```
# Counting the total number of the items in the images

import torch
import torchvision
import cv2
import numpy as np
from torchvision.transforms import functional as F
from google.colab.patches import cv2_imshow
from collections import Counter

model = torchvision.models.detection.fasterrcnn_resnet50_fpn(pretrained=True)
model.eval()

coco_cat_names = ['__background__', 'person', 'bicycle', 'car', 'motorcycle', 'airplane', 'bus',
                  'train', 'truck', 'boat', 'traffic light', 'fire hydrant', 'stop sign',
                  'parking meter', 'bench', 'bird', 'cat', 'dog', 'horse', 'sheep', 'cow',
                  'elephant', 'bear', 'zebra', 'giraffe', 'backpack', 'umbrella', 'handbag',
                  'tie', 'suitcase', 'frisbee', 'skis', 'snowboard', 'sports ball', 'kite',
                  'baseball bat', 'baseball glove', 'skateboard', 'surfboard', 'tennis racket',
                  'bottle', 'wine glass', 'cup', 'fork', 'knife', 'spoon', 'bowl', 'banana',
                  'apple', 'sandwich', 'orange', 'broccoli', 'carrot', 'hot dog', 'pizza',
                  'donut', 'cake', 'chair', 'couch', 'potted plant', 'bed', 'dining table',
                  'toilet', 'tv', 'laptop', 'mouse', 'remote', 'keyboard', 'cell phone',
                  'microwave', 'oven', 'toaster', 'sink', 'refrigerator', 'book', 'clock',
                  'vase', 'scissors', 'teddy bear', 'hair drier', 'toothbrush']

def calculate_iou(box1, box2):
    """Calculate Intersection over Union (IoU) between two bounding boxes."""
    x1, y1, x2, y2 = box1
    x1_p, y1_p, x2_p, y2_p = box2

    # Calculate the intersection
    inter_x1 = max(x1, x1_p)
    inter_y1 = max(y1, y1_p)
    inter_x2 = min(x2, x2_p)
    inter_y2 = min(y2, y2_p)

    inter_area = max(0, inter_x2 - inter_x1) * max(0, inter_y2 - inter_y1)

          ulate the union
    box1_area = (x2 - x1) * (y2 - y1)
    box2_area = (x2_p - x1_p) * (y2_p - y1_p)
    union_area = box1_area + box2_area - inter_area

    if union_area == 0:
        return 0
    return inter_area / union_area

def detect_obj(path, threshold=0.5, specific_item=None):
    img = cv2.imread(path)
    if img is None:
        print(f'Error: Could not load image from {path}. Please check the file path and ensure the image exists.')
        return None, None

    original_img = img.copy()
    img_tensor = F.to_tensor(img)

    with torch.no_grad():
        pred = model([img_tensor])

    boxes = pred[0]['boxes'].cpu().numpy()
    labels = pred[0]['labels'].cpu().numpy()
    scores = pred[0]['scores'].cpu().numpy()

    object_counts = Counter()

    for i, box in enumerate(boxes):
        if scores[i] >= threshold:
            label_index = labels[i]
            if 0 <= label_index < len(coco_cat_names):
                label = coco_cat_names[label_index]
            else:
                label = f"Unknown Label ({label_index})"
                print(f"Warning: Encountered unknown label index: {label_index}")

            score = scores[i]

            start = (int(box[0]), int(box[1]))
            end = (int(box[2]), int(box[3]))
            cv2.rectangle(original_img, start, end, (0, 255, 0), 2)
            cv2.putText(original_img, f"{label}: {score:.2f}", start, cv2.FONT_HERSHEY_SIMPLEX, 0.5, (255, 0, 0), 2)
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                object_counts[label] += 1

        overlaps = 0
        for i in range(len(boxes)):
            for j in range(i + 1, len(boxes)):
                if calculate_iou(boxes[i], boxes[j]) > 0.5:
                    overlaps += 1
        print(f"\nNumber of overlapping objects: {overlaps}")

        movable_objects = ["car", "truck", "bicycle", "motorcycle", "bus", "train"]
        stationary_objects = ["chair", "bench", "dining table", "bed", "toilet", "couch"]

        movable_count = sum(object_counts[item] for item in movable_objects if item in object_counts)
        stationary_count = sum(object_counts[item] for item in stationary_objects if item in object_counts)

        print("\nSummary by Category:")
        print(f"Movable Objects: {movable_count}")
        print(f"Stationary Objects: {stationary_count}")

        if specific_item:
            specific_item_count = object_counts.get(specific_item, 0)
            print(f"\nCount of '{specific_item}': {specific_item_count}")

        print("\nObject counts:")
        for label, count in object_counts.items():
            print(f"{label}: {count}")

        return original_img, object_counts

    if __name__ == '__main__':
        path = '/content/traffic_new.webp'
        detected_image, object_counts = detect_obj(path)

        if detected_image is not None:
            cv2_imshow(detected_image)
```
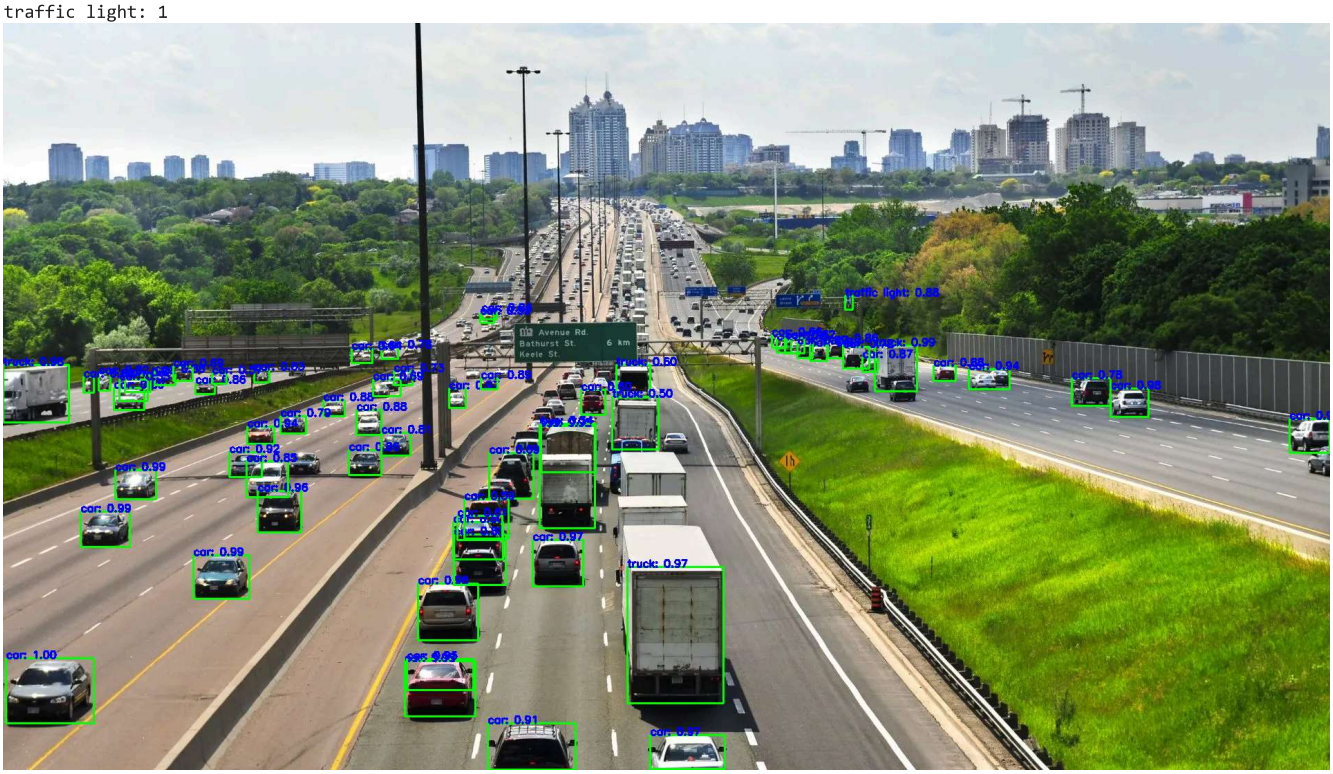

```
Number of overlapping objects: 12

Summary by Category:
Movable Objects: 63
Stationary Objects: 0

Object counts:
car: 56
truck: 5
bus: 2
traffic light: 1
```




LAB 5

```
import torch
import cv2
import numpy as np
from google.colab.patches import cv2_imshow

# Load YOLOv5 model (pre-trained on COCO dataset)
model = torch.hub.load('ultralytics/yolov5', 'yolov5s', pretrained=True)
model.eval()

coco_cat_names = model.names  # Get category names directly from YOLOv5

def detect_obj(path, threshold=0.5):
    img = cv2.imread(path)
    if img is None:
        print(f'Error: Could not load image from {path}. Please check the file path and ensure the image exists.')
        return None
```

```
    original_img = img.copy()
    # Convert image to RGB for YOLOv5 compatibility
    img_rgb = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)

    results = model(img_rgb)
    pred_boxes = results.xyxy[0].cpu().numpy()
    pred_labels = results.names
    pred_confidence = results.xyxy[0][:, 4].cpu().numpy()

    for i, box in enumerate(pred_boxes):
        if pred_confidence[i] >= threshold:
            label = coco_cat_names[int(box[5])]
            score = pred_confidence[i]

            start = (int(box[0]), int(box[1]))
            end = (int(box[2]), int(box[3]))
            cv2.rectangle(original_img, start, end, (0, 255, 0), 2)
            cv2.putText(original_img, f"{label}: {score:.2f}", start, cv2.FONT_HERSHEY_SIMPLEX, 0.5, (255, 0, 0), 2)

    return original_img

if __name__ == '__main__':
    path = '/content/traffic_new.webp'
    detected_image = detect_obj(path)

    if detected_image is not None:
        cv2_imshow(detected_image)
```

```
/usr/local/lib/python3.10/dist-packages/torch/hub.py:330: UserWarning: You are about to download and run code from an untrusted r
  warnings.warn(
Downloading: "https://github.com/ultralytics/yolov5/zipball/master" to /root/.cache/torch/hub/master.zip
Creating new Ultralytics Settings v0.0.6 file ✅
View Ultralytics Settings with 'yolo settings' or at '/root/.config/Ultralytics/settings.json'
Update Settings with 'yolo settings key=value', i.e. 'yolo settings runs_dir=path/to/dir'. For help see https://docs.ultralytics.
YOLOv5 🚀 2024-11-27 Python-3.10.12 torch-2.5.1+cu121 CPU

Downloading https://github.com/ultralytics/yolov5/releases/download/v7.0/yolov5s.pt to yolov5s.pt...
100%|██████████| 14.1M/14.1M [00:00<00:00, 112MB/s]

Fusing layers...
YOLOv5s summary: 213 layers, 7225885 parameters, 0 gradients, 16.4 GFLOPs
Adding AutoShape...
/root/.cache/torch/hub/ultralytics_yolov5_master/models/common.py:892: FutureWarning: `torch.cuda.amp.autocast(args...)` is depre
  with amp.autocast(autocast):
```