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FACIAL EXPRESSION RECOGNITION SYSTEM BASED ON CNN ALGORITHM FOR EMOTION PERCEPTION

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Abstract

The facial expression recognition system has many real-time applications including the understanding of human behavior, detection of psychological disorders, and artificial human expressions. Although there is a lot of research using images, the search continues for the development of new methods that would be quiet in the calculation and have less memory usage compared to previous methodology. The ability to recognize facial expressions automatically allows new applications in human-machine interaction and other areas. As a result, there has been active research in this area, with several recent works using convolutional neural networks (CNNs) for feature extraction and inference. The proposed system has input module as an interactive webcam interface with CK+, the processing module has frame preprocessing component using datasets and neural net and the output module will determine the efficiency of the facial expression recognition system.

Keywords: Facial Expression, Convolutional neural networks, Preprocessing

(I) Introduction

(I.a) General

Facial expression recognition, which many researchers have put much effort in, is a significant portion of modernized computing and artificial intelligence. However, facial emotions change so subtly that recognition efficiency of most traditional approaches largely depends on extraction of features. An emotion expression is one or more motions or positions of the facial sense muscles beneath the membrane of the face. As motioned by one arrangement of disputable hypotheses, these developments pass on the enthusiastic condition of a person to audience. Outward appearances are a type of non-verbal correspondence. They are the essential methods for passing on social data between people, yet they additionally happen in most different vertebrates and some other living species.

(I.b) Objective

The major objective of the resultant proposed model will be the increasing efficiency of the existing model. Further the proposed model will also performing expression based recognition on the user and there will be personalized user interactive front end which will help the user to be very much user friendly.

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(I.c) Description

The originality or the novelty of the proposed system will be frame by frame analysis of the video or the input module. This will be using artificial neural networks instead of biological neural networks. The scope of this will be at macroscopic level including the selection boards of defense forces for the psychological fields and also in the interrogation detection and emotion quotient testing. This will be put up using completely accumulated data sets and a video webcam for a customized ad user friendly interface .

(II) Related works

Facial expression recognition, which many researchers have put much effort in, is an important portion of affective computing and artificial intelligence. On the other hand, human facial emotions change so subtly that recognition accuracy of most traditional approaches majorly depends on extraction of features. Meanwhile, deep learning is a hot research topic in the field of machine learning recently, which intends to simulate the organizational structure of human brain's nerve and combine low level features to form a more abstract level. In this paper, we employ a deep convolutional neural network (CNN) to devise a facial expression recognition system, which is capable to discover deeper feature representation of facial expression to achieve automatic recognition. We introduce both the Japanese Female Facial Expression Database (JAFFE) and the Extended Cohn-Kanade Dataset(CK+) to simulate and evaluate the recognition performance under the influence of different factors (network structure, learning rate and pre-processing). We also introduce a K-nearest neighbor (KNN) algorithm compared with CNN to make the results more convincing. The accuracy performance of the proposed system reaches 76.7442% and 80.303% in the JAFFE and CK+, respectively, which demonstrates feasibility and effectiveness of our system.

In 2000, the Cohn-Kanade (CK) database was released for the use of advanced scanning to naturally recognize unique facial feelings. From that moment, the Cohn-Kanade database proved to be one of the most used tests to improve and evaluate the calculation. In this period, three difficulties were evident: As a result, the CK + database was used for both the AU and the joint discovery (although the names of the latter were not approved), the computational review lacks reference, and the use of arbitrary subsets of the first database makes meta-surveys problematic. To focus on these and other concerns, we have posted the Extended Cohn-Kanade (CK +) database. The number of arrangements is increased by 22% and the number of components by 27%. The goal articulation for each group is fully coded by FACS and the sensitivity marks have been reconsidered and approved. In addition, non-postural arrangements have been included for some smiles and their associated metadata. We show indicators using active appearance models (AAM) and a direct help vector machine classifier (SVM) that uses cross-subject approval for AU and sensory recognition for postulated information. AU sentiment and names, as well as expanded image information and points of interest, will be available in July 2010.

A rectangular component similar to the Haar can be characterized as the distinction of all the pixels of the regions within the rectangle, which can be in any position and scale within the first image. This adjusted list of capacities is called highlighting of 2 rectangles. The qualities demonstrate certain attributes of a specific area of the image. Each composite component can demonstrate the presence (or non-appearance) of specific qualities in the image, for example, edges or changes in the surface. For example, a highlight of 2 rectangles can show where the fringe lies between a dark and light regions respectively.

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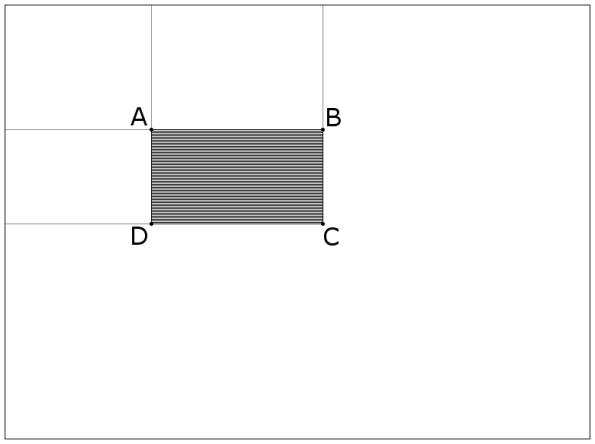

T_Sum=I(C)+I(A)-I(B)-I(D)

Where feature points A,B,C,D belong to the integral image I as shown in the above figure.

(III)ARCHITECTURE

This is the first attempt to use optical flow method to determine the direction of movement of facial muscles. Then, they extracted the feature vectors to achieve four kinds of automatic expression recognition including Happy, Angry, Disgust, Fear and Surprise. In this proposed system, we observe a method to achieve facial expression recognition based on a CNN model. Firstly we implement face detection by using Haar-like features and histogram equalization. Then we construct a four-layer CNN architecture, including two convolutional layers and two sub sampling layers (C-S-C-S). Finally, a Softmax classifier is used for multi-classification. One of the main reasons was that CNN could not get ideal results on large size images. The major methodology used was

Optical flow method

Convolutional neural network

K-nearest neighbour

Data sets used – CK+

As a result of the existing model studies the accuracy performance of the proposed system reaches

76.7442% for JAFFE Data set

80.303% for CK+ Data set

But it was changed when Hinton and his students used a deeper Convolutional Neural Network to reach the optimal results in the world on ImageNet in 2012. Since then, more attention has been paid on CNN based image recognition.

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(III.a) Architecture Diagram

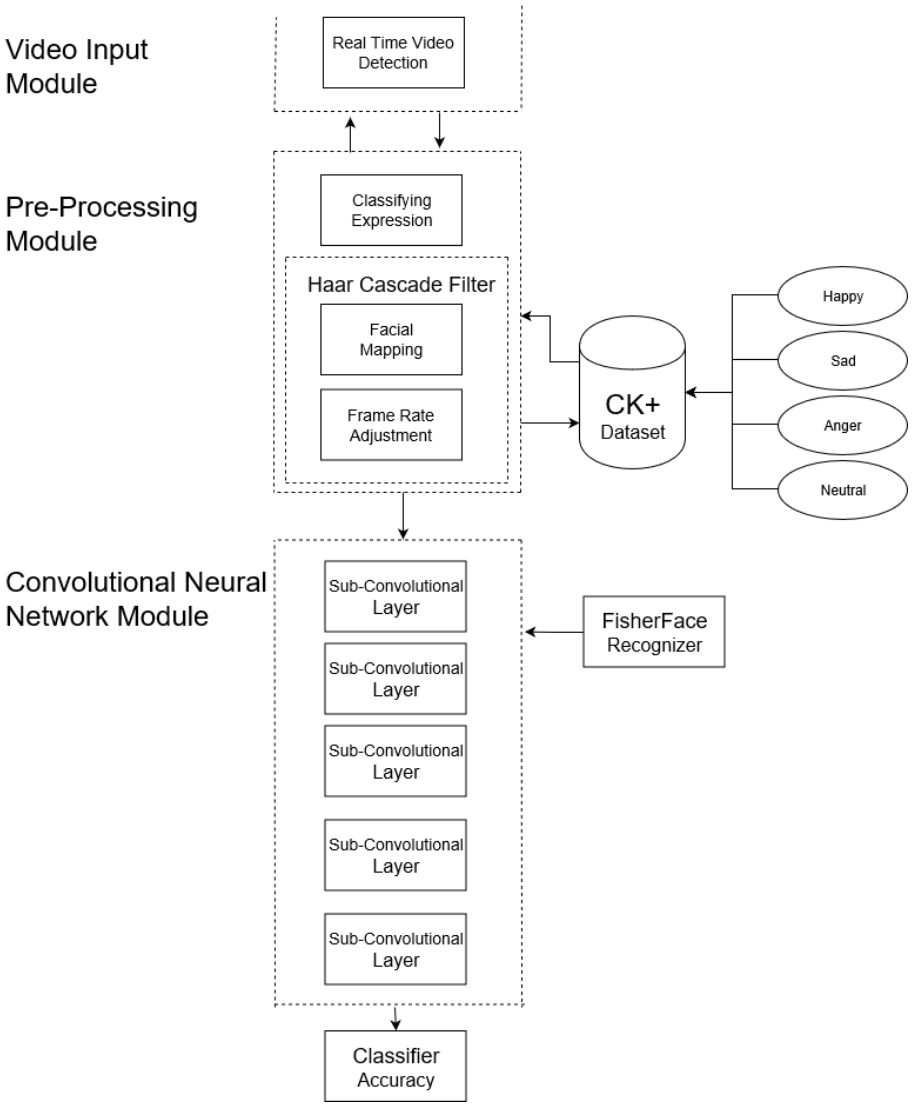

Figure (III-1): Architecture diagram which denotes each subdomain and its functionality.

(IV)METHODOLOGY

The proposed given system has many real-time applications including the understanding of human behavior, detection of mental and psychological disorders, and synthetic human emotional expressions. Even though there is a research going on using static images, the search continues for the development of new modernized methods that would be easy in the calculation and have less memory usage compared to previous iterative models and methods. The ability to recognize facial emotion expressions

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automatically allows new applications in human-machine interaction and other areas. As a result, there has been effortless research in this area, with several recent works using convolutional neural networks (CNNs) for feature extraction and inference. The proposed system has input module as an interactive video interface with JAFFE and CK+, the processing module has frame preprocessing component using datasets and neural net and the output module will determine the efficiency of the facial expression recognition system.

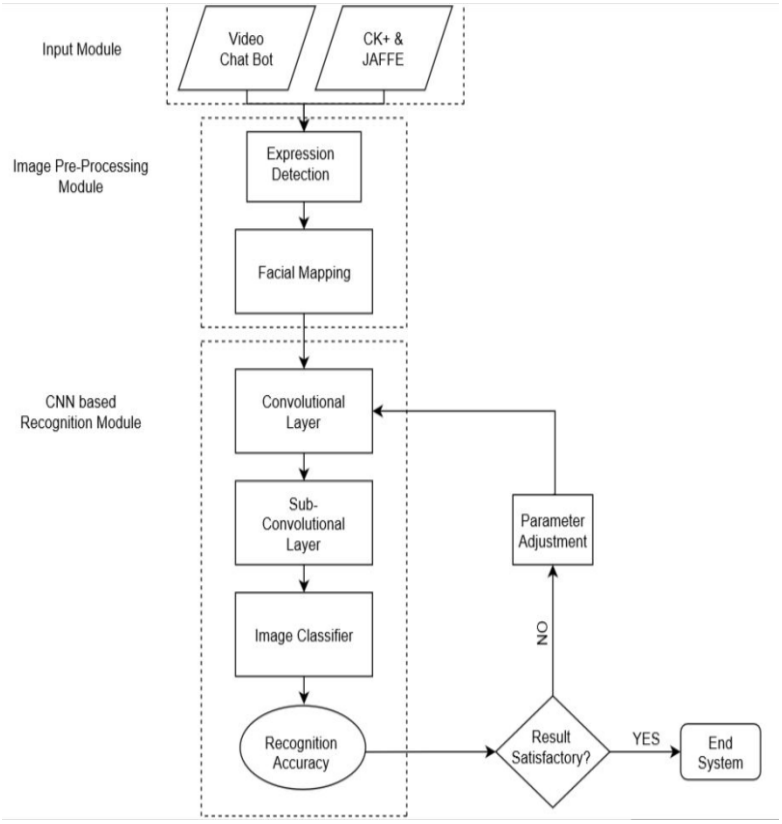

Figure (IV-1): Module diagram representing each function and its flow.

(IV.a) Webcam Interface

Description:- A webcam interface is an interactive agent, or Artificial Entity is a computer program which conducts a conversation by the help of auditory or textual methods

Methodology:- A Programmable User interface will be used as multimedia message bot. Predefined questionnaire based on users queries. Significant breakdown of video file into frames.

Novelty:- It will capture frame inputs during user client interaction.

Challenges:-Interface for image capture. The complexity for video input.

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Results

Efficiency in detecting and face mapping for emotions.

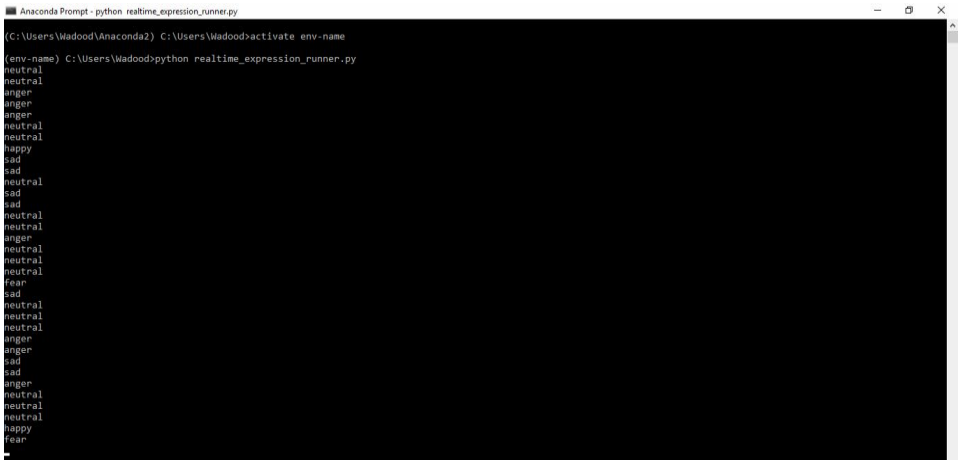

Figure (IV.a-1): FisherFace Recognizer using webcam as input, gives out the emotion the user is expressing.

(IV.b) Frame pre-preprocessing

Description:- We employ two standard facial expression databases for the simulation. CK+ covers the expression images of all races of people and has 328 pictures totally.

Methodology:- Face detection based on Haar-like feature using HAARCascade filter.

Novelty:- Using facial expressions as input.

Challenges:- Sequential expression analysis. Extraction of emotions excluding basic human feelings.

Results:- Images will be captured from the video input.

Figure (IV.b-1): HAARCascade filter recognized the emotion and sorted in various files.

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Figure (IV.b-2): Sorting the dataset into various emotion

(IV.c) CNN based recognition

Description:- The algorithm consists of several basic parts; respectively achieve the function of data input, parameter initialization, network training and testing.

Methodology:- Frame classification algorithm, Image and video recognition
Novelty:- Increasing efficiency with frame classification algorithms
Challenges:- Hard to get ideal results for large size images/frames.
Results:- Efficiency of frame captured will be increase

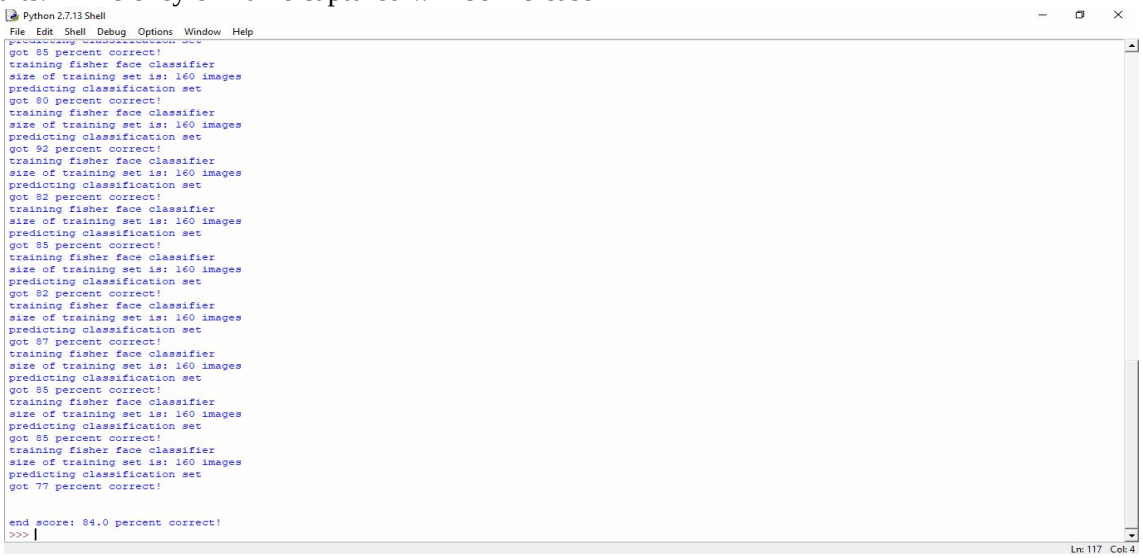

Figure (IV.c-1): Efficiency is iterating by the CNN module and final end percentage is calculated.

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(IV.d) The FisherFace algorithm:-

Python idle 2.7, 3.5 and Anaconda Prompt (IDE) now comes with the new Face_Recognizer class for face recognition, so you can start experimenting and analyzing with facial recognition in an easy and quick way.
The algorithms used now are:

- Eigen_faces (see create_Eigen_FaceRecognizer())
- Fisher_faces (see create_FisherFaceRecognizer())
- Local Binary Patterns Histograms (see create_LBPH_FaceRecognizer())

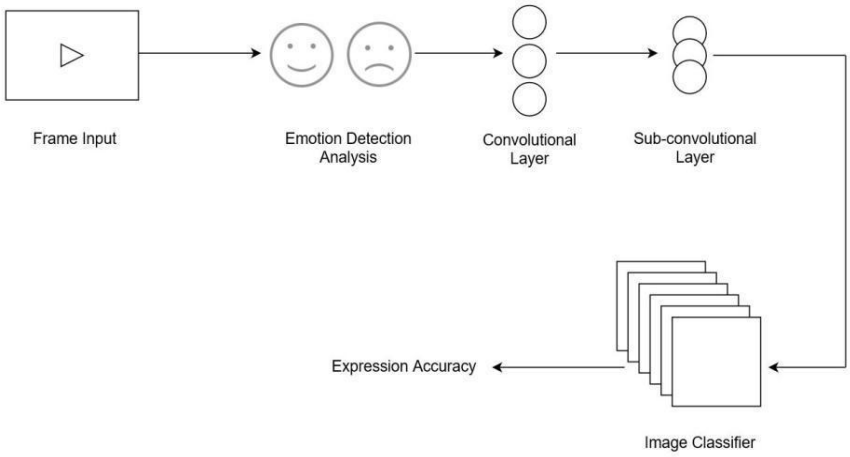

Figure (IV.d-1): Flow of the underlying functionality of FisherFace Recognizer and how it performs in a video simulation.

(V) Reference

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