Traffic Camera car counter

October 8, 2020

[1]:

```
import tensorflow as tf
import tensorflow_hub as hub

import matplotlib.pyplot as plt
from six import BytesIO

# For drawing onto the image.
import numpy as np
from PIL import Image
from PIL import ImageColor
from PIL import ImageDraw
from PIL import ImageFont
from PIL import ImageOps

# For measuring the inference time.
import time

# For downloading the traffic camera photo
import requests
from bs4 import BeautifulSoup
```

[2]:

```
def display_image(image):
    fig = plt.figure(figsize=(20, 15))
    plt.grid(False)
    plt.imshow(image)

def draw_title(image,font,title):
    """Draw the title"""
    im_width, im_height = image.size
    draw = ImageDraw.Draw(image)
    w, h = font.getsize(title)
    # draw a box
    draw.rectangle((10, im_height-50, 10 + w, im_height-50 + h * 2.5), fill =␣
 ↪'black')
    # draw the title
    draw.multiline_text((10, im_height-50), title, font=font,␣
 ↪fill=(255,255,255))
```

```
def draw_bounding_box_on_image(image,
                               ymin,
                               xmin,
                               ymax,
                               xmax,
                               color,
                               font,
                               thickness=4,
                               display_str_list=()
                              ):
    """Adds a bounding box to an image."""
    draw = ImageDraw.Draw(image)
    im_width, im_height = image.size
    (left, right, top, bottom) = (xmin * im_width, xmax * im_width,
                                  ymin * im_height, ymax * im_height)
    draw.line([(left, top), (left, bottom), (right, bottom), (right, top),
             (left, top)],
            width=thickness,
            fill=color)

    # If the total height of the display strings added to the top of the␣
 ↪bounding
    # box exceeds the top of the image, stack the strings below the bounding box
    # instead of above.
    display_str_heights = [font.getsize(ds)[1] for ds in display_str_list]
    # Each display_str has a top and bottom margin of 0.05x.
    total_display_str_height = (1 + 2 * 0.05) * sum(display_str_heights)

    if top > total_display_str_height:
        text_bottom = top
    else:
        text_bottom = top + total_display_str_height
    # Reverse list and print from bottom to top.
    for display_str in display_str_list[::-1]:
        text_width, text_height = font.getsize(display_str)
        margin = np.ceil(0.05 * text_height)
        draw.rectangle([(left, text_bottom - text_height - 2 * margin),
                        (left + text_width, text_bottom)],
                       fill=color)
        draw.text((left + margin, text_bottom - text_height - margin),
                  display_str,
                  fill="black",
                  font=font)
        text_bottom -= text_height - 2 * margin
```

```
def draw_boxes(image, boxes, class_names, scores, title, max_boxes=10,␣
↪min_score=0.1):
    """Overlay labeled boxes on an image with formatted scores and label names.
↪"""
    colors = list(ImageColor.colormap.values())

    try:
        font = ImageFont.truetype("/Users/lingjie/Library/Fonts/
↪JosefinSansLight-ZVEll.ttf", 20)
    except IOError:
        print("Font not found, using default font.")
        font = ImageFont.load_default()

    for i in range(min(boxes.shape[0], max_boxes)):
        if scores[i] >= min_score:
            ymin, xmin, ymax, xmax = tuple(boxes[i])
            display_str = "{}: {}%".format(class_names[i].decode("ascii"),
                                           int(100 * scores[i]))
            color = colors[hash(class_names[i]) % len(colors)]
            image_pil = Image.fromarray(np.uint8(image)).convert("RGB")
           ␣
↪draw_bounding_box_on_image(image_pil,ymin,xmin,ymax,xmax,color,font,display_str_list=[displ
            np.copyto(image, np.array(image_pil))

    image_pil = Image.fromarray(np.uint8(image)).convert("RGB")
    draw_title(image_pil,font, title)
    np.copyto(image, np.array(image_pil))

    return image
```

[3]:
```
def get_url(url):
    page = requests.get(url)
    soup = BeautifulSoup(page.content, 'html.parser')
    title = soup.title.string
    links = soup.find_all('img')
    img_links = {}
    for link in links:
        if 'View from' in link.get('alt'):
            img_links[link.get('alt')] = 'http://' + link.get('src').replace('//
↪', '')
    return img_links
```

[4]:
```
def get_img(img_url):
    img = requests.get(img_url, stream=True)
    image_data = BytesIO(img.content)
    pil_image = Image.open(image_data)
```

```
#     pil_image = ImageOps.fit(pil_image, (512, 512), Image.ANTIALIAS) # resize␣
↪photo
    return pil_image
```

[5]:

```
def run_detector_car(detector, img_link):
    img = get_img(img_link)
    img_np = np.array(img)
    converted_img = tf.convert_to_tensor(img_np)
    converted_img  = tf.image.convert_image_dtype(converted_img, tf.float32)[tf.
↪newaxis, ...]
    start_time = time.time()
    result = detector(converted_img)
    end_time = time.time()

    result = {key:value.numpy() for key,value in result.items()}

    car_index = (np.isin(np.array(result["detection_class_entities"],␣
↪dtype='str'),
                         ['Car', 'Vehicle', 'Land vehicle', 'Motorcycle'])) &␣
↪(result["detection_scores"] >= 0.1) # min score

#     print("Found %d cars." % len(result["detection_scores"][car_index]))
#     print("Inference time: ", end_time-start_time)

    title = 'Found {} cars.\nInference time: {}'.
↪format(len(result["detection_scores"][car_index]), end_time-start_time)

    image_with_boxes = draw_boxes(
        np.array(img_np, np.int32), result["detection_boxes"][car_index],
        result["detection_class_entities"][car_index],␣
↪result["detection_scores"][car_index],
        title
    )

#     display_image(image_with_boxes)
    return {'num_cars' : len(result["detection_scores"][car_index]),␣
↪'time_taken' : end_time-start_time, 'img' : image_with_boxes}
```

[6]:

```
def update_camera():
    traffic_cameras = {}
    for url in urls:
        traffic_cameras.update(get_url(url))
    return traffic_cameras
```

[7]:

```
module_handle = "https://tfhub.dev/google/openimages_v4/ssd/mobilenet_v2/1"␣
 ↪#@param ["https://tfhub.dev/google/openimages_v4/ssd/mobilenet_v2/1", "https:
 ↪//tfhub.dev/google/faster_rcnn/openimages_v4/inception_resnet_v2/1"]

detector = hub.load(module_handle).signatures['default']
```

```
INFO:tensorflow:Saver not created because there are no variables in the graph to
restore
```

```
INFO:tensorflow:Saver not created because there are no variables in the graph to
restore
```

[8]:

```
woodlands = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/woodlands.html#trafficCameras'
kje = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/kje.html#trafficCameras'
sle = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/sle.html#trafficCameras'
tpe = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/tpe.html#trafficCameras'
bke = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/bke.html#trafficCameras'
aye = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/aye.html#trafficCameras'
cte = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/cte.html#trafficCameras'
mce = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/mce.html#trafficCameras'
ecp = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/ecp.html#trafficCameras'
pie = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/pie.html#trafficCameras'
stg = 'https://www.onemotoring.com.sg/content/onemotoring/home/driving/
 ↪traffic_information/traffic-cameras/stg.html#trafficCameras'
urls = [woodlands, kje, sle, tpe, bke, aye, cte, mce, ecp, pie, stg]
```

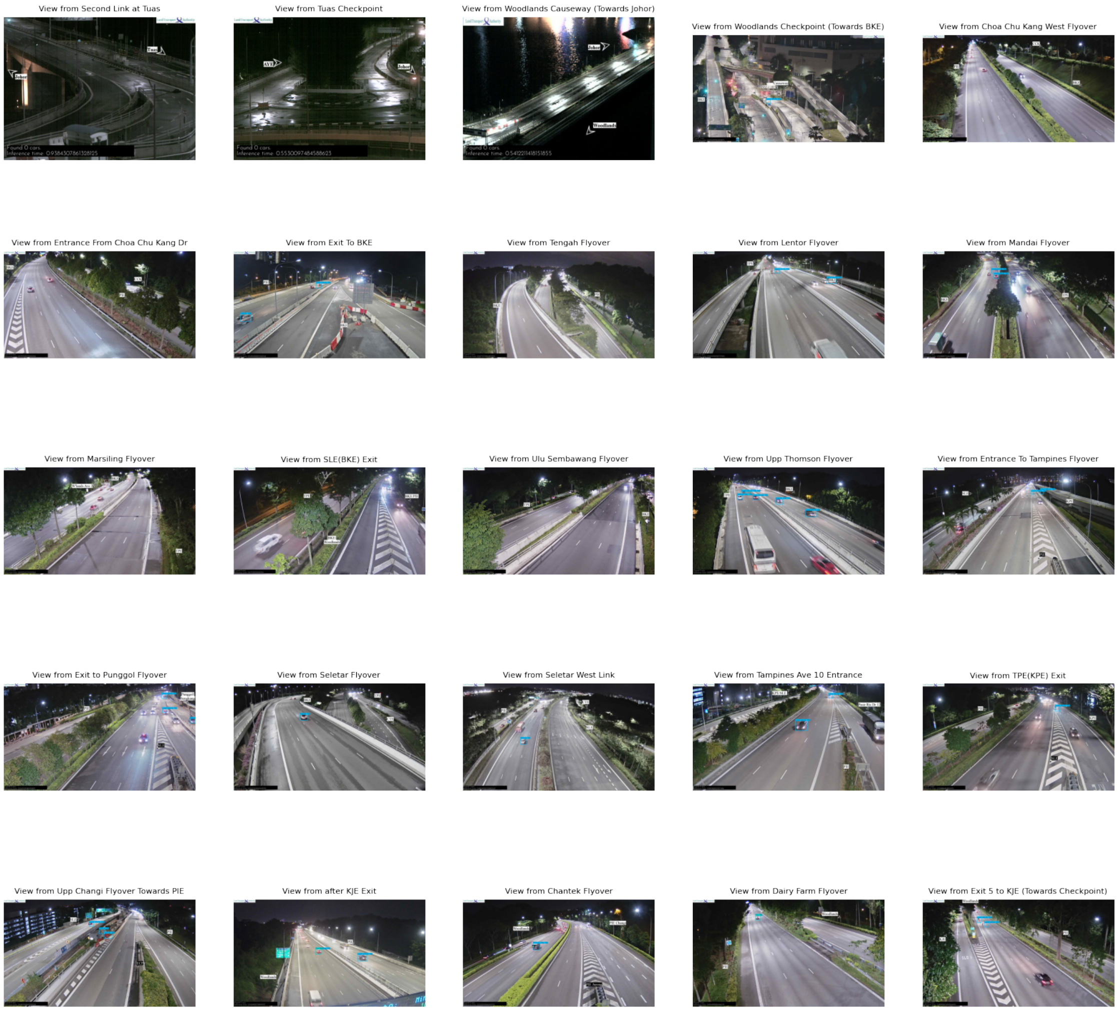
[9]:

```
traffic_cameras = update_camera()
```

[16]:

```
fig, [ax1, ax2, ax3, ax4, ax5] = plt.subplots(5, 5, figsize=(20,20), dpi=100,␣
 ↪gridspec_kw={'hspace':0})
for ax, cam, title in zip(ax1, list(traffic_cameras.values())[:5],␣
 ↪list(traffic_cameras.keys())[:5]):
    ax.axis('off')
    result = run_detector_car(detector, cam)
    ax.imshow(result['img'])
    ax.set_title(title, fontdict={'fontsize':8})
```

```
for ax, cam, title in zip(ax2, list(traffic_cameras.values())[5:10],␣
 ↪list(traffic_cameras.keys())[5:10]):
    ax.axis('off')
    result = run_detector_car(detector, cam)
    ax.imshow(result['img'])
    ax.set_title(title, fontdict={'fontsize':8})
for ax, cam, title in zip(ax3, list(traffic_cameras.values())[10:15],␣
 ↪list(traffic_cameras.keys())[10:15]):
    ax.axis('off')
    result = run_detector_car(detector, cam)
    ax.imshow(result['img'])
    ax.set_title(title, fontdict={'fontsize':8})
for ax, cam, title in zip(ax4, list(traffic_cameras.values())[15:20],␣
 ↪list(traffic_cameras.keys())[15:20]):
    ax.axis('off')
    result = run_detector_car(detector, cam)
    ax.imshow(result['img'])
    ax.set_title(title, fontdict={'fontsize':8})
for ax, cam, title in zip(ax5, list(traffic_cameras.values())[20:25],␣
 ↪list(traffic_cameras.keys())[20:25]):
    ax.axis('off')
    result = run_detector_car(detector, cam)
    ax.imshow(result['img'])
    ax.set_title(title, fontdict={'fontsize':8})
```


View from Second Link at Tuas
View from Tuas Checkpoint
View from Woodlands Causeway (Towards Johor)
View from Woodlands Checkpoint (Towards BKE)
View from Choa Chu Kang West Flyover
View from Entrance From Choa Chu Kang Dr
View from Exit To BKE
View from Tengah Flyover
View from Lentor Flyover
View from Mandai Flyover
View from Marsiling Flyover
View from SLE(BKE) Exit
View from Ulu Sembawang Flyover
View from Upp Thomson Flyover
View from Entrance To Tampines Flyover
View from Exit to Punggol Flyover
View from Seletar Flyover
View from Seletar West Link
View from Tampines Ave 10 Entrance
View from TPE(KPE) Exit
View from Upp Changi Flyover Towards PIE
View from after KJE Exit
View from Chantek Flyover
View from Dairy Farm Flyover
View from Exit 5 to KJE (Towards Checkpoint)

[11]:
```
# fig.savefig('output/traffic_cam.jpg', dpi=600, bbox_inches='tight', facecolor='white')
```

[12]:
```
# fig2, [ax1, ax2, ax3, ax4, ax5] = plt.subplots(5, 5, figsize=(20,20), dpi=300, gridspec_kw={'hspace':0})
# for ax, cam, title in zip(ax1, list(traffic_cameras.values())[25:30], list(traffic_cameras.keys())[25:30]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# for ax, cam, title in zip(ax2, list(traffic_cameras.values())[30:35], list(traffic_cameras.keys())[30:35]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# for ax, cam, title in zip(ax3, list(traffic_cameras.values())[35:40],␣
 ↪list(traffic_cameras.keys())[35:40]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# for ax, cam, title in zip(ax4, list(traffic_cameras.values())[40:45],␣
 ↪list(traffic_cameras.keys())[40:45]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# for ax, cam, title in zip(ax5, list(traffic_cameras.values())[45:50],␣
 ↪list(traffic_cameras.keys())[45:50]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# fig2.savefig('output/traffic_cam2.jpg', dpi=600, bbox_inches='tight',␣
 ↪facecolor='white')
```

[13]:

```
# fig3, [ax1, ax2, ax3, ax4, ax5] = plt.subplots(5, 5, figsize=(20,20),␣
 ↪dpi=300, gridspec_kw={'hspace':0})
# for ax, cam, title in zip(ax1, list(traffic_cameras.values())[50:55],␣
 ↪list(traffic_cameras.keys())[50:55]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# for ax, cam, title in zip(ax2, list(traffic_cameras.values())[55:60],␣
 ↪list(traffic_cameras.keys())[55:60]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# for ax, cam, title in zip(ax3, list(traffic_cameras.values())[60:65],␣
 ↪list(traffic_cameras.keys())[60:65]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# for ax, cam, title in zip(ax4, list(traffic_cameras.values())[65:70],␣
 ↪list(traffic_cameras.keys())[65:70]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# for ax, cam, title in zip(ax5, list(traffic_cameras.values())[70:75],␣
 ↪list(traffic_cameras.keys())[70:75]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# fig3.savefig('output/traffic_cam3.jpg', dpi=600, bbox_inches='tight',␣
 ↪facecolor='white')
```

[14]:

```
# fig4, [ax1, ax2] = plt.subplots(2, 4, figsize=(20,20), dpi=300,␣
 ↪gridspec_kw={'hspace':0})
# for ax, cam, title in zip(ax1, list(traffic_cameras.values())[75:79],␣
 ↪list(traffic_cameras.keys())[75:79]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# for ax, cam, title in zip(ax2, list(traffic_cameras.values())[78:82],␣
 ↪list(traffic_cameras.keys())[78:82]):
#     ax.axis('off')
#     result = run_detector_car(detector, cam)
#     ax.imshow(result['img'])
#     ax.set_title(title, fontdict={'fontsize':8})
# ax2[-1].axis('off')
# fig4.savefig('output/traffic_cam4.jpg', dpi=600, bbox_inches='tight',␣
 ↪facecolor='white')
```

[ ]: