```
#Imports the print function from newer versions of python
from __future__ import print_function

%tensorflow_version 1.x
%matplotlib inline
```

```
import numpy as np
```

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
zip_path = "/content/drive/My Drive/Object_Detection_from_Satellite_Imagery_Data/SIMD.zip"
```

```
!unzip '$zip_path' -d ./data/
!unzip -q 'data/SIMS dataset/images.zip' -d data/
!unzip -q 'data/SIMS dataset/Annotations_in_3_formats.zip' -d data
```

```
Archive:  /content/drive/My Drive/Object_Detection_from_Satellite_Imagery_Data/SIMD.zip
  inflating: ./data/SIMS dataset/test.txt
  inflating: ./data/SIMS dataset/training.txt
  inflating: ./data/SIMS dataset/validation.txt
  inflating: ./data/SIMS dataset/Assignment-2_modified scope.pdf
  inflating: ./data/SIMS dataset/Annotations_in_3_formats.zip
  inflating: ./data/SIMS dataset/images.zip
```

```
import os, csv, PIL

def create_csv(txt_path, output_path, class_mapping):
  """
  Creates a csv file that can be used with keras-retinanet csv generator
  (Dependencies: [os, csv, PIL])
  """
  # A subfunction to read annotations file
```

```
    # A subfunction to read annotations file
    def read_ann(ann_path):
      with open(ann_path, 'r') as f:
        lines = f.readlines()
      return lines

    # A subfunction to convert percentage centre
    # co-ordinates to x1, y1, x2, y2 absolute co-ordinates
    def get_abs_coord(coords, im_w, im_h):
      n_coords = coords.copy()
      n_coords[0] = (coords[0] - (coords[2]/2)) * im_w
      n_coords[2] = n_coords[0] + (coords[2] * im_w)
      n_coords[1] = (coords[1] - (coords[3]/2)) * im_h
      n_coords[3] = n_coords[1] + (coords[3] * im_h)

      return list(map(int, n_coords))

    # Class ID to name mapping
    id_to_name = class_mapping

    # create_csv continues.
    # A bit of mangling with the path
    root = '/content/data'
    # CSV list to keep track of the lines needed to be written to the csv
    csv_list = []
    with open(txt_path, 'r') as f:
      line = f.readline()
      while line:
        # Get images path
        im_path = line.strip()
        abs_im_path = root + '/' + "/".join(line.strip().split('/')[1:])
        # Get path of annotations for the image
        im_txt_path = os.path.splitext(abs_im_path)[0] + '.txt'
        # Get the annotations
        anns = read_ann(im_txt_path)
        for ann in anns:
          items = ann.strip().split(' ')
          c_id, bb = int(items[0]), list(map(float, items[1:]))
```

```
          # Get the size of the image
          w, h = PIL.Image.open(abs_im_path).size
          # Get absolute co-ordinates
          bb = get_abs_coord(bb, w, h)
          # Row for csv file, converting x,y,w,h to x,y,x1, y1
          csv_list.append([abs_im_path, *bb, id_to_name[c_id]])
        # Read next line
        line = f.readline()

    with open(output_path, 'w', newline="") as f:
        writer = csv.writer(f)
        writer.writerows(csv_list)

```

```
class_mapping = ['Car', 'Truck', 'Van', 'LongVehicle', 'Bus',
                 'Airliner', 'Propeller Aircraft', 'Trainer Aircraft', 'Chartered Aircraft',
                 'Fighter Aircraft', 'Others', 'Stair Truck', 'Pushback Truck',
                 'Helicopter', 'Boat']
class_mapping = dict(enumerate(class_mapping))

create_csv('data/SIMS dataset/training.txt', 'data/training.csv', class_mapping)
create_csv('data/SIMS dataset/test.txt', 'data/test.csv', class_mapping)
create_csv('data/SIMS dataset/validation.txt', 'data/validation.csv', class_mapping)

class_csv = list(map(lambda x: (x[1], x[0]), class_mapping.items()))

with open('data/classes.csv', 'w', newline="") as f:
  writer = csv.writer(f)
  writer.writerows(class_csv)
```

```
!git clone https://github.com/kbardool/keras-frcnn
!mv keras-frcnn/* .
!rm -r keras-frcnn
!pip install -r requirements.txt
```

```
Cloning into 'keras-frcnn'...
remote: Enumerating objects: 589, done.
remote: Total 589 (delta 0), reused 0 (delta 0), pack-reused 589
Receiving objects: 100% (589/589), 173.38 KiB | 739.00 KiB/s, done.
Resolving deltas: 100% (402/402), done.
Requirement already satisfied: h5py in /usr/local/lib/python3.6/dist-packages (from -r requirements.txt (line 1)) (2.10.0)
Collecting Keras==2.0.3
  Downloading https://files.pythonhosted.org/packages/1b/36/fc4b247ec139ad9cc6f223ed10729d85401fc5203703c23457794f9bfe60/Keras-2
     |████████████████████████████████| 204kB 8.1MB/s
Requirement already satisfied: numpy in /usr/local/lib/python3.6/dist-packages (from -r requirements.txt (line 3)) (1.18.4)
Requirement already satisfied: opencv-python in /usr/local/lib/python3.6/dist-packages (from -r requirements.txt (line 4)) (4.1.
Requirement already satisfied: sklearn in /usr/local/lib/python3.6/dist-packages (from -r requirements.txt (line 5)) (0.0)
Requirement already satisfied: six in /usr/local/lib/python3.6/dist-packages (from h5py->-r requirements.txt (line 1)) (1.12.0)
Requirement already satisfied: theano in /usr/local/lib/python3.6/dist-packages (from Keras==2.0.3->-r requirements.txt (line 2)
Requirement already satisfied: pyyaml in /usr/local/lib/python3.6/dist-packages (from Keras==2.0.3->-r requirements.txt (line 2)
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.6/dist-packages (from sklearn->-r requirements.txt (line 5
Requirement already satisfied: scipy>=0.14 in /usr/local/lib/python3.6/dist-packages (from theano->Keras==2.0.3->-r requirements
Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.6/dist-packages (from scikit-learn->sklearn->-r requiremen
Building wheels for collected packages: Keras
  Building wheel for Keras (setup.py) ... done
  Created wheel for Keras: filename=Keras-2.0.3-cp36-none-any.whl size=232962 sha256=a697e6ec5bc6bba681e02ea6a8eb862c78ee82177eb
  Stored in directory: /root/.cache/pip/wheels/a6/fb/de/faea9e49d563a35f198c6dede7f9260074b5beb8f9bffaaaa1
Successfully built Keras
ERROR: textgenrnn 1.4.1 has requirement keras>=2.1.5, but you'll have keras 2.0.3 which is incompatible.
Installing collected packages: Keras
  Found existing installation: Keras 2.3.1
    Uninstalling Keras-2.3.1:
      Successfully uninstalled Keras-2.3.1
Successfully installed Keras-2.0.3
```

```
1  !python train_frcnn.py -o simple -p data/training.csv --num_epochs 1
```

```
Using TensorFlow backend.
Parsing annotation files
Training images per class:
{'Airliner': 756,
 'Boat': 3965,
 'Bus': 1337,
 'Car': 8861,
 'Chartered Aircraft': 485,
 'Fighter Aircraft': 41,
 'Helicopter': 44,
 'LongVehicle': 1241,
 'Others': 595,
 'Propeller Aircraft': 154,
 'Pushback Truck': 141,
 'Stair Truck': 317,
 'Trainer Aircraft': 490,
 'Truck': 1936,
 'Van': 3510,
 'bg': 0}
Num classes (including bg) = 16
Config has been written to config.pickle, and can be loaded when testing to ensure correct results
Num train samples 2707
Num val samples 526
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:47: The name tf.get_default_g

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:351: The name tf.placeholder

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:3176: The name tf.random_unif

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:3043: The name tf.nn.max_pool

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:3153: The name tf.random_norm

WARNING:tensorflow:From /content/keras_frcnn/RoiPoolingConv.py:105: The name tf.image.resize_images is deprecated. Please use tf

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:3045: The name tf.nn.avg_pool

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:1064: calling reduce_prod_v1
Instructions for updating:
keep_dims is deprecated, use keepdims instead
loading weights from resnet50_weights_tf_dim_ordering_tf_kernels.h5
Could not load pretrained model weights. Weights can be found in the keras application folder      https://github.com/fchol
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/optimizers.py:675: The name tf.train.Optimizer is deprecate

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:2642: The name tf.log is depr

WARNING:tensorflow:From /tensorflow-1.15.2/python3.6/tensorflow_core/python/ops/nn_impl.py:183: where (from tensorflow.python.op
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:1046: calling reduce_sum_v1 (
Instructions for updating:
keep_dims is deprecated, use keepdims instead
Starting training
Epoch 1/1
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:768: The name tf.assign_add i

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:521: calling Constant.__init_
Instructions for updating:
Call initializer instance with the dtype argument instead of passing it to the constructor
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:764: The name tf.assign is de

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:141: The name tf.get_default_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:146: The name tf.ConfigProto

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:151: The name tf.Session is d

2020-05-15 11:38:34.891790: I tensorflow/core/platform/cpu_feature_guard.cc:142] Your CPU supports instructions that this Tensor
2020-05-15 11:38:34.916618: I tensorflow/core/platform/profile_utils/cpu_utils.cc:94] CPU Frequency: 2000165000 Hz
2020-05-15 11:38:34.916916: I tensorflow/compiler/xla/service/service.cc:168] XLA service 0x19bd2c0 initialized for platform Hos
2020-05-15 11:38:34.916953: I tensorflow/compiler/xla/service/service.cc:176]   StreamExecutor device (0): Host, Default Version
2020-05-15 11:38:34.923395: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
2020-05-15 11:38:35.158023: I tensorflow/stream_executor/cuda/cuda_gpu_executor.cc:983] successful NUMA node read from SysFS had
2020-05-15 11:38:35.158795: I tensorflow/compiler/xla/service/service.cc:168] XLA service 0x19bd480 initialized for platform CUD
2020-05-15 11:38:35.158846: I tensorflow/compiler/xla/service/service.cc:176]   StreamExecutor device (0): Tesla T4, Compute Cap
2020-05-15 11:38:35.160309: I tensorflow/stream_executor/cuda/cuda_gpu_executor.cc:983] successful NUMA node read from SysFS had
2020-05-15 11:38:35.160928: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1639] Found device 0 with properties:
name: Tesla T4 major: 7 minor: 5 memoryClockRate(GHz): 1.59
pciBusID: 0000:00:04.0
2020-05-15 11:38:35.161323: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
2020-05-15 11:38:35.423916: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
2020-05-15 11:38:35.579286: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
2020-05-15 11:38:35.606975: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
2020-05-15 11:38:35.868300: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
```

```
2020-05-15 11:38:35.909038: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
2020-05-15 11:38:36.453439: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
2020-05-15 11:38:36.453693: I tensorflow/stream_executor/cuda/cuda_gpu_executor.cc:983] successful NUMA node read from SysFS had
2020-05-15 11:38:36.454429: I tensorflow/stream_executor/cuda/cuda_gpu_executor.cc:983] successful NUMA node read from SysFS had
2020-05-15 11:38:36.455027: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1767] Adding visible gpu devices: 0
2020-05-15 11:38:36.459667: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
2020-05-15 11:38:36.461369: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1180] Device interconnect StreamExecutor with str
2020-05-15 11:38:36.461406: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1186]      0
2020-05-15 11:38:36.461418: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1199] 0:   N
2020-05-15 11:38:36.462789: I tensorflow/stream_executor/cuda/cuda_gpu_executor.cc:983] successful NUMA node read from SysFS had
2020-05-15 11:38:36.463345: I tensorflow/stream_executor/cuda/cuda_gpu_executor.cc:983] successful NUMA node read from SysFS had
2020-05-15 11:38:36.463859: W tensorflow/core/common_runtime/gpu/gpu_bfc_allocator.cc:39] Overriding allow_growth setting becaus
2020-05-15 11:38:36.463911: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1325] Created TensorFlow device (/job:localhost/r
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:300: The name tf.global_varia

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:308: The name tf.variables_in

2020-05-15 11:38:46.600343: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
2020-05-15 11:38:51.789489: I tensorflow/stream_executor/platform/default/dso_loader.cc:44] Successfully opened dynamic library
 997/1000 [============================>.] - ETA: 3s - rpn_cls: 0.6512 - rpn_regr: 0.5063 - detector_cls: 0.9675 - detector_regr
1000/1000 [==============================] - 1011s - rpn_cls: 0.6526 - rpn_regr: 0.5055 - detector_cls: 0.9672 - detector_regr:
Mean number of bounding boxes from RPN overlapping ground truth boxes: 7.400797607178465
Classifier accuracy for bounding boxes from RPN: 0.79109375
Loss RPN classifier: 0.6526153698760773
Loss RPN regression: 0.5054750957861542
Loss Detector classifier: 0.9671904136855155
Loss Detector regression: 0.4607448527738452
```

```
1  !pip install keras==2.1.5
```

```
Requirement already satisfied: keras==2.1.5 in /usr/local/lib/python3.6/dist-packages (2.1.5)
Requirement already satisfied: scipy>=0.14 in /usr/local/lib/python3.6/dist-packages (from keras==2.1.5) (1.4.1)
Requirement already satisfied: numpy>=1.9.1 in /usr/local/lib/python3.6/dist-packages (from keras==2.1.5) (1.18.4)
Requirement already satisfied: six>=1.9.0 in /usr/local/lib/python3.6/dist-packages (from keras==2.1.5) (1.12.0)
Requirement already satisfied: pyyaml in /usr/local/lib/python3.6/dist-packages (from keras==2.1.5) (3.13)
```

```
1  %matplotlib inline
```

```
1  from __future__ import division
2  import os
3  import cv2
```

```
import cv2
import numpy as np
import sys
import pickle
from optparse import OptionParser
import time
from keras_frcnn import config
from keras import backend as K
from keras.layers import Input
from keras.models import Model
from keras_frcnn import roi_helpers

sys.setrecursionlimit(40000)

parser = OptionParser()

test_path="test"
num_rois=32
config_filename="config.pickle"
network='resnet50'


config_output_filename = config_filename

with open(config_output_filename, 'rb') as f_in:
    C = pickle.load(f_in)

if C.network == 'resnet50':
    import keras_frcnn.resnet as nn
elif C.network == 'vgg':
    import keras_frcnn.vgg as nn

# turn off any data augmentation at test time
C.use_horizontal_flips = False
C.use_vertical_flips = False
C.rot_90 = False

img_path = test_path
```

```
41
42  def format_img_size(img, C):
43      """ formats the image size based on config """
44      img_min_side = float(C.im_size)
45      (height,width,_) = img.shape
46
47      if width <= height:
48          ratio = img_min_side/width
49          new_height = int(ratio * height)
50          new_width = int(img_min_side)
51      else:
52          ratio = img_min_side/height
53          new_width = int(ratio * width)
54          new_height = int(img_min_side)
55      img = cv2.resize(img, (new_width, new_height), interpolation=cv2.INTER_CUBIC)
56      return img, ratio
57
58  def format_img_channels(img, C):
59      """ formats the image channels based on config """
60      img = img[:, :, (2, 1, 0)]
61      img = img.astype(np.float32)
62      img[:, :, 0] -= C.img_channel_mean[0]
63      img[:, :, 1] -= C.img_channel_mean[1]
64      img[:, :, 2] -= C.img_channel_mean[2]
65      img /= C.img_scaling_factor
66      img = np.transpose(img, (2, 0, 1))
67      img = np.expand_dims(img, axis=0)
68      return img
69
70  def format_img(img, C):
71      """ formats an image for model prediction based on config """
72      img, ratio = format_img_size(img, C)
73      img = format_img_channels(img, C)
74      return img, ratio
75
76  # Method to transform the coordinates of the bounding box to its original size
77  def get_real_coordinates(ratio, x1, y1, x2, y2):
78
```

```
        real_x1 = int(round(x1 // ratio))
        real_y1 = int(round(y1 // ratio))
        real_x2 = int(round(x2 // ratio))
        real_y2 = int(round(y2 // ratio))

        return (real_x1, real_y1, real_x2 ,real_y2)

class_mapping = C.class_mapping

if 'bg' not in class_mapping:
    class_mapping['bg'] = len(class_mapping)

class_mapping = {v: k for k, v in class_mapping.items()}
print(class_mapping)
class_to_color = {class_mapping[v]: np.random.randint(0, 255, 3) for v in class_mapping}
C.num_rois = int(num_rois)

if C.network == 'resnet50':
    num_features = 1024
elif C.network == 'vgg':
    num_features = 512

if K.image_dim_ordering() == 'th':
    input_shape_img = (3, None, None)
    input_shape_features = (num_features, None, None)
else:
    input_shape_img = (None, None, 3)
    input_shape_features = (None, None, num_features)


img_input = Input(shape=input_shape_img)
roi_input = Input(shape=(C.num_rois, 4))
feature_map_input = Input(shape=input_shape_features)

# define the base network (resnet here, can be VGG, Inception, etc)
shared_layers = nn.nn_base(img_input, trainable=True)

# define the RPN, built on the base layers
```

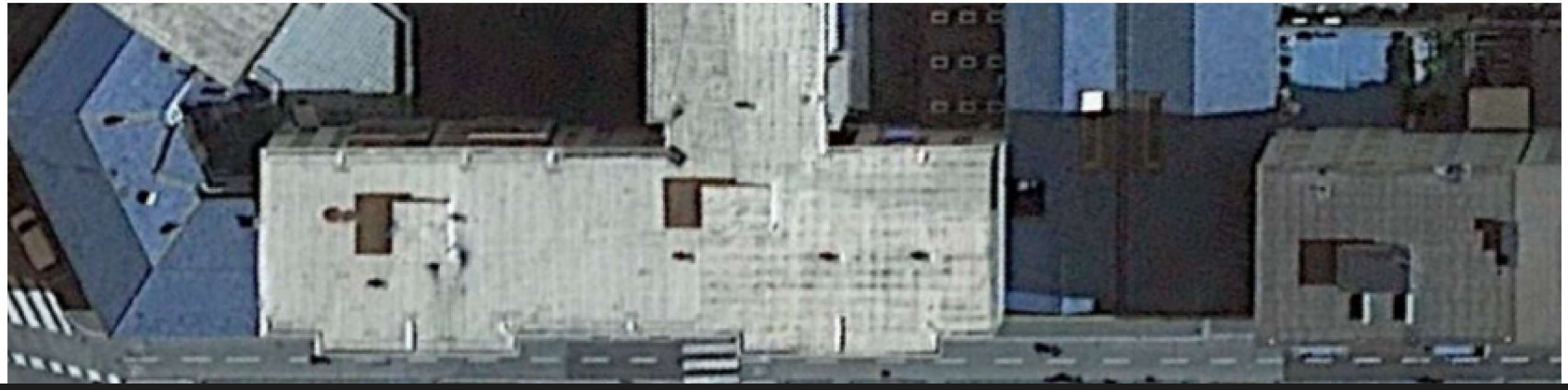
```
# define the RPN, built on the base layers
num_anchors = len(C.anchor_box_scales) * len(C.anchor_box_ratios)
rpn_layers = nn.rpn(shared_layers, num_anchors)

classifier = nn.classifier(feature_map_input, roi_input, C.num_rois, nb_classes=len(class_mapping), trainable=True)

model_rpn = Model(img_input, rpn_layers)
model_classifier_only = Model([feature_map_input, roi_input], classifier)

model_classifier = Model([feature_map_input, roi_input], classifier)

print('Loading weights from {}'.format(C.model_path))
model_rpn.load_weights(C.model_path, by_name=True)
model_classifier.load_weights(C.model_path, by_name=True)

model_rpn.compile(optimizer='sgd', loss='mse')
model_classifier.compile(optimizer='sgd', loss='mse')

all_imgs = []

classes = {}

bbox_threshold = 0.8

visualise = True

for idx, img_name in enumerate(sorted(os.listdir(img_path))):
    if not img_name.lower().endswith(('.bmp', '.jpeg', '.jpg', '.png', '.tif', '.tiff')):
        continue
    print(img_name)
    st = time.time()
    filepath = os.path.join(img_path,img_name)

    img = cv2.imread(filepath)

    X, ratio = format_img(img, C)

    if K.image_dim_ordering() == 'tf':
```

```
        X = np.transpose(X, (0, 2, 3, 1))

    # get the feature maps and output from the RPN
    [Y1, Y2, F] = model_rpn.predict(X)


    R = roi_helpers.rpn_to_roi(Y1, Y2, C, K.image_dim_ordering(), overlap_thresh=0.7)

    # convert from (x1,y1,x2,y2) to (x,y,w,h)
    R[:, 2] -= R[:, 0]
    R[:, 3] -= R[:, 1]

    # apply the spatial pyramid pooling to the proposed regions
    bboxes = {}
    probs = {}

    for jk in range(R.shape[0]//C.num_rois + 1):
        ROIs = np.expand_dims(R[C.num_rois*jk:C.num_rois*(jk+1), :], axis=0)
        if ROIs.shape[1] == 0:
            break

        if jk == R.shape[0]//C.num_rois:
            #pad R
            curr_shape = ROIs.shape
            target_shape = (curr_shape[0],C.num_rois,curr_shape[2])
            ROIs_padded = np.zeros(target_shape).astype(ROIs.dtype)
            ROIs_padded[:, :curr_shape[1], :] = ROIs
            ROIs_padded[0, curr_shape[1]:, :] = ROIs[0, 0, :]
            ROIs = ROIs_padded

        [P_cls, P_regr] = model_classifier_only.predict([F, ROIs])

        for ii in range(P_cls.shape[1]):

            if np.max(P_cls[0, ii, :]) < bbox_threshold or np.argmax(P_cls[0, ii, :]) == (P_cls.shape[2] - 1):
                continue

            cls_name = class_mapping[np.argmax(P_cls[0, ii, :])]
```

```
192
193             if cls_name not in bboxes:
194                 bboxes[cls_name] = []
195                 probs[cls_name] = []
196
197             (x, y, w, h) = ROIs[0, ii, :]
198
199             cls_num = np.argmax(P_cls[0, ii, :])
200             try:
201                 (tx, ty, tw, th) = P_regr[0, ii, 4*cls_num:4*(cls_num+1)]
202                 tx /= C.classifier_regr_std[0]
203                 ty /= C.classifier_regr_std[1]
204                 tw /= C.classifier_regr_std[2]
205                 th /= C.classifier_regr_std[3]
206                 x, y, w, h = roi_helpers.apply_regr(x, y, w, h, tx, ty, tw, th)
207             except:
208                 pass
209             bboxes[cls_name].append([C.rpn_stride*x, C.rpn_stride*y, C.rpn_stride*(x+w), C.rpn_stride*(y+h)])
210             probs[cls_name].append(np.max(P_cls[0, ii, :]))
211
212     all_dets = []
213
214     for key in bboxes:
215         bbox = np.array(bboxes[key])
216
217         new_boxes, new_probs = roi_helpers.non_max_suppression_fast(bbox, np.array(probs[key]), overlap_thresh=0.5)
218         for jk in range(new_boxes.shape[0]):
219             (x1, y1, x2, y2) = new_boxes[jk,:]
220
221             (real_x1, real_y1, real_x2, real_y2) = get_real_coordinates(ratio, x1, y1, x2, y2)
222
223             cv2.rectangle(img,(real_x1, real_y1), (real_x2, real_y2), (int(class_to_color[key][0]), int(class_to_color[key][1]),
224
225             textLabel = '{}: {}'.format(key,int(100*new_probs[jk]))
226             all_dets.append((key,100*new_probs[jk]))
227
228             (retval,baseLine) = cv2.getTextSize(textLabel,cv2.FONT_HERSHEY_COMPLEX,1,1)
229             textOrg = (real_x1, real_y1-0)
```

```
230
231             cv2.rectangle(img, (textOrg[0] - 5, textOrg[1]+baseLine - 5), (textOrg[0]+retval[0] + 5, textOrg[1]-retval[1] - 5),
232             cv2.rectangle(img, (textOrg[0] - 5,textOrg[1]+baseLine - 5), (textOrg[0]+retval[0] + 5, textOrg[1]-retval[1] - 5), (
233             cv2.putText(img, textLabel, textOrg, cv2.FONT_HERSHEY_DUPLEX, 1, (0, 0, 0), 1)
234
235     print('Elapsed time = {}'.format(time.time() - st))
236     print(all_dets)
237     import matplotlib.pyplot as plt
238     plt.figure(figsize=(15, 15))
239     plt.axis('off')
240     plt.imshow(img)
241     plt.show()
```

```
{0: 'Car', 1: 'Chartered Aircraft', 2: 'Airliner', 3: 'Van', 4: 'Others', 5: 'Stair Truck', 6: 'Pushback Truck', 7: 'Bus', 8: 'T
Loading weights from ./model_frcnn.hdf5
0884.jpg
Elapsed time = 3.447936534881592
[]
```



```
1
```