[CS-F425: Deep Learning] Class Project Jan-Apr 2022

Age Inveriant Face Recognition

Instructions

This semester, the class project will be on age-invariant face recognition. You would develop a system that can reliably match images of a person taken at two different ages. There are two-part to this project. First, the **data collection** and the second **system development**.

1 Data Collection

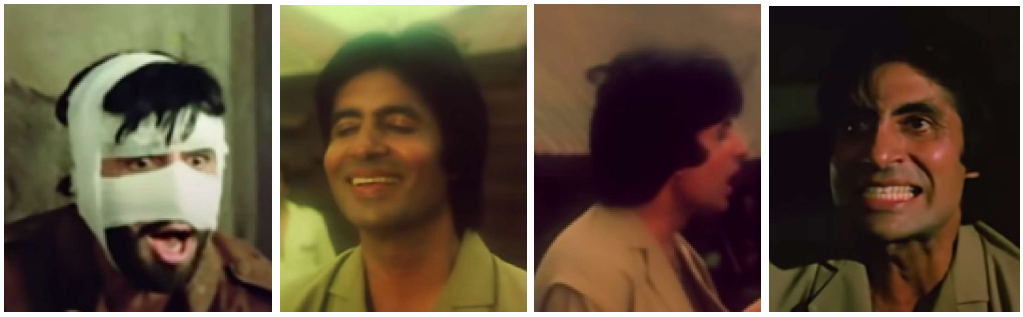
- Choose any four celebrity actor/actress who have done enough movies (hindi/tamil/telgu/... any language). You can select hero/villian/side hero/ etc. International actors are also allowed.
- Register your celebrity in the file mentioned in the footnote here [1]. Note that your celebrity should be different than the others already chosen.
- Get their movies done at different ages.
  - How many movies? 6
  - Difference of age between two movies? should be 4 -to- 6 year
  - Number of images of the actor per movie? 50
  - Image specification: you may take a print screen and crop the image. Do not resize. The image should not be very small in size (not less than 500×500). Frontal image only. No occlusion (part not visible). No extreme pose (like looking to sky or floor). Eyes open. No extreme lighting (very dark or bright). No heavy makeup.
  - Can another actor be in the scene? avoid as much you can.
- **Example:** consider a celebrity actor **Amitabh Bachchan**, who had done a movie **Satte Pe Satta** when he was of age 40 years. You have to determine the age of the celebrity by exploring the date of birth of the actor (1942 in this case) and the release date of the movie (1982 in our case). The 50 images that you have collected should be given names as

  AmitabhBachchan-SattePeSatta-40-01.jpg, AmitabhBachchan-SattePeSatta-40-02.jpg, AmitabhBachchan-SattePeSatta-40-03.jpg, AmitabhBachchan-SattePeSatta-40-04.jpg, AmitabhBachchan-SattePeSatta-40-05.jpg, ... AmitabhBachchan-SattePeSatta-40-50.jpg

  - Actor name should be a single word in camel format with no space. for example, **Amitabh Bachchan** is AmitabhBachchan
  - Similarly, movie name should also be in camel format like SattePeSatta
  - Age in year should be in **two** digit like 01, 02, 03, ..., 99
- Few GOOD images of **Amitabh Bachchan** from the movie **Satte Pe Satta** are as below

[1] https://docs.google.com/spreadsheets/d/1r0IeTFrt3QE5saxjcVNnAhSG3TIf-fGtvLFCMoWANwk/edit?usp=sharing

- Similarly some BAD images of **Amitabh Bachchan** from the movie **Satte Pe Satta** are as below



You would upload your data on NALANDA. Marks would be awarded based on the captured age variation and the quality of data.

2 System Development

A large subset of the data uploaded on NALANDA would be made available to every student through the course webpage. Please note you are not supposed to distribute it and must delete it after submitting your report.

2.1 What need to be done

We expect the following experiments to be done. However, the list is neither exhaustive nor exclusive.

1. Do $n \times n$ matching using popular feature extractor like SIFT/SURF/ORB/ArcFace/CosFace and more
2. $n \times n$ matching here means the following
   take any image with name S1 and match with all other having names S2
3. Prepare genuin/imposter histogram
4. Explain how scores are obtained
5. Plot ROC
6. Report EER and the corresponding threshold.
7. Report CRR
8. Do some ablation study and modify parameters

Explain what your observations and conclusions are. You can take help from the paper arxive paper [2] on teethphoto.

2.2 Definitions

Standard performance parameter are,

- **Correct Recognition Rate (CRR):** It is defined as the number of actual matches that are obtained at rank one recognition.

$$CRR = \frac{Number\ of\ matches\ correctly\ recognized}{Total\ number\ of\ matches}$$

- **False Acceptance Rate (FAR) and False Rejection Rate (FRR):** FAR refers to the likelihood of the biometric system to incorrectly accept an unauthorized user as an authorized one *i.e.* the rate of false acceptance over the number of imposter attempts. It is defines as:

$$FAR = \frac{Number\ of\ incorrect\ matches\ recognized}{Total\ number\ of\ matches}$$

[2] https://arxiv.org/abs/2107.13217 'DeepTeeth: A Teeth-photo Based Human Authentication System for Mobile and Hand-held Devices'

FRR on the other hand, is the likelihood of a biometric system to incorrectly rejecting an authorized user by considering him to be an unauthorized user, which is defines as the rate of false rejection over the number of genuine attempts by the user.

$$FFR = \frac{Number\ of\ correct\ matches\ not\ recognized}{Total\ number\ of\ matches}$$

- **Equal Error Rate (EER):** It is the point at which the False Acceptance Rate (FAR) and False Rejection Rate (FRR) are equal. It gives a threshold to evaluate the recognition performance of a system. Also, a system with lower EER is considered better.
- **Accuracy:** is maximum value of $(100 - (FRR + FAR)/2)$ across all thresholds.
- **ROC Curve:** An ROC curve is obtained by plotting FRR vs FAR, by varying the decision threshold. The area under the curve gives the error rate of the system. A system having less area under the curve is better at classification.

3 Submission

1. **Data Collection:** Submit a single zip file containing all the images and a report stating the names of all files, movies, and the corresponding age of the actor.
2. **System Development:** A single .zip file on Nalanda containing .pdf and code. The report need not be very large; talk about the experimental findings and results only. The Result-score file need not be submitted. Keep it with you. Will be asked if needed. Evaluation would be done based on the results obtained, the number of experiments done, insights gained.

3.1 Important dates

S.No.	Activity	Deadline
1.	Choose your actor (write name in file)	Feb 25, 2022
2.	Data collection and submission	March 06, 2022
3.	System development, report writing and submission	March 20, 2022