

Homework 4: Detection and Classification

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Handout: 2024-11-01

Due: 2024-11-15, at 3:00 PM on Canvas

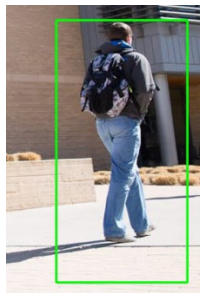
Instructions:

- Homework is on a “rolling” basis and more **questions will be added until 1 week** before the due date. There will be an announcement (on Discord or in class) when new questions are added.
- For all problems in this homework, you can convert your images to **grayscale** for simplicity. So, no need to work with RGB images (unless you want to).
- You can get help from your teammates (or others) for all problems and/or code. However, you will need to code the problems and submit your report **individually** on Canvas. Reports/code that are **identical** will receive a grade of **zero**.
- The **quiz** will strongly resemble homework questions, and if you understood/coded the homework yourself, you will be able to answer the quiz questions immediately. Because the quiz will be closed-notes & no internet access, understanding the homework is crucial!
- **Deliverables:** You will submit a **single PDF** file to Canvas. The PDF must contain your **answers**, your **code** (copy-paste in the document), and any requested **outputs** (like images). For convenience, you may use Jupyter notebook and convert it to a PDF.
- Only use **images provided** in the homework material, as requested by each problem. Using any other image, will result in a **grade of zero**.
- **Grading:** This homework will be scaled to **10pts** of your final grade. Grading **rubric** will be posted on **Canvas** after the assignment due date.

Problem 1: Dalal-Triggs Pedestrian Detector

Use OpenCV’s trained classifier provided in `cv2.HOGDescriptor()` and `cv2.HOGDescriptor_getDefaultPeopleDetector()` to detect pedestrians in images “**csm1.jpg**”, “**csm2.jpg**”, and “**csm3.jpg**”. You can use the template code provided in the homework material.

- Provide a copy of your code in the report
- Display **input images**
- Display **output images** with pedestrian detections **marked by rectangles**, as shown below



- Do you notice any issues with the detected pedestrians? Discuss at least **two major issues**.

Problem 2: Viola-Jones Face Detection

Use OpenCV’s trained Haar classifier weights ‘`haarcascade_frontalface_default.xml`’ in `cv2.CascadeClassifier()`, and write a script that detect faces in images “**csm1.jpg**”, “**csm2.jpg**”, and “**csm3.jpg**”. You can use the template code provided in the homework material.

- Provide a copy of your code in the report
- Display **input images**

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- Display **output images** with face detections **marked by rectangles**, as shown below



- Do you notice any issues with the detected faces? Discuss at least **two major issues**.

Problem 3: Bag of Words

- Bag of words with nearest neighbors
- Bag of words with SVM