Facial Emotions Recognition

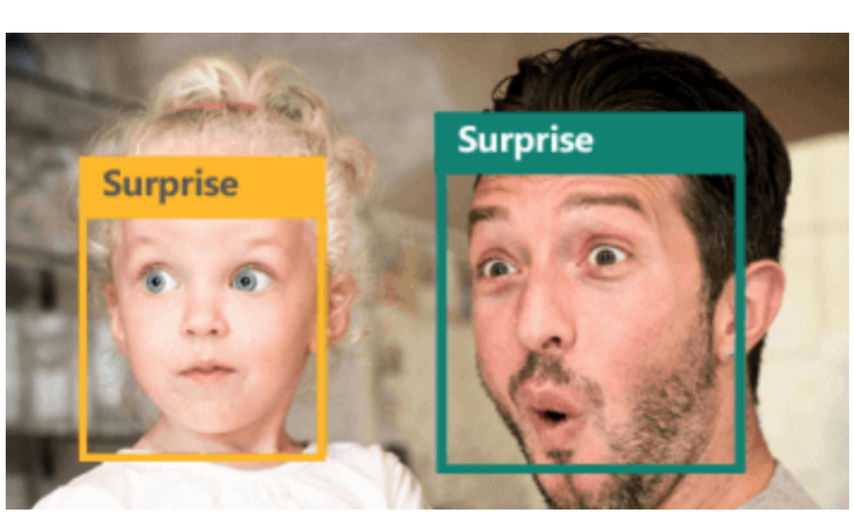
Judy Lu **Zhenyu Li**
Instructors: Martin Takáč, Xi He

Abstract

We have developed a convolutional neural network to classify human facial emotions. We use transfer learning on the fully- connected layers of an existing convolutional neural network which was trained for human emotion classification. A variety of datasets, as well as our own unique image dataset, is used to train the model. So far, an overall training accuracy of 39.5% is achieved. In this project, we aim to accomplish real time facial emotion recognition and possibly move to facial emotion generation.

Main Objectives

1. Facial emotion recognition for given face image, output its emotion label (happy, sad, angry, etc.)
2. Real time facial emotion recognition use web-camera to recognize facial emotion in real time
3. Facial emotion generation (for given plain face, generate face with wanted emotion)

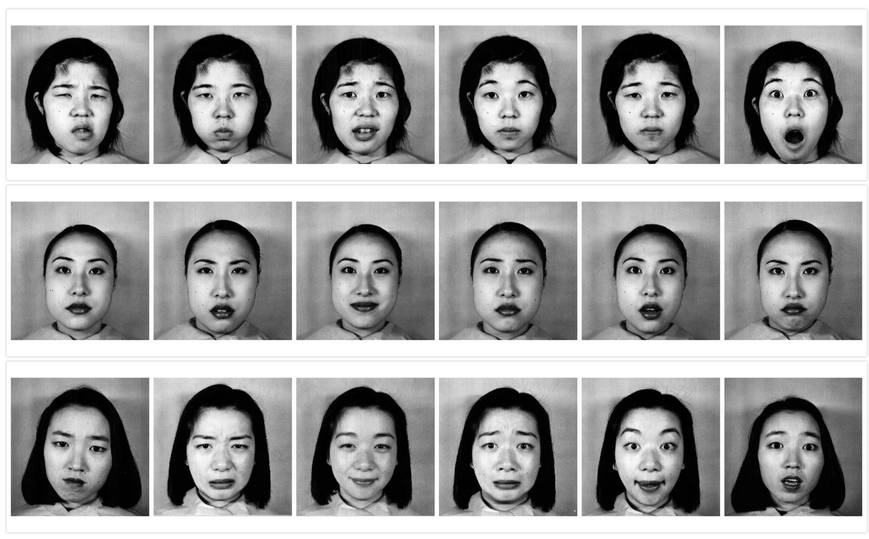


Dependency

1. python basics/opencv/pytorch
2. basic linear algebra
3. neural networks

Datasets/Training Data

To develop a working model, we use two different datasets: the extended Cohn-Kanade dataset (CK+) and the Japanese Female Facial Expression (JAFFE) database. The CK+ dataset, although small, provides well-defined facial expressions in a controlled laboratory environment. The JAFFE database provides additional images with more subtle facial expressions with laboratory conditions. Many images were recorded for each of the seven primary emotions (anger, disgust, fear, happy, neutral, sad, surprise) from each subject.



Data Augmentation

Data augmentation is another way we can reduce overfitting on models, where we increase the amount of training data using information only in our training data. Consider, data can be generated with good amount of diversity for each class and time of training is not a factor.Here, we use flipping to increase the amount of datasets.

Procedure

Architecture of the convolutional neural network used in this project.Due to time constraints, we only trained the last few fully-connected layers of the network (fc6, fc7, fc8). The network consists of five convolutional layers, three fully-connected layers, followed by a softmax classifier, for a total of approximately 7x106 convolutional parameters and 7x107 fully-connected parameters.

Figure 1: Grey Scale + Face Detection

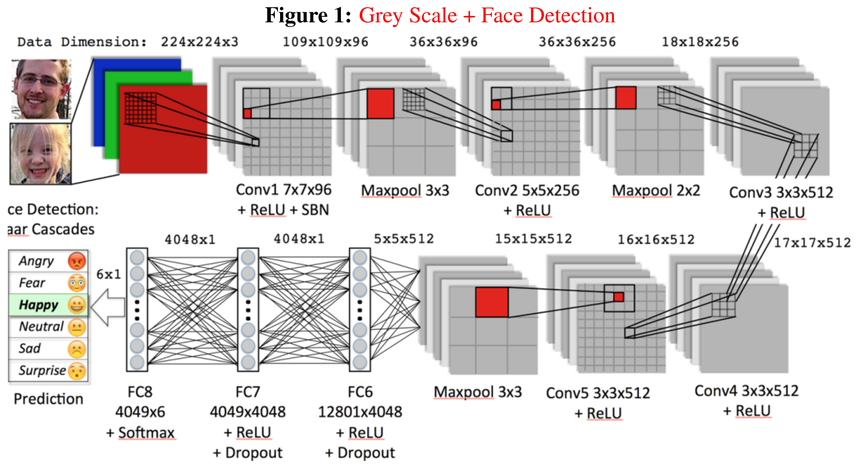


Figure 2: Model Architecture

We also applied a Haar-Cascade filter provided by OpenCV to crop the input image faces, which significantly improved test and training accuracy. A small batch size was required for training. Convergence to low loss appears to occur after 100 iterations.

Results

- All the datasets are processed into seven category(emotion set)and can be used as training data.
- Real time face detection is achieved by OpenCV.
- Donec sem metus, facilisis at condimentum eget, vehicula ut massa. Morbi consequat, diam sed convallis tincidunt, arcu nunc.
- Have a workable facial emotions recognition (FER) model with an overall training accuracy of 39.5%

Future Work

- Have a higher accuracy workable facial emotions recognition (FER) model and try deeper networks and larger dataset.
- Extend the work to web-camera, we will export images from real time web-camera and recognize the face emotions in the image.
- A real time web-camera implementation by OpenCV. Produce a visual demo for our real time facial emotions recognition. Try other networks architecture, like ‘resNet‘ and ‘denseNet‘. Start work on facial emotion generation (FEG) model using ‘GAN‘ networks.

Reference

- M.Lyons,S.Akamatsu,M.Kamachi,andJ.Gyoba,Coding facial expressions with gabor wavelets, in Automatic Face and Gesture Recognition, 1998. Proceedings. Third IEEE In- ternational Conference on, pp. 200205, Apr 1998.
- Lucey, J. F. Cohn, T. Kanade, J. Saragih, Z. Ambadar, and I. Matthews, The extended cohn-kanade dataset (ck+): A complete dataset for action unit and emotion-specified expression, in Computer Vision and Pattern Recognition Workshops (CVPRW), 2010 IEEE Computer Society Confer- ence on, pp. 94101, June 2010.

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