Capstone Project
Machine Learning Engineer
Nano degree

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Face Emotion Recognition

Link of the review: https://review.udacity.com/#!/reviews/3975189

Project Overview

This project is to help people to define the emotion of the face, so in this project I implement an emotion recognition system using machine learning.

Problem statement:

Some children can't understand the emotion of person who talk with , so FER models could help those children in their life, also FER could help the doctors to monitor the health of patients remotely ,also FER could be used in driving car system to make any alarm in case driver don't aware of street, So I made ML model with less space and time complexity for facial emotion recognition.

Datasets and inputs:

Dataset is COHN-KANADE (CK+) DATASET, and this dataset contains 981 images, Image size 48 x 48.

Solution statement:

This project aims to classify human facial expressions from the face image. Solution will be used classical machine learning techniques so that it requires less computing and complexity. The project will use GCN to enhance the input image as a preprocessing step, extract a DLTP descriptor, use PCA to reduce the high-dimensional DLTP features, and implement a K-ELM classifier to classify the face expression

Benchmark model:

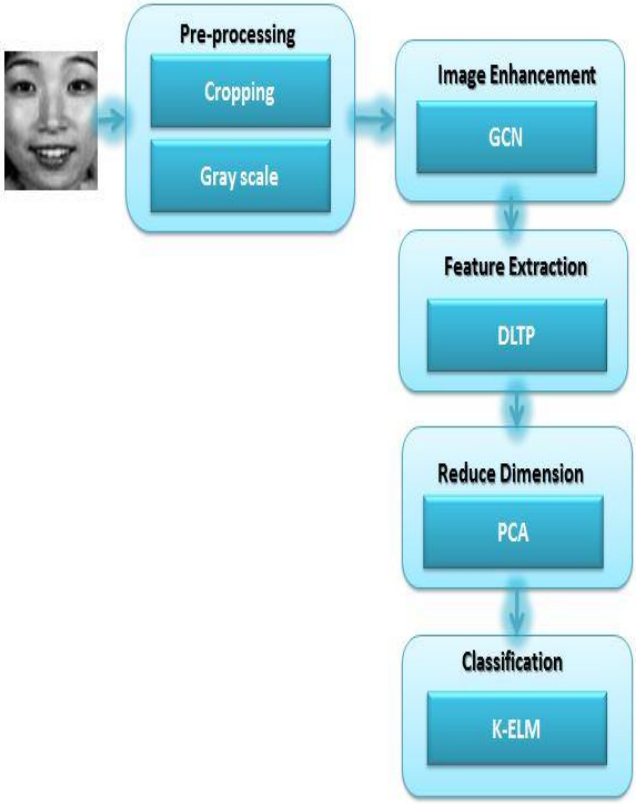
I tried different models for this problem:

1. HOG with SVM: this model used HOG as the extracted feature and then classify image using SVM classifier, this model gives good result but when used K-ELM classifier, it gives bad result

2. TFM with SVM: this model used TFM as the extracted feature and then classify image using SVM classifier, this model doesn't give good result and take more time in execution.

Evaluation metrics:

My evaluation metrics are the value of accuracy and the time of execution, this model gives best accuracy and takes less complexity.



Project design:

The pipeline consists of five: units, namely preprocessing, image enhancement, feature extraction, dimensionality reduction and classification.

Preprocessing:

In this step I resize the image with size 48x48, and then convert each image into a gray scale.

Image enhancement:

I use contrast enhancement techniques to enhance the input images, so this will make a powerful feature. The GCN is a global contrast enhancement technique that transforms the intensity of pixels using a single transformation. GCN performs contrast normalization, which considers all image pixels' value

Feature extraction:

I extract the DLTP. It is a very powerful feature. It determines the threshold automatically that depends on the values of pixels; unlike the LTP, it sets the threshold manually which is a critical task in LTP. DLTP is a new variant of LTP which dynamically determines the threshold and is used to get the texture information for the input face image so this texture information will help to get the emotion of face from input image.

Dimensionality reduction:

In this step, I want to reduce the number of input features. As High-dimensional features affect the performance of classifiers, features from DLTP have high-dimensional and redundant information, so I used PCA

Classification:

K-ELM solves many issues that exist in naïve ELM, K-ELM used a kernel instead of many hidden nodes in ELM classifier. This kernel helped to decrease the training time and computational complexity

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List of Abbreviation:

DLTP: Dynamic Local Ternary Pattern
HOG: Histogram of Oriented Gradients
TFP: Taylor Feature Pattern
SVML Support Vector Machine
ELM: Extreme Learning Machine Classifier
PCA: Principal Component Analysis
GCN: Global Contrast Normalization
K-ELM: Kernel Extreme Learning Machine Classifier