lib/python3.6/site-
packages/keras/engine/saving.py:1009: UserWarning: skipping loading of weights
for layer conv2d_67 due to mismatch in shape ((1, 1, 512, 24) vs (255, 512, 1,
1)).  

    weight_values[i].shape))  

/home/ma-user/anaconda3/envs/TensorFlow-1.13.1/lib/python3.6/site-
packages/keras/engine/saving.py:1009: UserWarning: skipping loading of weights
for layer conv2d_67 due to mismatch in shape ((24,) vs (255,)).  

    weight_values[i].shape))  

/home/ma-user/anaconda3/envs/TensorFlow-1.13.1/lib/python3.6/site-
packages/keras/engine/saving.py:1009: UserWarning: skipping loading of weights
for layer conv2d_75 due to mismatch in shape ((1, 1, 256, 24) vs (255, 256, 1,
1)).  

    weight_values[i].shape))  

/home/ma-user/anaconda3/envs/TensorFlow-1.13.1/lib/python3.6/site-
packages/keras/engine/saving.py:1009: UserWarning: skipping loading of weights
for layer conv2d_75 due to mismatch in shape ((24,) vs (255,)).  

    weight_values[i].shape))

```

## 显示模型

```
model.summary()
```

Layer (type)	Output Shape	Param #	Connected to
<hr/>			
<hr/>			
input_1 (InputLayer)	(None, None, None, 3 0		

conv2d_1 (Conv2D)	(None, None, None, 3 864	input_1[0][0]
batch_normalization_1 (BatchNor	(None, None, None, 3 128	conv2d_1[0][0]
leaky_re_lu_1 (LeakyReLU)	(None, None, None, 3 0	
batch_normalization_1[0][0]		
zero_padding2d_1 (ZeroPadding2D	(None, None, None, 3 0	
leaky_re_lu_1[0][0]		
conv2d_2 (Conv2D)	(None, None, None, 6 18432	
zero_padding2d_1[0][0]		
batch_normalization_2 (BatchNor	(None, None, None, 6 256	conv2d_2[0][0]
leaky_re_lu_2 (LeakyReLU)	(None, None, None, 6 0	
batch_normalization_2[0][0]		
conv2d_3 (Conv2D)	(None, None, None, 3 2048	
leaky_re_lu_2[0][0]		
batch_normalization_3 (BatchNor	(None, None, None, 3 128	conv2d_3[0][0]
leaky_re_lu_3 (LeakyReLU)	(None, None, None, 3 0	
batch_normalization_3[0][0]		
conv2d_4 (Conv2D)	(None, None, None, 6 18432	
leaky_re_lu_3[0][0]		
batch_normalization_4 (BatchNor	(None, None, None, 6 256	conv2d_4[0][0]
leaky_re_lu_4 (LeakyReLU)	(None, None, None, 6 0	
batch_normalization_4[0][0]		
add_1 (Add)	(None, None, None, 6 0	
leaky_re_lu_2[0][0]		
leaky_re_lu_4[0][0]		

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zero\_padding2d\_2 (ZeroPadding2D (None, None, None, 6 0 add\_1[0][0]

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conv2d\_5 (Conv2D) (None, None, None, 1 73728 zero\_padding2d\_2[0][0]

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---

batch\_normalization\_5 (BatchNor (None, None, None, 1 512 conv2d\_5[0][0]

---

---

leaky\_re\_lu\_5 (LeakyReLU) (None, None, None, 1 0 batch\_normalization\_5[0][0]

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---

conv2d\_6 (Conv2D) (None, None, None, 6 8192 leaky\_re\_lu\_5[0][0]

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batch\_normalization\_6 (BatchNor (None, None, None, 6 256 conv2d\_6[0][0]

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---

leaky\_re\_lu\_6 (LeakyReLU) (None, None, None, 6 0 batch\_normalization\_6[0][0]

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conv2d\_7 (Conv2D) (None, None, None, 1 73728 leaky\_re\_lu\_6[0][0]

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batch\_normalization\_7 (BatchNor (None, None, None, 1 512 conv2d\_7[0][0]

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---

leaky\_re\_lu\_7 (LeakyReLU) (None, None, None, 1 0 batch\_normalization\_7[0][0]

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---

add\_2 (Add) (None, None, None, 1 0 leaky\_re\_lu\_5[0][0]

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leaky\_re\_lu\_7[0][0]

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---

conv2d\_8 (Conv2D) (None, None, None, 6 8192 add\_2[0][0]

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---

batch\_normalization\_8 (BatchNor (None, None, None, 6 256 conv2d\_8[0][0]

---

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leaky\_re\_lu\_8 (LeakyReLU) (None, None, None, 6 0 batch\_normalization\_8[0][0]

conv2d_9 (Conv2D) leaky_re_lu_8[0][0]	(None, None, None, 1 73728	
batch_normalization_9 (BatchNor batch_normalization_9[0][0]	(None, None, None, 1 512	conv2d_9[0][0]
leaky_re_lu_9 (LeakyReLU) batch_normalization_9[0][0]	(None, None, None, 1 0	
add_3 (Add)	(None, None, None, 1 0	add_2[0][0]
leaky_re_lu_9[0][0]		
zero_padding2d_3 (ZeroPadding2D zero_padding2d_3[0][0]	(None, None, None, 1 0	add_3[0][0]
conv2d_10 (Conv2D) zero_padding2d_3[0][0]	(None, None, None, 2 294912	
batch_normalization_10 (BatchNo batch_normalization_10[0][0]	(None, None, None, 2 1024	conv2d_10[0][0]
leaky_re_lu_10 (LeakyReLU) batch_normalization_10[0][0]	(None, None, None, 2 0	
conv2d_11 (Conv2D) leaky_re_lu_10[0][0]	(None, None, None, 1 32768	
batch_normalization_11 (BatchNo batch_normalization_11[0][0]	(None, None, None, 1 512	conv2d_11[0][0]
leaky_re_lu_11 (LeakyReLU) batch_normalization_11[0][0]	(None, None, None, 1 0	
conv2d_12 (Conv2D) leaky_re_lu_11[0][0]	(None, None, None, 2 294912	
batch_normalization_12 (BatchNo batch_normalization_12[0][0]	(None, None, None, 2 1024	conv2d_12[0][0]
leaky_re_lu_12 (LeakyReLU) batch_normalization_12[0][0]	(None, None, None, 2 0	

add_4 (Add)	(None, None, None, 2 0
leaky_re_lu_10[0] [0]	
<hr/>	
leaky_re_lu_12[0] [0]	
<hr/>	
conv2d_13 (Conv2D)	(None, None, None, 1 32768
	add_4[0] [0]
<hr/>	
batch_normalization_13 (BatchNo	(None, None, None, 1 512
	conv2d_13[0] [0]
<hr/>	
leaky_re_lu_13 (LeakyReLU)	(None, None, None, 1 0
batch_normalization_13[0] [0]	
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conv2d_14 (Conv2D)	(None, None, None, 2 294912
leaky_re_lu_13[0] [0]	
<hr/>	
batch_normalization_14 (BatchNo	(None, None, None, 2 1024
	conv2d_14[0] [0]
<hr/>	
leaky_re_lu_14 (LeakyReLU)	(None, None, None, 2 0
batch_normalization_14[0] [0]	
<hr/>	
add_5 (Add)	(None, None, None, 2 0
	add_4[0] [0]
<hr/>	
leaky_re_lu_14[0] [0]	
<hr/>	
conv2d_15 (Conv2D)	(None, None, None, 1 32768
	add_5[0] [0]
<hr/>	
batch_normalization_15 (BatchNo	(None, None, None, 1 512
	conv2d_15[0] [0]
<hr/>	
leaky_re_lu_15 (LeakyReLU)	(None, None, None, 1 0
batch_normalization_15[0] [0]	
<hr/>	
conv2d_16 (Conv2D)	(None, None, None, 2 294912
leaky_re_lu_15[0] [0]	
<hr/>	
batch_normalization_16 (BatchNo	(None, None, None, 2 1024
	conv2d_16[0] [0]
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leaky\_re\_lu\_16 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_16[0][0]

---

add\_6 (Add) (None, None, None, 2 0 add\_5[0][0]

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leaky\_re\_lu\_16[0][0]

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conv2d\_17 (Conv2D) (None, None, None, 1 32768 add\_6[0][0]

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batch\_normalization\_17 (BatchNo (None, None, None, 1 512 conv2d\_17[0][0]

---

leaky\_re\_lu\_17 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_17[0][0]

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conv2d\_18 (Conv2D) (None, None, None, 2 294912  
leaky\_re\_lu\_17[0][0]

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batch\_normalization\_18 (BatchNo (None, None, None, 2 1024 conv2d\_18[0][0]

---

leaky\_re\_lu\_18 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_18[0][0]

---

add\_7 (Add) (None, None, None, 2 0 add\_6[0][0]

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leaky\_re\_lu\_18[0][0]

---

conv2d\_19 (Conv2D) (None, None, None, 1 32768 add\_7[0][0]

---

batch\_normalization\_19 (BatchNo (None, None, None, 1 512 conv2d\_19[0][0]

---

leaky\_re\_lu\_19 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_19[0][0]

---

conv2d\_20 (Conv2D) (None, None, None, 2 294912  
leaky\_re\_lu\_19[0][0]

---

batch\_normalization\_20 (BatchNo (None, None, None, 2 1024 conv2d\_20[0][0]

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---

leaky\_re\_lu\_20 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_20[0][0]

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add\_8 (Add) (None, None, None, 2 0 add\_7[0][0]

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leaky\_re\_lu\_20[0][0]

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conv2d\_21 (Conv2D) (None, None, None, 1 32768 add\_8[0][0]

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batch\_normalization\_21 (BatchNo (None, None, None, 1 512 conv2d\_21[0][0]

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leaky\_re\_lu\_21 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_21[0][0]

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conv2d\_22 (Conv2D) (None, None, None, 2 294912  
leaky\_re\_lu\_21[0][0]

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batch\_normalization\_22 (BatchNo (None, None, None, 2 1024 conv2d\_22[0][0]

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leaky\_re\_lu\_22 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_22[0][0]

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add\_9 (Add) (None, None, None, 2 0 add\_8[0][0]

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leaky\_re\_lu\_22[0][0]

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conv2d\_23 (Conv2D) (None, None, None, 1 32768 add\_9[0][0]

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---

batch\_normalization\_23 (BatchNo (None, None, None, 1 512 conv2d\_23[0][0]

---

---

leaky\_re\_lu\_23 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_23[0][0]

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conv2d\_24 (Conv2D) (None, None, None, 2 294912  
leaky\_re\_lu\_23[0][0]

---

batch\_normalization\_24 (BatchNo (None, None, None, 2 1024 conv2d\_24[0][0])  

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---

leaky\_re\_lu\_24 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_24[0][0])  

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add\_10 (Add) (None, None, None, 2 0 add\_9[0][0])  
  
leaky\_re\_lu\_24[0][0]  

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conv2d\_25 (Conv2D) (None, None, None, 1 32768 add\_10[0][0])  

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---

batch\_normalization\_25 (BatchNo (None, None, None, 1 512 conv2d\_25[0][0])  

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---

leaky\_re\_lu\_25 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_25[0][0])  

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conv2d\_26 (Conv2D) (None, None, None, 2 294912  
leaky\_re\_lu\_25[0][0])  

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---

batch\_normalization\_26 (BatchNo (None, None, None, 2 1024 conv2d\_26[0][0])  

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leaky\_re\_lu\_26 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_26[0][0])  

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add\_11 (Add) (None, None, None, 2 0 add\_10[0][0])  
  
leaky\_re\_lu\_26[0][0]  

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zero\_padding2d\_4 (ZeroPadding2D (None, None, None, 2 0 add\_11[0][0])  

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conv2d\_27 (Conv2D) (None, None, None, 5 1179648  
zero\_padding2d\_4[0][0])  

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batch\_normalization\_27 (BatchNo (None, None, None, 5 2048 conv2d\_27[0][0])  

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leaky\_re\_lu\_27 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_27[0][0])

conv2d_28 (Conv2D) leaky_re_lu_27[0] [0]	(None, None, None, 2 131072)	
batch_normalization_28 (BatchNo batch_normalization_28[0] [0]	(None, None, None, 2 1024)	conv2d_28[0] [0]
leaky_re_lu_28 (LeakyReLU) batch_normalization_28[0] [0]	(None, None, None, 2 0)	
conv2d_29 (Conv2D) leaky_re_lu_28[0] [0]	(None, None, None, 5 1179648)	
batch_normalization_29 (BatchNo batch_normalization_29[0] [0]	(None, None, None, 5 2048)	conv2d_29[0] [0]
leaky_re_lu_29 (LeakyReLU) batch_normalization_29[0] [0]	(None, None, None, 5 0)	
add_12 (Add) leaky_re_lu_27[0] [0]	(None, None, None, 5 0)	
leaky_re_lu_29[0] [0]		
conv2d_30 (Conv2D)	(None, None, None, 2 131072)	add_12[0] [0]
batch_normalization_30 (BatchNo batch_normalization_30[0] [0]	(None, None, None, 2 1024)	conv2d_30[0] [0]
leaky_re_lu_30 (LeakyReLU) batch_normalization_30[0] [0]	(None, None, None, 2 0)	
conv2d_31 (Conv2D) leaky_re_lu_30[0] [0]	(None, None, None, 5 1179648)	
batch_normalization_31 (BatchNo batch_normalization_31[0] [0]	(None, None, None, 5 2048)	conv2d_31[0] [0]
leaky_re_lu_31 (LeakyReLU) batch_normalization_31[0] [0]	(None, None, None, 5 0)	
add_13 (Add)	(None, None, None, 5 0)	add_12[0] [0]

leaky\_re\_lu\_31[0] [0]

---

conv2d\_32 (Conv2D) (None, None, None, 2 131072 add\_13[0] [0])

---

batch\_normalization\_32 (BatchNo (None, None, None, 2 1024 conv2d\_32[0] [0])

---

leaky\_re\_lu\_32 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_32[0] [0])

---

conv2d\_33 (Conv2D) (None, None, None, 5 1179648  
leaky\_re\_lu\_32[0] [0])

---

batch\_normalization\_33 (BatchNo (None, None, None, 5 2048 conv2d\_33[0] [0])

---

leaky\_re\_lu\_33 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_33[0] [0])

---

add\_14 (Add) (None, None, None, 5 0 add\_13[0] [0])

---

leaky\_re\_lu\_33[0] [0]

---

conv2d\_34 (Conv2D) (None, None, None, 2 131072 add\_14[0] [0])

---

batch\_normalization\_34 (BatchNo (None, None, None, 2 1024 conv2d\_34[0] [0])

---

leaky\_re\_lu\_34 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_34[0] [0])

---

conv2d\_35 (Conv2D) (None, None, None, 5 1179648  
leaky\_re\_lu\_34[0] [0])

---

batch\_normalization\_35 (BatchNo (None, None, None, 5 2048 conv2d\_35[0] [0])

---

leaky\_re\_lu\_35 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_35[0] [0])

---

add_15 (Add)	(None, None, None, 5 0	add_14[0][0]
<hr/>		
conv2d_36 (Conv2D)	(None, None, None, 2 131072	add_15[0][0]
<hr/>		
batch_normalization_36 (BatchNo	(None, None, None, 2 1024	conv2d_36[0][0]
<hr/>		
leaky_re_lu_36 (LeakyReLU)	(None, None, None, 2 0	
batch_normalization_36[0][0]		
<hr/>		
conv2d_37 (Conv2D)	(None, None, None, 5 1179648	
leaky_re_lu_36[0][0]		
<hr/>		
batch_normalization_37 (BatchNo	(None, None, None, 5 2048	conv2d_37[0][0]
<hr/>		
leaky_re_lu_37 (LeakyReLU)	(None, None, None, 5 0	
batch_normalization_37[0][0]		
<hr/>		
add_16 (Add)	(None, None, None, 5 0	add_15[0][0]
leaky_re_lu_37[0][0]		
<hr/>		
conv2d_38 (Conv2D)	(None, None, None, 2 131072	add_16[0][0]
<hr/>		
batch_normalization_38 (BatchNo	(None, None, None, 2 1024	conv2d_38[0][0]
<hr/>		
leaky_re_lu_38 (LeakyReLU)	(None, None, None, 2 0	
batch_normalization_38[0][0]		
<hr/>		
conv2d_39 (Conv2D)	(None, None, None, 5 1179648	
leaky_re_lu_38[0][0]		
<hr/>		
batch_normalization_39 (BatchNo	(None, None, None, 5 2048	conv2d_39[0][0]
<hr/>		
leaky_re_lu_39 (LeakyReLU)	(None, None, None, 5 0	
batch_normalization_39[0][0]		

add_17 (Add)	(None, None, None, 5 0	add_16[0][0]
<hr/>		
leaky_re_lu_39[0][0]		
<hr/>		
conv2d_40 (Conv2D)	(None, None, None, 2 131072	add_17[0][0]
<hr/>		
batch_normalization_40 (BatchNo	(None, None, None, 2 1024	conv2d_40[0][0]
<hr/>		
leaky_re_lu_40 (LeakyReLU)	(None, None, None, 2 0	
batch_normalization_40[0][0]		
<hr/>		
conv2d_41 (Conv2D)	(None, None, None, 5 1179648	
leaky_re_lu_40[0][0]		
<hr/>		
batch_normalization_41 (BatchNo	(None, None, None, 5 2048	conv2d_41[0][0]
<hr/>		
leaky_re_lu_41 (LeakyReLU)	(None, None, None, 5 0	
batch_normalization_41[0][0]		
<hr/>		
add_18 (Add)	(None, None, None, 5 0	add_17[0][0]
leaky_re_lu_41[0][0]		
<hr/>		
conv2d_42 (Conv2D)	(None, None, None, 2 131072	add_18[0][0]
<hr/>		
batch_normalization_42 (BatchNo	(None, None, None, 2 1024	conv2d_42[0][0]
<hr/>		
leaky_re_lu_42 (LeakyReLU)	(None, None, None, 2 0	
batch_normalization_42[0][0]		
<hr/>		
conv2d_43 (Conv2D)	(None, None, None, 5 1179648	
leaky_re_lu_42[0][0]		
<hr/>		
batch_normalization_43 (BatchNo	(None, None, None, 5 2048	conv2d_43[0][0]
<hr/>		

leaky\_re\_lu\_43 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_43[0][0]

---

add\_19 (Add) (None, None, None, 5 0 add\_18[0][0]

---

leaky\_re\_lu\_43[0][0]

---

zero\_padding2d\_5 (ZeroPadding2D (None, None, None, 5 0 add\_19[0][0]

---

conv2d\_44 (Conv2D) (None, None, None, 1 4718592  
zero\_padding2d\_5[0][0]

---

batch\_normalization\_44 (BatchNo (None, None, None, 1 4096 conv2d\_44[0][0]

---

leaky\_re\_lu\_44 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_44[0][0]

---

conv2d\_45 (Conv2D) (None, None, None, 5 524288  
leaky\_re\_lu\_44[0][0]

---

batch\_normalization\_45 (BatchNo (None, None, None, 5 2048 conv2d\_45[0][0]

---

leaky\_re\_lu\_45 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_45[0][0]

---

conv2d\_46 (Conv2D) (None, None, None, 1 4718592  
leaky\_re\_lu\_45[0][0]

---

batch\_normalization\_46 (BatchNo (None, None, None, 1 4096 conv2d\_46[0][0]

---

leaky\_re\_lu\_46 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_46[0][0]

---

add\_20 (Add) (None, None, None, 1 0  
leaky\_re\_lu\_44[0][0]

---

leaky\_re\_lu\_46[0][0]

---

conv2d\_47 (Conv2D) (None, None, None, 5 524288 add\_20[0][0]

---

---

batch\_normalization\_47 (BatchNo (None, None, None, 5 2048 conv2d\_47[0][0]

---

---

---

leaky\_re\_lu\_47 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_47[0][0]

---

---

---

conv2d\_48 (Conv2D) (None, None, None, 1 4718592  
leaky\_re\_lu\_47[0][0]

---

---

---

batch\_normalization\_48 (BatchNo (None, None, None, 1 4096 conv2d\_48[0][0]

---

---

---

leaky\_re\_lu\_48 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_48[0][0]

---

---

---

add\_21 (Add) (None, None, None, 1 0 add\_20[0][0]

---

---

---

leaky\_re\_lu\_48[0][0]

---

---

---

conv2d\_49 (Conv2D) (None, None, None, 5 524288 add\_21[0][0]

---

---

---

batch\_normalization\_49 (BatchNo (None, None, None, 5 2048 conv2d\_49[0][0]

---

---

---

leaky\_re\_lu\_49 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_49[0][0]

---

---

---

conv2d\_50 (Conv2D) (None, None, None, 1 4718592  
leaky\_re\_lu\_49[0][0]

---

---

---

batch\_normalization\_50 (BatchNo (None, None, None, 1 4096 conv2d\_50[0][0]

---

---

---

leaky\_re\_lu\_50 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_50[0][0]

---

---

---

add\_22 (Add) (None, None, None, 1 0 add\_21[0][0]

---

---

---

leaky\_re\_lu\_50[0][0]

---

conv2d_51 (Conv2D)	(None, None, None, 5 524288	add_22[0][0]
batch_normalization_51 (BatchNo	(None, None, None, 5 2048	conv2d_51[0][0]
leaky_re_lu_51 (LeakyReLU)	(None, None, None, 5 0	
batch_normalization_51[0][0]		
conv2d_52 (Conv2D)	(None, None, None, 1 4718592	
leaky_re_lu_51[0][0]		
batch_normalization_52 (BatchNo	(None, None, None, 1 4096	conv2d_52[0][0]
leaky_re_lu_52 (LeakyReLU)	(None, None, None, 1 0	
batch_normalization_52[0][0]		
add_23 (Add)	(None, None, None, 1 0	add_22[0][0]
leaky_re_lu_52[0][0]		
conv2d_53 (Conv2D)	(None, None, None, 5 524288	add_23[0][0]
batch_normalization_53 (BatchNo	(None, None, None, 5 2048	conv2d_53[0][0]
leaky_re_lu_53 (LeakyReLU)	(None, None, None, 5 0	
batch_normalization_53[0][0]		
conv2d_54 (Conv2D)	(None, None, None, 1 4718592	
leaky_re_lu_53[0][0]		
batch_normalization_54 (BatchNo	(None, None, None, 1 4096	conv2d_54[0][0]
leaky_re_lu_54 (LeakyReLU)	(None, None, None, 1 0	
batch_normalization_54[0][0]		
conv2d_55 (Conv2D)	(None, None, None, 5 524288	
leaky_re_lu_54[0][0]		

batch\_normalization\_55 (BatchNo (None, None, None, 5 2048 conv2d\_55[0][0])  

---

---

leaky\_re\_lu\_55 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_55[0][0])  

---

---

conv2d\_56 (Conv2D) (None, None, None, 1 4718592  
leaky\_re\_lu\_55[0][0])  

---

---

batch\_normalization\_56 (BatchNo (None, None, None, 1 4096 conv2d\_56[0][0])  

---

---

leaky\_re\_lu\_56 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_56[0][0])  

---

---

conv2d\_57 (Conv2D) (None, None, None, 5 524288  
leaky\_re\_lu\_56[0][0])  

---

---

batch\_normalization\_57 (BatchNo (None, None, None, 5 2048 conv2d\_57[0][0])  

---

---

leaky\_re\_lu\_57 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_57[0][0])  

---

---

conv2d\_60 (Conv2D) (None, None, None, 2 131072  
leaky\_re\_lu\_57[0][0])  

---

---

batch\_normalization\_59 (BatchNo (None, None, None, 2 1024 conv2d\_60[0][0])  

---

---

leaky\_re\_lu\_59 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_59[0][0])  

---

---

up\_sampling2d\_1 (UpSampling2D) (None, None, None, 2 0  
leaky\_re\_lu\_59[0][0])  

---

---

concatenate\_1 (Concatenate) (None, None, None, 7 0  
up\_sampling2d\_1[0][0]) add\_19[0][0]  

---

---

conv2d\_61 (Conv2D) (None, None, None, 2 196608  
concatenate\_1[0][0])  

---

---

batch\_normalization\_60 (BatchNo (None, None, None, 2 1024 conv2d\_61[0][0])  

---

---

leaky\_re\_lu\_60 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_60[0][0])  

---

---

conv2d\_62 (Conv2D) (None, None, None, 5 1179648  
leaky\_re\_lu\_60[0][0])  

---

---

batch\_normalization\_61 (BatchNo (None, None, None, 5 2048 conv2d\_62[0][0])  

---

---

leaky\_re\_lu\_61 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_61[0][0])  

---

---

conv2d\_63 (Conv2D) (None, None, None, 2 131072  
leaky\_re\_lu\_61[0][0])  

---

---

batch\_normalization\_62 (BatchNo (None, None, None, 2 1024 conv2d\_63[0][0])  

---

---

leaky\_re\_lu\_62 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_62[0][0])  

---

---

conv2d\_64 (Conv2D) (None, None, None, 5 1179648  
leaky\_re\_lu\_62[0][0])  

---

---

batch\_normalization\_63 (BatchNo (None, None, None, 5 2048 conv2d\_64[0][0])  

---

---

leaky\_re\_lu\_63 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_63[0][0])  

---

---

conv2d\_65 (Conv2D) (None, None, None, 2 131072  
leaky\_re\_lu\_63[0][0])  

---

---

batch\_normalization\_64 (BatchNo (None, None, None, 2 1024 conv2d\_65[0][0])  

---

---

leaky\_re\_lu\_64 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_64[0][0])  

---

---

conv2d\_68 (Conv2D) (None, None, None, 1 32768  
leaky\_re\_lu\_64[0][0])

---

---

batch\_normalization\_66 (BatchNo (None, None, None, 1 512 conv2d\_68[0][0])

---

---

leaky\_re\_lu\_66 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_66[0][0])

---

---

up\_sampling2d\_2 (UpSampling2D) (None, None, None, 1 0  
leaky\_re\_lu\_66[0][0])

---

---

concatenate\_2 (Concatenate) (None, None, None, 3 0  
up\_sampling2d\_2[0][0] add\_11[0][0])

---

---

conv2d\_69 (Conv2D) (None, None, None, 1 49152  
concatenate\_2[0][0])

---

---

batch\_normalization\_67 (BatchNo (None, None, None, 1 512 conv2d\_69[0][0])

---

---

leaky\_re\_lu\_67 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_67[0][0])

---

---

conv2d\_70 (Conv2D) (None, None, None, 2 294912  
leaky\_re\_lu\_67[0][0])

---

---

batch\_normalization\_68 (BatchNo (None, None, None, 2 1024 conv2d\_70[0][0])

---

---

leaky\_re\_lu\_68 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_68[0][0])

---

---

conv2d\_71 (Conv2D) (None, None, None, 1 32768  
leaky\_re\_lu\_68[0][0])

---

---

batch\_normalization\_69 (BatchNo (None, None, None, 1 512 conv2d\_71[0][0])

---

---

leaky\_re\_lu\_69 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_69[0][0])

---

---

conv2d\_72 (Conv2D) (None, None, None, 2 294912  
leaky\_re\_lu\_69[0][0])

---

---

batch\_normalization\_70 (BatchNo (None, None, None, 2 1024 conv2d\_72[0][0])

---

---

leaky\_re\_lu\_70 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_70[0][0])

---

---

conv2d\_73 (Conv2D) (None, None, None, 1 32768  
leaky\_re\_lu\_70[0][0])

---

---

batch\_normalization\_71 (BatchNo (None, None, None, 1 512 conv2d\_73[0][0])

---

---

leaky\_re\_lu\_71 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_71[0][0])

---

---

conv2d\_58 (Conv2D) (None, None, None, 1 4718592  
leaky\_re\_lu\_57[0][0])

---

---

conv2d\_66 (Conv2D) (None, None, None, 5 1179648  
leaky\_re\_lu\_64[0][0])

---

---

conv2d\_74 (Conv2D) (None, None, None, 2 294912  
leaky\_re\_lu\_71[0][0])

---

---

batch\_normalization\_58 (BatchNo (None, None, None, 1 4096 conv2d\_58[0][0])

---

---

batch\_normalization\_65 (BatchNo (None, None, None, 5 2048 conv2d\_66[0][0])

---

---

batch\_normalization\_72 (BatchNo (None, None, None, 2 1024 conv2d\_74[0][0])

---

---

leaky\_re\_lu\_58 (LeakyReLU) (None, None, None, 1 0  
batch\_normalization\_58[0][0])

---

---

leaky\_re\_lu\_65 (LeakyReLU) (None, None, None, 5 0  
batch\_normalization\_65[0][0])

---

---

leaky\_re\_lu\_72 (LeakyReLU) (None, None, None, 2 0  
batch\_normalization\_72[0][0])

---

```

conv2d_59 (Conv2D)           (None, None, None, 2 24600
leaky_re_lu_58[0][0]

-----
conv2d_67 (Conv2D)           (None, None, None, 2 12312
leaky_re_lu_65[0][0]

-----
conv2d_75 (Conv2D)           (None, None, None, 2 6168
leaky_re_lu_72[0][0]

-----
input_2 (InputLayer)          (None, 13, 13, 3, 8) 0

-----
input_3 (InputLayer)          (None, 26, 26, 3, 8) 0

-----
input_4 (InputLayer)          (None, 52, 52, 3, 8) 0

-----
yolo_loss (Lambda)            (None, 1)             0      conv2d_59[0][0]
                                         conv2d_67[0][0]
                                         conv2d_75[0][0]
                                         input_2[0][0]
                                         input_3[0][0]
                                         input_4[0][0]

=====
=====

Total params: 61,587,112
Trainable params: 61,534,504
Non-trainable params: 52,608

```

## 训练callbacks定义

```

from keras.callbacks import ReduceLROnPlateau, EarlyStopping, ModelCheckpoint

reduce_lr = ReduceLROnPlateau(monitor='val_loss', factor=0.1, patience=3,
verbose=1)
early_stopping = EarlyStopping(monitor='val_loss', min_delta=0, patience=10,
verbose=1)

```

## 读取数据

```

import numpy as np
val_split = 0.1
with open(annotation_path) as f:
    lines = f.readlines()
np.random.seed(10101)
np.random.shuffle(lines)
np.random.seed(None)
num_val = int(len(lines)*val_split)
num_train = len(lines) - num_val

```

## 读取数据函数

```

def data_generator(annotation_lines, batch_size, input_shape, anchors,
num_classes):
    '''data generator for fit_generator'''
    n = len(annotation_lines)
    i = 0
    while True:
        image_data = []
        box_data = []
        for b in range(batch_size):
            if i==0:
                np.random.shuffle(annotation_lines)
            image, box = get_random_data(annotation_lines[i], input_shape,
random=True)
                image_data.append(image)
                box_data.append(box)
                i = (i+1) % n
            image_data = np.array(image_data)
            box_data = np.array(box_data)
            y_true = preprocess_true_boxes(box_data, input_shape, anchors,
num_classes)
            yield [image_data, *y_true], np.zeros(batch_size)

def data_generator_wrapper(annotation_lines, batch_size, input_shape, anchors,
num_classes):
    n = len(annotation_lines)
    if n==0 or batch_size<=0: return None
    return data_generator(annotation_lines, batch_size, input_shape, anchors,
num_classes)

```

## 训练周期数设定

```

import os
os.makedirs(log_dir, exist_ok=True)
frozen_train_epoch = 5
fine_tuning_epoch = 5

```

## 冻结时训练参数

```

from keras.optimizers import Adam
from yolo3.utils import get_random_data
if frozen_train_epoch:
    model.compile(optimizer=Adam(lr=1e-3), loss={
        # use custom yolo_loss Lambda layer.

```

```

'yolo_loss': lambda y_true, y_pred: y_pred})

batch_size = 8
print('Train on {} samples, val on {} samples, with batch size
{}.'.format(num_train, num_val, batch_size))
model.fit_generator(data_generator_wrapper(lines[:num_train], batch_size,
input_shape, anchors, num_classes),
steps_per_epoch=max(1, num_train//batch_size),
validation_data=data_generator_wrapper(lines[num_train:], batch_size,
input_shape, anchors, num_classes),
validation_steps=max(1, num_val//batch_size),
epochs=frozen_train_epoch,
initial_epoch=0,
callbacks=[])

model.save_weights(log_dir + 'trained_weights_stage_1.h5')

```

```

Train on 4287 samples, val on 476 samples, with batch size 8.
Epoch 1/5
535/535 [=====] - 358s 669ms/step - loss: 121.2328 -
val_loss: 43.5569
Epoch 2/5
535/535 [=====] - 332s 621ms/step - loss: 45.2910 -
val_loss: 38.0415
Epoch 3/5
535/535 [=====] - 335s 626ms/step - loss: 41.9102 -
val_loss: 37.2522
Epoch 4/5
535/535 [=====] - 339s 634ms/step - loss: 40.9120 -
val_loss: 35.4150
Epoch 5/5
535/535 [=====] - 337s 630ms/step - loss: 59.7642 -
val_loss: 454135.6431

```

## fine tuning

```

for i in range(len(model.layers)):
    model.layers[i].trainable = True
model.compile(optimizer=Adam(lr=1e-4), loss={'yolo_loss': lambda y_true, y_pred:
y_pred}) # recompile to apply the change
print('Unfreeze all of the layers.')

batch_size = 2 # note that more GPU memory is required after unfreezing the body
print('Train on {} samples, val on {} samples, with batch size
{}.'.format(num_train, num_val, batch_size))
model.fit_generator(data_generator_wrapper(lines[:num_train], batch_size,
input_shape, anchors, num_classes),
steps_per_epoch=max(1, num_train//batch_size),
validation_data=data_generator_wrapper(lines[num_train:], batch_size,
input_shape, anchors, num_classes),
validation_steps=max(1, num_val//batch_size),
epochs=frozen_train_epoch+fine_tuning_epoch,
initial_epoch=frozen_train_epoch,
callbacks=[reduce_lr, early_stopping])
model.save_weights(log_dir + 'trained_weights_final.h5')

```

```
Unfreeze all of the layers.  
Train on 4287 samples, val on 476 samples, with batch size 2.  
Epoch 6/10  
2143/2143 [=====] - 401s 187ms/step - loss: 63.9933 -  
val_loss: 81.5493  
Epoch 7/10  
2143/2143 [=====] - 378s 176ms/step - loss: 55.0096 -  
val_loss: 182.4871  
Epoch 8/10  
2143/2143 [=====] - 378s 176ms/step - loss: 50.0493 -  
val_loss: 52.6781  
Epoch 9/10  
2143/2143 [=====] - 379s 177ms/step - loss: 47.5252 -  
val_loss: 47.6857  
Epoch 10/10  
2142/2143 [=====>.] - ETA: 0s - loss: 45.6222
```

## 训练结果展示

### 展示测试集前几张图片

```
# 在预测之前，需要将（可能发生的）之前预测的结果删除  
!rm input/detection-results/*  
!rm input/ground-truth/*  
!rm -rf results  
!rm -rf test_result  
!mkdir -p input/detection-results  
!mkdir -p input/ground-truth  
!mkdir test_result
```

```
rm: cannot remove 'input/detection-results/*': No such file or directory  
rm: cannot remove 'input/ground-truth/*': No such file or directory
```

```
import random, os  
from PIL import Image  
from yolo_video_ import detect_img_many, path_construct  
class_path = 'model_data/oldDrawingClasses.txt'  
log_dir = 'logs/'  
anchors_path = 'model_data/yolo_anchors.txt'  
h5_file = log_dir + 'trained_weights_final.h5'  
# 随机在测试集中选取10张图片进行标注  
inputs, outputs, gt_files, dr_files = path_construct(10)  
detect_img_many(h5_file, anchors_path, class_path, inputs, outputs, gt_files,  
dr_files)  
# 显示标注结果  
from IPython.display import display  
for output in outputs:  
    display(Image.open(output))
```

```
logs/trained_weights_final.h5 model, anchors, and classes loaded.  
(416, 416, 3)  
Found 0 boxes for img
```

```
3.972397169098258
(416, 416, 3)
Found 0 boxes for img
0.055635412223637104
(416, 416, 3)
Found 0 boxes for img
0.05384439788758755
(416, 416, 3)
Found 0 boxes for img
0.04201371408998966
(416, 416, 3)
Found 0 boxes for img
0.04886780818924308
(416, 416, 3)
Found 0 boxes for img
0.04431925993412733
(416, 416, 3)
Found 0 boxes for img
0.08189580822363496
(416, 416, 3)
Found 0 boxes for img
0.053870758041739464
(416, 416, 3)
Found 1 boxes for img
person 0.38 (255, 453) (313, 586)
0.05450587905943394
(416, 416, 3)
Found 0 boxes for img
0.04383068485185504
```



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中畫 000241N0000000000

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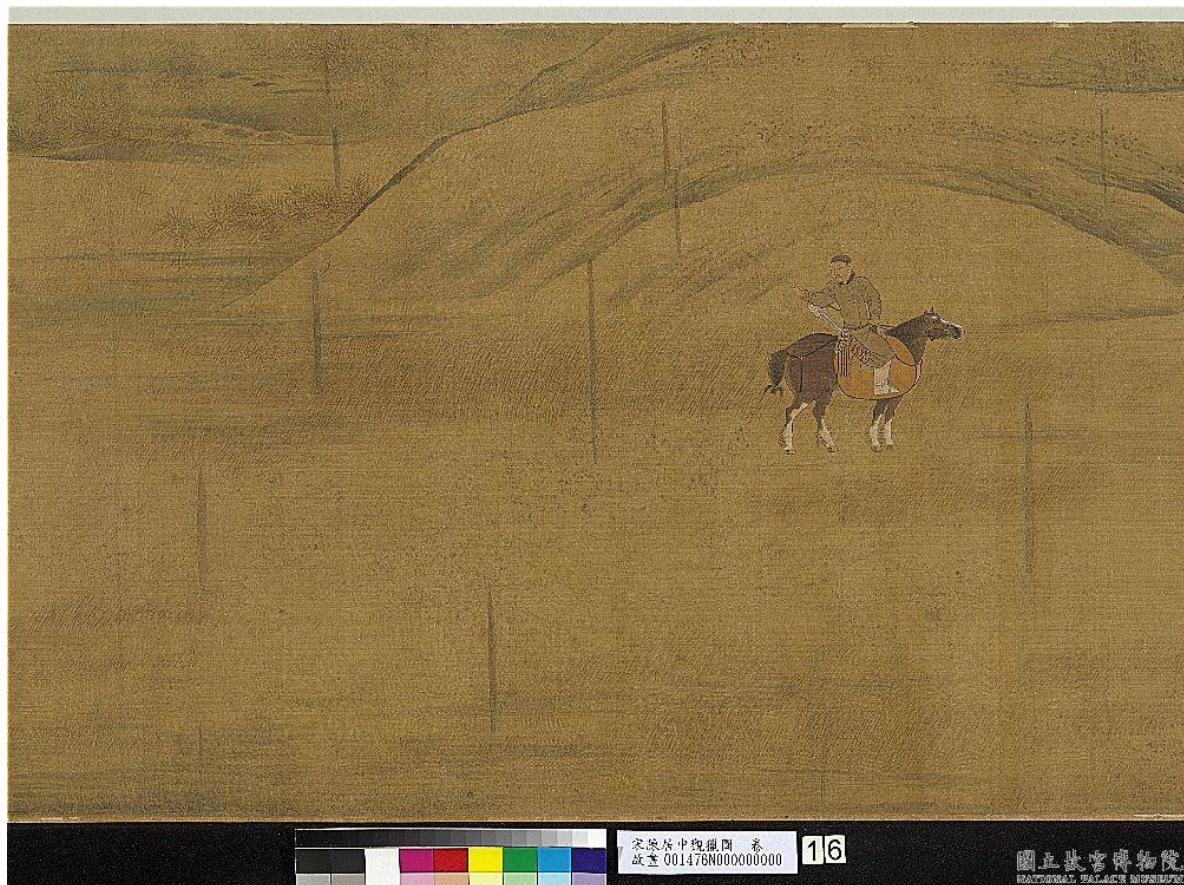
龍腰琴式

魯涓子作腰  
間半月形三  
絃如七絃文  
音常遊江淮  
撫弄非常俗  
之声遇女抱  
綠綺撫美有  
神仙調引涓  
子近之曰妾  
昆陵之女也  
常操清江引



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