CECS 551
Assignment 10
Total: 80 Points

General Instruction

- Submit uncompressed file(s) in the Dropbox folder via BeachBoard (Not email).

1. Develop face recognition software using pre-trained YOLO V3 and Facenet model. Please note that you don't need to implement and train a model.

   (a) Search and study open source codes of YOLO V3 and Facenet model.

   (b) Import the open source codes into your workstation.

   (c) Download the dataset (`img_celeba.7z`) *at here*. You should download all 7-zip parts to extract it. The dataset includes $202,599$ images of $10,177$ celebrities.

   (d) (10 points) `identity_CelebA.txt` includes pairs of the file name and the id. Using `identity_CelebA.txt`, choose the image files of ids included in the `selected_ids.txt`. Create a selected dataset with the selected images. The selected dataset will include $1,200$ images. (30 images for each of the 40 celebrities)

   (e) (25 points) By using pre-trained YOLO V3 and Facenet model, implement a Python program `image2vect.py`.

      - Input: An image (x) which includes a human face.
      - Intermediate steps
         1. Find bounding box of the face in the input image.
         2. Crop the input image for the bounding box. (x')
      - Output: Embedding vector $(f(x') \in \mathbb{R}^d)$ in d-dimensional Euclidean space for the cropped image. The embedding vector should be normalized, i.e. $||f(x')||_2 = \sum_i^d f_i(x')^2 = 1$.

   (f) (25 points) Implement a Python program `imageFinder.py`.

      - Input: An image of a celebrity in the selected dataset.
      - Intermediate steps
         1. Using `image2vect.py`, compute Euclidean distances between the embedding vector of the input image and the embedding vectors of other images in the selected dataset. You will have $1,199$ Euclidean distances.
         2. Consider a hyper-parameter τ. The other images will be recognized as the same celebrity of the input image if the Euclidean distance is less than τ.
      - Output: A list of image files recognized as the same celebrity of the input image.

   (g) (10 points) For different τ's, compute the precision and recall. The range of τ should be wide enough and the interval of τ should be small enough to verify the effect of τ.

- Precision $= \frac{\text{\# of correctly recognized images}}{\text{\# of recognized images}}$
- Recall $= \frac{\text{\# of correctly recognized images}}{\text{\# of actual images of the celebrity (29)}}$

(h) (10 points) Repeat the step (f) and (g) for input images of 10 randomly selected unique celebrities. Draw the overlapped precision and recall curve as shown in Figure 1.

(i) Submit your source code, requirements.txt and a report file. The report file should include the experimental results, discussions, and the references of the pre-trained models.
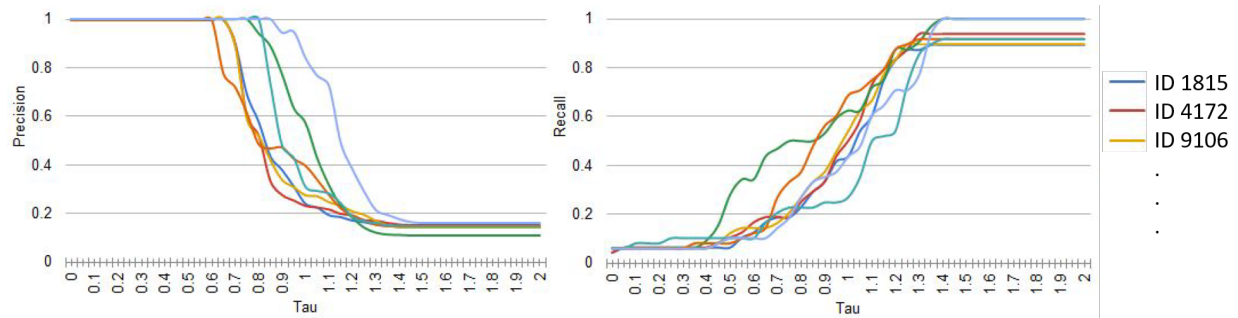

Figure 1: An example of precision and recall curve