HERO: HUMAN EMOTIONS RECOGNITION FOR REALIZING INTELLIGENT INTERNET OF THINGS

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ABSTRACT:

Now-a-days with the continued development of artificial intelligence facial emotion recognition has become more popular. The emotion recognition plays a major role in interaction technology. In interaction technology the verbal components only play a one third of communication and the non-verbal components plays a two third of communication. A facial emotion recognition (FER) method is used for detecting facial expressions. Facial expression plays a major role in expressing what a person feels and it expresses inner feeling and his or her mental situation or human perspective. This paper aims to identify basic human emotions with the combination of gender classification and age estimation. The facial emotions such as happy, sad, angry, fear, surprised, neutral emotions are considered as basic emotions. Here proposes a real time facial emotion recognition system based on You Look Only Once (YOLO) version 2 architecture and a squeezenet architecture. The yolo architecture is a real time object detection system. Here it used for identify and detect faces in real time. These images are captured by using anchor boxes for accuracy. The second architecture is squeezenet and is used for gender classification and age estimation. It provides significant, accurate object detection and extracts high-level features that help to achieve tremendous performance to classify the image and detecting objects. Both the architectures provide accurate result than other methods with the large no of hidden layers and cross validation in the neural network.

Keywords: YOLO, emotion, data set, CNN, sequeezenet.

INTRODUCTION

A face detection includes classifying image into two classes: one with faces (targets), and other containing the background (clutter) which needs to be removed. Commonalities exist between

faces, they vary differently in terms of age, skin color and facial expression, this becomes difficult due to this commonality. The further problem is complicated by differing lighting conditions, image qualities and geometries, partial occlusion and disguise is also a possibility. A face detector should be able to detect the presence of any face under different set of lighting conditions in any background condition. The face detection analysis can be broken into two tasks. The first task is a classification task that takes some random regions of image as input and outputs a binary value of yes or no, indicating if there are any faces present in the image. The other task is the face localization task which is to take an image as input and output the location of any face or faces within that image as some bounding box/boxes with (x, y, width, height). Smart robots can be built by automatic facial expression application. These bots can be used in various applications like interactive games and service center. There are six universal expressions according to Ekman they are fear, disgust surprise, anger, sadness and happiness. Face variances can be observed to recognize these expressions. For example, we can say a person is happy which can be identified as a gesture of smile by tightened eyelids and raised lips corners. A person's internal states, social communication and intentions are indicated by change in facial expressions. Many applications in many areas like human emotions analysis, natural Human computer interaction, image retrieval and talking bots have a large effect on them by automatic facial expression detection. Face Recognition with Histogram of Oriented Gradients using CNN detection has been an impacting issue in the technological community as human beings fined facial expressions one of the most natural and powerful means to express their intentions and emotions. Last stage of the system is facial expression detection. There are basically three steps in training procedure in expression recognition systems named as feature learning, classifier construction and feature selection. Feature learning stage is first, feature selection is second and the last one is classifier construction. Only learned facial expressions variations among all features are extracted after feature learning stage. Facial expression is then represented by the best features which are chosen by feature selection. Not only maximizing inter class variation but they also should try to minimize the intra class variations of expressions not only maximizing

inters class variation but they also should minimize the intra class variations of expressions. Because same expressions of different individuals in image are far from each other in pixel's space so minimizing the intra class variation of expressions is a problem. Techniques that can be used for facial detection are YOLO, SDD, RCNN, Faster RCNN.

LITERATURE SURVEY

2.1 Facial Expression Recognition with Histogram of Oriented Gradients using CNN.

Authors: Fayyaz Ali,Sahar Zafar,Irfan Ali,Subhash Guriro,Asif KhanAdnan Zaidi Abstract: A new method is introduced in this study for Facial expression recognition using FER2013 database consisting seven classes consisting (Surprise, Fear, Angry, Neutral, Sad, Disgust, Happy) in past few decades, Exploration of methods to recognize facial expressions have been active research area and many applications have been developed for feature extraction and inference. However, it is still challenging due to the high-intra class variation. Methods/Statistical Analysis: we deeply analyzed the accuracy of both handcrafted and leaned aspects such as HOG. This study proposed two models; (1) FER using Deep Convolutional Neural Network (FER-CNN) and (2) Histogram of oriented Gradients based Deep Convolutional Neural Network (FER-HOGCNN). the training and testing accuracy of FER-CNN model set 98%, 72%, similarly Losses were 0.02, 2.02 respectively. On the other side, the training and testing accuracy of FER-HOGCNN model set 97%, 70%, similarly Losses were 0.04, 2.04. Findings: It has been found that the accuracy of FER-HOGCNN model is good overall but comparatively not better than Simple FER-CNN. In dataset the quality of images are low and small dimensions, for that reason, the HOG loses some important features during training and testing. Application/Improvements: The study helps for improving the FER System in image processing and furthermore, this work shall be extended in future, and order to extract the important features from images by combining LBP and HOG operator using Deep Learning models.

2.2 Active Clustering with Ensembles for Social structure extraction

Authors: J. R. Barr, L. A. Cament, K. W. Bowyer, and P. J. Flynn.

Abstract: We introduce a method for extracting the social network structure for the persons appearing in a set of video clips. Individuals are unknown, and are not matched against known enrollments. An identity cluster representing an individual is formed by grouping similar-appearing faces from different videos. Each identity cluster is represented by a node in the social network. Two nodes are linked if the faces from their clusters appeared together in one or more video frames. Our approach incorporates a novel active clustering technique to create more accurate identity clusters based on feedback from the user about ambiguously matched faces. The final output consists of one or more network structures that represent the social group(s), and a list of persons who potentially connect multiple social groups. Our results demonstrate the efficacy of the proposed clustering algorithm and network analysis techniques.

2.3 Fast human detection using a cascade of histograms of oriented gradients

Authors: Q. Zhu, M.-C. Yeh, K.-T. Cheng, and S. Avidan

Abstract: We integrate the cascade-of-rejectors approach with the Histograms of Oriented Gradients (HoG) features to achieve a fast and accurate human detection system. The features used in our system are HoGs of variable-size blocks that capture salient features of humans automatically. Using AdaBoost for feature selection, we identify the appropriate set of blocks, from a large set of possible blocks. In our system, we use the integral image representation and a rejection cascade which significantly speed up the computation. For a 320 × 280 image, the system can process 5 to 30 frames per second depending on the density in which we scan the image, while maintaining an accuracy level similar to existing methods.

2.4 Local directional ternary pattern for facial expression recognition

Authors: Ryu, A. R. Rivera, J. Kim, and O. Chae

Abstract: This paper presents a new face descriptor, local directional ternary pattern (LDTP), for facial expression recognition. LDTP efficiently encodes information of emotion-related features (ı.e., eyes, eyebrows, upper nose, and mouth) by using the directional information and ternary pattern in order to take advantage of the robustness of edge patterns in the edge region while

overcoming weaknesses of edge-based methods in smooth regions. Our proposal, unlike existing histogram-based face description methods that divide the face into several regions and sample the codes uniformly, uses a two-level grid to construct the face descriptor while sampling expression-related information at different scales. We use a coarse grid for stable codes (highly related to non-expression), and a finer one for active codes (highly related to expression). This multi-level approach enables us to do a finer grain description of facial motions while still characterizing the coarse features of the expression. Moreover, we learn the active LDTP codes from the emotion-related facial regions. We tested our method by using person-dependent and independent cross-validation schemes to evaluate the performance. We show that our approaches improve the overall accuracy of facial expression recognition on six data sets.

EXISTING SYSTEM

The emotion recognition plays a major role in interaction technology. In interaction technology the verbal components only play a one third of communication and the non-verbal components plays a two third of communication. A facial emotion recognition (FER) method is used for detecting facial expressions. Facial expression plays a major role in expressing what a person feels and it expresses inner feeling and his or her mental situation or human perspective

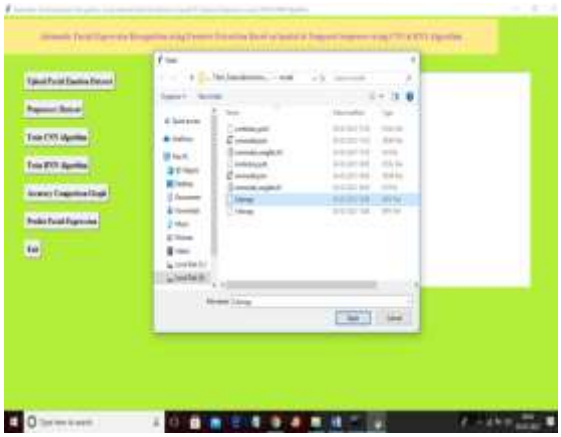
PROPOSED SYSTEM

This paper aims to identify basic human emotions with the combination of gender classification and age estimation. The facial emotions such as happy, sad, angry, fear, surprised, neutral emotions are considered as basic emotions. Here proposes a real time facial emotion recognition system based on You Look Only Once (YOLO) version 2 architecture and a squeezenet architecture. The yolo architecture is a real time object detection system. Here it used for identify and detect faces in real time. These images are captured by using anchor boxes for accuracy. The second architecture is squeezenet and is used for gender classification and age estimation. It provides significant, accurate object detection and extracts high-level features that help to achieve tremendous performance to classify the image and detecting objects. Both the architectures provide accurate result than other methods with the large no of hidden layers and cross validation in the neural network.

IMPLEMENTATION

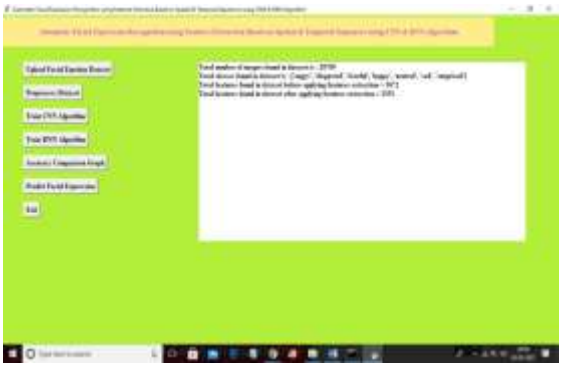
In above screen go inside title1 folder and then click on 'run.bat' file to get below screen

In above screen click on 'Upload Facial Emotion Dataset' button to upload dataset



In above screen selecting and uploading 'X.txt.npy' file which contains images of all emotion faces and then click on 'Open' button to load dataset and to get below screen

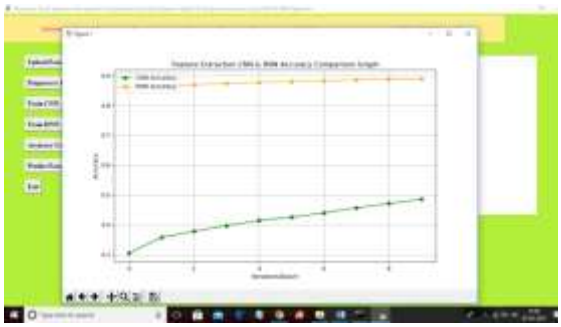
In above screen dataset loaded and now click on 'Preprocess Dataset' button to read all images and then apply feature extraction algorithm called PCA to read important features from dataset and to get below screen. This module may take 5 to 8 minutes time to give output so please wait till process complete like below screen



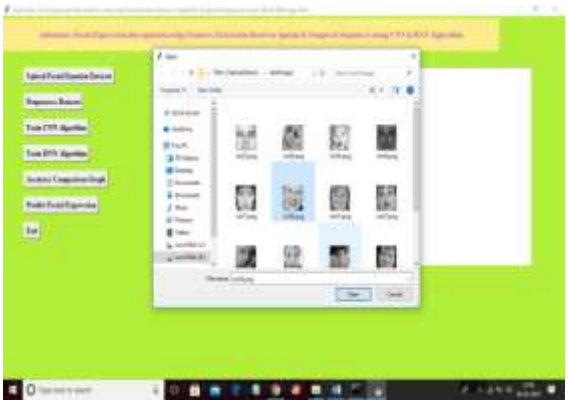
In above screen we can see dataset contains total 28709 images and before applying feature extraction algorithm total images features/pixels are 3072 and then after applying features reduces to 2352 as PCA remove unimportant pixels and used only important pixels/features. Now image data is ready and now click on 'Train CNN Algorithm' button to train CNN with process image features

In above screen CNN accuracy is 48 and now click on 'Train RNN Accuracy' button to train dataset with RNN

In above screen RNN accuracy is 88% and now click on 'Accuracy Comparison Graph' to get below graph of both algorithms



In above screen x-axis represents epoch/iteration ad y-axis represents accuracy and in above graph orange line represents RNN accuracy and green line represents CNN accuracy and from above graph we can see with further epoch/iteration both algorithm accuracy get better and better and from above graph we can conclude that RNN is giving better result. Now click on 'Predict Facial Expression' button to upload new test image and the application predict emotion from it

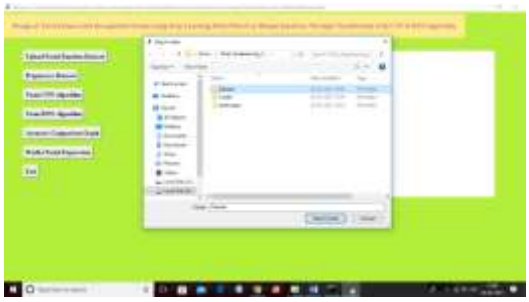


In above screen selecting and uploading im38.png image and then click on 'Open' button to get below result

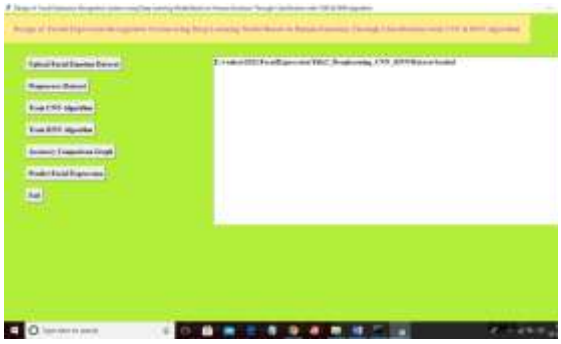
In above screen we got detected emotion as 'happy' and similarly you can upload any image and then predict emotion. So this is the output of TITLE 1.

Now run title 2 project by double click on 'run.bat' file from 'Title2_Deeplearning_CNN_RNN' folder to get below screen

In above screen click on 'Upload Facial Emotion Dataset' button to load dataset and to get below screen



In above screen select and upload 'Dataset' folder and then click on 'Select Folder' button to load dataset and to get below screen

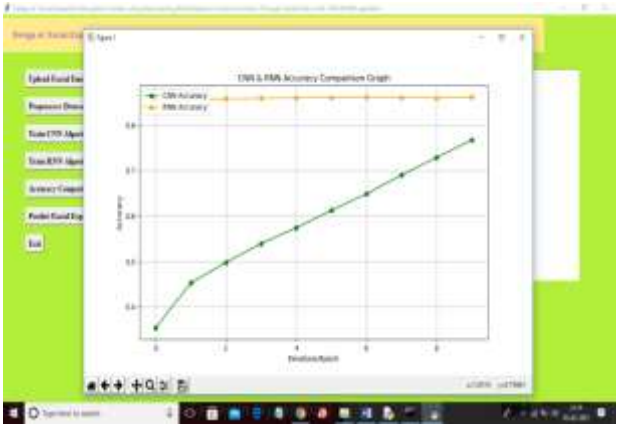


In above screen dataset loaded and then click on 'Preprocess Dataset' button to read all images for training and to get below screen

In above screen application read 28709 images from 7 different emotions and now dataset is ready and now click on 'Train CNN Algorithm' button to train above dataset.

In above screen CNN accuracy is 76% and now click on 'Train RNN Algorithm' button to train dataset with RNN algorithm

In above screen RNN train with accuracy as 86% and now click on 'Accuracy Comparison Graph' to get below graph

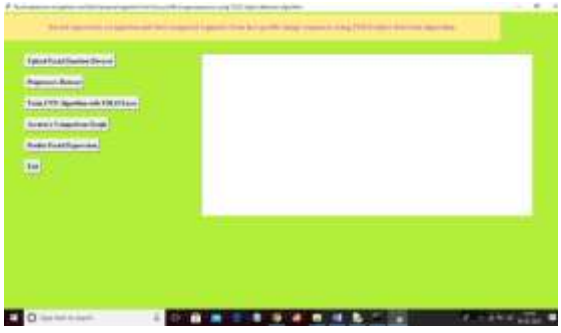


Now click on 'Predict Facial Expression' button to upload test image

and then application will predict emotion

In above screen selecting and uploading im25.png and then click on 'Open' button to get below result

In above screen emotion detected as 'sad'. Now run title3 by clicking on 'run.bat' file from 'Title3_YOLO_CNN' folder to get below screen



In above screen click on 'Upload Facial Emotion dataset' button to load dataset and to get below screen

In above screen select and upload 'X.txt.npy' file which contains all emotion faces and then click on 'Open' button to load dataset and to get below screen

In above screen dataset loaded and similarly you can click on all button to get output and its accuracy details. Similarly you run title4 project and upload dataset and then run all modules to get error rate.

CONCLUSION

The use of machines in society has increased widely in the last decades. Nowadays, machines are used in many different industries. As their exposure with human's increase, the interaction also has to become smoother and more natural. In order to achieve this, machines have to be provided with a capability that let them understand the

surrounding environment. Specially, the intentions of a human being. Emotion recognition is still a difficult and a complex problem in computer science because every expression is a mix of emotions. Here proposed an efficient real time facial expression recognition system with the combination of two algorithms such as yolo version 2 and squeezenet architecture based on deep neural networks for more accurate and efficient facial expression recognition. The future scope can be an action that is done upon recognition of the emotions. If get a sad emotion, can have the systems plays a song or tells a joke or send his/her best friend a message. This can be the next step of AI where the system can understand, comprehend the user's feelings and emotions and react accordingly. This bridges the gap between machines and humans. We can also have an interactive keyboard where the users can just use the app and the app will then identify the emotion and convert that emotion to the emoticon of choice.

REFERANCES

[1] Jumani, S.Z., Ali, F., Guriro, S., Kandhro, I.A., Khan, A. and Zaidi, A., 2019. Facial Expression Recognition with Histogram of Oriented Gradients using CNN. Indian Journal of Science and Technology, 12, p.24.

[2] J. R. Barr, L. A. Cament, K. W. Bowyer, and P. J. Flynn. Active clustering with ensembles for social structure extraction. In Winter Conference on Applications of Computer Vision, pages 969–976, 2014

[3] Ren, S., He, K., Girshick, R. and Sun, J., 2015. Faster r-cnn: Towards real-time object detection with region proposal networks. In Advances in neural information processing systems (pp. 91-99).

[4] Ren, S., He, K., Girshick, R. and Sun, J., 2015. Faster r-cnn: Towards real-time object detection with region proposal networks. In Advances in neural information processing systems (pp. 91-99).R. Goh, L. Liu, X. Liu, and T. Chen. The CMU face in action (FIA) database. In International Conference on Analysis and Modelling of Faces and Gestures, pages 255–263. 2005.

[5] L. Wolf, T. Hassner, and I. Maoz. Face recognition in unconstrained videos with matched background similarity. In Computer Vision and Pattern Recognition, pages 529–534, 2011

[6] Y. Wong, S. Chen, S. Mau, C. Sanderson, and B. C. Lovell. Patchbased probabilistic image quality assessment for face selection and improved video-based face recognition. In Computer

Vision and Pattern Recognition Workshops, pages 74–81, 2011.

[7] B. R. Beveridge, P. J. Phillips, D. S. Bolme, B. A. Draper, G. H. Givens, Y. M. Lui, M. N. Teli, H. Zhang, W. T. Scruggs, K. W. Bowyer, P. J. Flynn, and S. Cheng. The challenge of face recognition from digital point-and-shoot cameras. In Biometrics: Theory Applications and Systems, pages 1–8, 2013

[8] N. D. Kalka, B. Maze, J. A. Duncan, K. A. O Connor, S. Elliott, K. Hebert, J. Bryan, and A. K. Jain. IJB–S: IARPA Janus Surveillance Video Benchmark. In IEEE International Conference on Biometrics: Theory, Applications, and Systems, 2018.

[9] M. Singh, S. Nagpal, N. Gupta, S. Gupta, S. Ghosh, R. Singh, and M. Vatsa. Cross-spectral cross-resolution video database for face recognition. In IEEE International Conference on Biometrics Theory, Applications and Systems, 2016

[10] X. Zhu and D. Ramanan, “Face detection, pose estimation, and landmark localization in the wild,” in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2012, pp. 2879–2886.