```
!git clone https://github.com/ultralytics/yolov5.git
%cd yolov5
```

Show hidden output

```
!pip install -r requirements.txt
```

Show hidden output

```
from google.colab import files

uploaded = files.upload()

video_path = next(iter(uploaded.keys()))
print("Uploaded video:", video_path)
```

Choose Files background…lking _.mp4

- **background video _ people _ walking _.mp4**(video/mp4) - 2728834 bytes, last modified: 7/12/2025 - 100% done

```
Saving background video _ people _ walking _.mp4 to background video _ people _ walking _.mp4
Uploaded video: background video _ people _ walking _.mp4
```

```
import torch

model = torch.hub.load('ultralytics/yolov5', 'yolov5s', pretrained=True)
model.conf = 0.25  # confidence threshold
```

```
/usr/local/lib/python3.11/dist-packages/torch/hub.py:330: UserWarning: You are about to download and run code from an untrusted repository. In a future 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.com/quickstart/#ultralyt
YOLOv5 🚀 2025-7-12 Python-3.11.13 torch-2.6.0+cu124 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, 91.5MB/s]

Fusing layers...
YOLOv5s summary: 213 layers, 7225885 parameters, 0 gradients, 16.4 GFLOPs
Adding AutoShape...
```

Assignment 1

```
import cv2
import json
from collections import Counter
import pandas as pd
import matplotlib.pyplot as plt
import torch

video_path = 'background video _ people _ walking _.mp4'
model = torch.hub.load('ultralytics/yolov5', 'yolov5s', pretrained=True)
model.conf = 0.25                    # confidence threshold
```

```
Using cache found in /root/.cache/torch/hub/ultralytics_yolov5_master
YOLOv5 🚀 2025-7-12 Python-3.11.13 torch-2.6.0+cu124 CPU

Fusing layers...
YOLOv5s summary: 213 layers, 7225885 parameters, 0 gradients, 16.4 GFLOPs
Adding AutoShape...
```

```
cap = cv2.VideoCapture(video_path)
frames = []          # will hold (frame_idx, BGR_image)
idx = 0

while True:
    ret, img = cap.read()
    if not ret:
        break
    if idx % 5 == 0:
        frames.append((idx, img.copy()))
    idx += 1

cap.release()
print(f"Extracted {len(frames)} frames (every 5th frame).")
```

```
Extracted 69 frames (every 5th frame).
```

```
summary = {}

for frame_idx, img in frames:
    # YOLOv5 inference (returns a Results object)
    results = model(img)
    detections = []
```

```python
    # each row: [x1, y1, x2, y2, conf, cls]
    for *box, conf, cls in results.pred[0].cpu().numpy():
        x1, y1, x2, y2 = map(float, box)
        detections.append({
            'class': model.names[int(cls)],
            'bbox': [x1, y1, x2, y2],
            'confidence': float(conf)
        })

    summary[f'frame_{frame_idx}'] = {'detections': detections}


with open('detections.json', 'w') as f:
    json.dump(summary, f, indent=2)

print("Saved detections.json with your summary.")
```

```
/root/.cache/torch/hub/ultralytics_yolov5_master/models/common.py:906: FutureWarning: `torch.cuda.amp.autocast(args...)` is deprecated. Please use `torc
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  with amp.autocast(autocast):
```
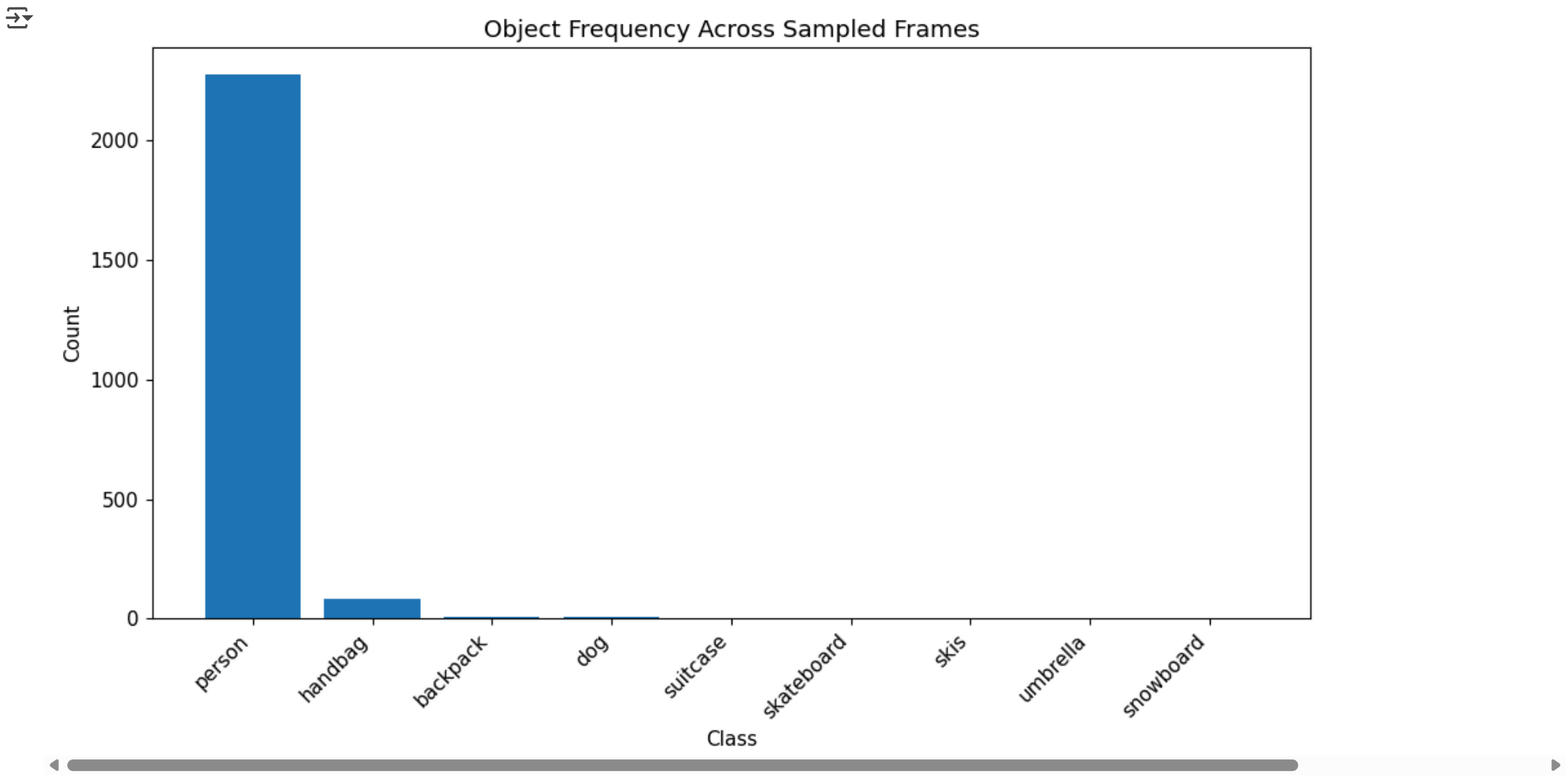

```python
# Total counts per class
all_detects = [
    det['class']
    for frame_data in summary.values()
    for det in frame_data['detections']
]
counts = Counter(all_detects)
print("Total object counts:\n", counts)

# unique classes per frame
diversity = {
    frame: len({det['class'] for det in data['detections']})
    for frame, data in summary.items()
}
best_frame = max(diversity, key=diversity.get)
print(f"Frame with max class diversity: {best_frame} ({diversity[best_frame]} classes)")
```

```
Total object counts:
 Counter({'person': 2275, 'handbag': 81, 'backpack': 7, 'dog': 6, 'suitcase': 4, 'skateboard': 3, 'skis': 2, 'umbrella': 2, 'snowboard': 1})
Frame with max class diversity: frame_95 (4 classes)
```

```
%matplotlib inline
```

```
df = pd.DataFrame(counts.items(), columns=['class', 'count']).sort_values('count', ascending=False)

plt.figure(figsize=(10,6))
plt.bar(df['class'], df['count'])
plt.xticks(rotation=45, ha='right')
plt.title('Object Frequency Across Sampled Frames')
plt.xlabel('Class')
plt.ylabel('Count')
plt.tight_layout()
plt.show()
```



Assignment 2

```
video_path = 'background video _ people _ walking _.mp4'
cap = cv2.VideoCapture(video_path)

frames_to_process = []
frame_count = 0

while cap.isOpened():
    ret, frame = cap.read()
    if not ret:
        break
    # pick every 3rd frame
    if frame_count % 3 == 0:
        frames_to_process.append((frame_count, frame.copy()))
    frame_count += 1

cap.release()
print(f"Collected {len(frames_to_process)} frames for detection.")
```

```
Collected 114 frames for detection.
```

```
people_counts = []
output_detections = {}   # full detection data, if you want to reuse

for fid, frame in frames_to_process:
    results = model(frame)
    dets = results.pred[0].cpu().numpy()
    # count how many “person” detections
    count_person = sum(1 for *_, conf, cls in dets
                       if model.names[int(cls)] == 'person')
    people_counts.append((fid, count_person))
    # store full detections
    output_detections[fid] = [
        {
          'class': model.names[int(cls)],
          'bbox': [float(x1) for x1 in box],
          'confidence': float(conf)
        }
```

```
        for *box, conf, cls in dets
    ]
```

```
/root/.cache/torch/hub/ultralytics_yolov5_master/models/common.py:906: FutureWarning: `torch.cuda.amp.autocast(args...)` is deprecated. Please use `torc
  with amp.autocast(autocast):
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  with amp.autocast(autocast):
```

```
from collections import deque
alert_log = []
window = deque(maxlen=5)

for fid, count in people_counts:
    window.append((fid, count))
    # once window is “full”, check if every entry has ≥3 people
    if len(window) == 5 and all(c >= 3 for _, c in window):
        # log at the latest frame in window
        alert_log.append({'frame': fid, 'alert': 'Crowd Detected'})

# Deduplicate in case overlapping windows fire multiple times for the same frame
alert_log = {entry['frame']: entry for entry in alert_log}
alert_log = list(alert_log.values())

print("Alerts:", alert_log)
```

```
Alerts: [{'frame': 12, 'alert': 'Crowd Detected'}, {'frame': 15, 'alert': 'Crowd Detected'}, {'frame': 18, 'alert': 'Crowd Detected'}, {'frame': 21, 'ale
```

```
# JSON
with open('alerts.json', 'w') as f:
    json.dump(alert_log, f, indent=2)

# TXT
with open('alerts.txt', 'w') as f:
    for entry in alert_log:
        f.write(f"Frame {entry['frame']}: {entry['alert']}\n")

print("Saved alerts.json and alerts.txt.")
```

```
Saved alerts.json and alerts.txt.
```

```
alert_frames = [e['frame'] for e in alert_log]
```

```
plt.figure(figsize=(12, 2))
plt.eventplot(alert_frames, orientation='horizontal', colors='red')
plt.xlabel('Frame Number')
plt.yticks([])
plt.title('Crowd Alert Timeline')
plt.tight_layout()
plt.show()
```