Homework3
Object Tracking

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Deadline: 2024 / 11 / 18 23:55

Objective

- Implement visual multiple object tracking on videos
- Using detection model + Hungarian algorithm
  - Using tracking model directly are not permitted
- Calculate the total number of people appearing in the video
- Output the tracking result video

Steps

1. Choose a detection model and do detection for each frame.
    - You can use pre-trained weight or train by yourself
    - It is only necessary to detect the ‘people’ category
2. Using Hungarian algorithm to match the bounding boxes.
    - You can use existing sklearn function (see reference)
    - Decide on the cost factor by yourself (IOU, distance, ReID similarity, etc.)
    - If same person leaves and re-enters the frame, they should be counted as a different individual.
3. Calculate the total number of people in the video.
4. Render tracking results and save the video (requirements on the next page)

Output Video Requirements

1. People count on the upper left corner
2. People bounding boxes
   - Box of different instance should be colored with difference colors.
   - Box of the same instance should maintain the same color within frames.
   - (Optional) unique box_id labeled on box.

Output Video Requirements - Bonus

1. **Trajectory visualization**
    - Visualize each people's trajectory
2. **Movement speed**
    - Calculate movement speed
    - Unit: pixel / frame
    - Display result around the box.

Benchmark

- **The compressed assignment file provides the following data:**
  - **‘easy_9.mp4’:** A simple scene (no overlapping), used to check if tracking successfully implemented.
  - **‘hard_9.mp4’:** A complex scene (with overlapping), used to evaluate the handling of intersecting bounding boxes.
  - **’easy_9_output.mp4’:** Tracking result example of ’easy_9.mp4’, including bonus.
  - The number after the underscore in the filename represents the correct answer.
  - You can also test with other videos of your choice.
- **You must save the video, including the requirements mentioned before.**
- **We will grade based on the result video.**

Grading Policy

- **Online DEMO**
  - **We will have DEMO in 11/21, 11/22 Via Google Meet.**
    - **If you can't demo on these two days, contact TA.**
  - **The procedure requires you to share your screen and turn on your microphone.**

    Please ensure that these functions are working properly.
  - **Please go to Google Sheet and fill demo time you prefer.**
  - **The meeting link will be announced on the demo day.**

Grading Policy

- **Tracking result**
  - **easy case - 60 points**
    - Show the result video of tracking **'easy_9.mp4'.**
    - 10 points will be deducted for each error.
  - **hard case - 20 points**
    - During the DEMO, you will get a video **'demo.mp4'.**
    - Run your tracking procedure and display the tracking result video.
    - You can have up to 3 errors, and 3 points will be deducted for each additional error.
  - **Bonus: Trajectory visualization - 10 points**
  - **Bonus: Movement speed - 5 points**
  - **Definition of error**
    - **People count mismatch**
      - **Example - predict: 4, answer: 7, and there're abs(7-4) =3 errors**
    - **Wrong tracking**
      - **Example, 2 people swap bounding boxes after overlapping, 1 times = 1 error**
- **Q&A** – 20 points
  - TA will ask some questions about your implementation.
- **If you don't implement using detection model + Hungarian algorithm, will get 0 points**

Submissions & Penalty

- Your submission should contain only your code
  - Do not contain any model weight or videos
- Compress into one zip file named HW3_{studentID}.zip
- Format penalty: 10 points
  - Submit in wrong name, wrong format, wrong file, etc.
- Late penalty: 20 points per day
  - 1 day -> 20 points, 2 days -> 60 points, and so on.
- You can use any code from Github, but DO NOT copy from your classmate!
  - Any copying will result in a score of zero.

Reference

- https://zh.wikipedia.org/zh-tw/匈牙利算法
- https://hackmd.io/@computerVision/S18nD20Vq
- https://alu2019.home.blog/2021/01/20/edge-ai-multiple-object-tracking-mot-duo-ge-wu-ti/
- https://blog.csdn.net/your_answer/article/details/79160045