Fundamentals of Computer Vision (Undergrad) - B. Nasihatkon
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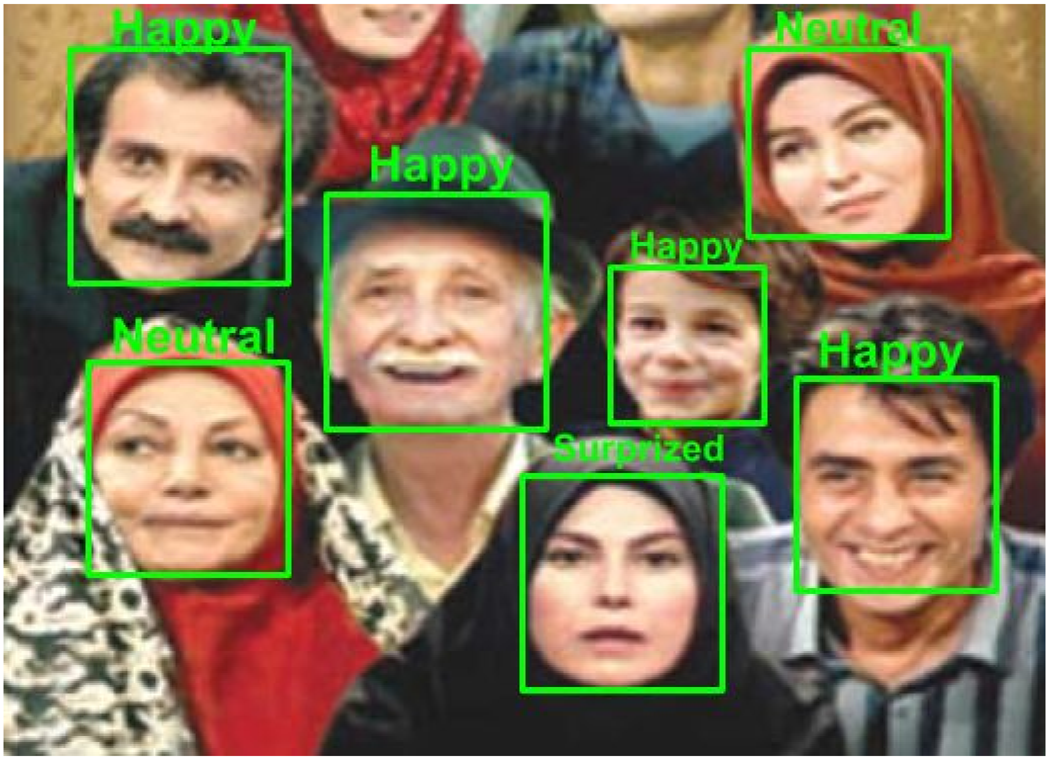
Face Detection and Facial Expression Classification using Cascade Detectors and Convolutional Neural Networks



Overview

Your task is to write a program that detects faces in an image and classifies them according to their expressions.

Goals

1. Preprocess and prepare training data for cascade detection,
2. Train and run a cascade detector in OpenCV.
3. Train a Convolutional neural network to classify facial expressions.

Phase 1: Cascade detection

In this phase, you need to:

1. Train a cascade detector to detect faces in images,
2. Run the cascade on real images and extract the false positives,
3. Add false positives to the negative data samples and retrain the cascade. (repeat this if needed)

There are lots of tutorials on the internet about cascade detectors and their training in OpenCV. You may start here:

https://docs.opencv.org/master/dc/d88/tutorial_traincascade.html

https://www.learnopencv.com/training-better-haar-lbp-cascade-eye-detector-opencv/

A variety of datasets can be found on the internet for face detection. For example, look here:

- http://vision.ucsd.edu/content/yale-face-database
- http://vision.ucsd.edu/content/extended-yale-face-database-b-b

You can use the cropped faces for positive examples (the cropped faces are either available in the datasets, or you need to extract them using bounding boxes and resize them for training).

Phase 2: Facial Expression Classification

Train a convolutional neural network to get a cropped image of a face and classifies it in at least 3 of the following categories:

- neutral
- happy
- sad
- surprised
- disgusted
- angry

Some of the datasets are listed here:

https://en.wikipedia.org/wiki/Facial_expression_databases

Phase 3: Combination

Combine phases 1 and 2: Detect faces in an image using a cascade detector. Then feed the detected face into the neural network for expression classification.

Teamwork and How to present

- You may work in teams of at most 2 people. But, each student will present the project to the TAs individually. Each student must be able to fully explain all parts of the code.
- Your program is tested on a video taken by a webcam. But, it does not need to perform at the frame rate (in real time).
- You have till the coming Saturday to send your team members to the TAs.
- **Your programs will be checked for similarity. Similar codes will not be marked.**
- **You cannot use pre-trained cascades or networks.**

Extra Credit

Extra credit is given for

- No false positives.
- Real-time execution on videos (at least 20 frames per second for an 800x600 video),
- Covering different poses (frontal to profile views),
- Also classifying according to gender (male, female) and age (adult, child).