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Facial Emotion Recognition for Autism Children

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Abstract – Nowadays Autism children find it difficult to interact socially with people emotions and make themselves isolated. This paper proposes Emotion detection for Autism spectrum disorder children (ASD). It is self-possessed of python libraries Open CV, Haar-cascade method and Age and gender prediction. Conversely, most existing methods rely on the detection of facial expressions of people in social media platforms such as snapchat use facial recognition technology and also detecting facial emotions from their Facial expressions in image. And for a better involvement of the children's social behaviour, here a face is captured in real time and age, gender and emotions are predicted by Facial expression recognition (FER). This proposed system helps to improve the Autism children behaviour as they often observe the facial expressions of humans and try to imitate their emotions which make a huge difference in their behaviour.

Keywords- Autism Spectrum Disorder (ASD), OpenCV, Age and Gender prediction, Facial Expression Recognition (FER).

I. INTRODUCTION

People can accurately identify a standard face and understand face expression during a single glance. However, children with Autism Spectrum Disorder (ASD) often have problems communicating and socializing. It is difficult for them to interact with their parents, teachers and the other kids. Also they do not express their emotion and also they are unaware of others feelings too. An innovative system to recognize facial expressions from human faces that is captured in real time from which children with ASD can learn others emotions.In this project a web application is produced which captures the human face in real time and predict their age, gender and emotion of the person and that can be stored in the database of the system. Children with ASD often tend to spend time by themselves, so we can integrate the system as a web application which the children can use using tablets for better involvement. The implementation process undergoes face detection, age and gender prediction and emotion recognition using python models and libraries.

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When the user captures the image of the person face, it then detects the face using haar cascade classifiers which does haar feature selection for feature extraction. Then agender python library generates the threshold value for age and gender. Facial Expression Recognition (FER) predicts the emotion percentage for each standard six emotion and shows the highest percentage of them. The prediction is then stored in a database for future observation of the child to learn the human expression. As the child observes the expressions often, it will make human faces familiar and also the child might try to imitate the expressions by learning from it. While there is no cure for autism, this application will make a huge difference in their lives. This will help them to improve their behaviors and skills.

II. EXISTING SYSTEM

Face recognition comes under the domain of Computer Vision which is an approach to identify and recognize images. Currently they are being applied to various applications to solve real world problems in many fields such as industries, manufacturing, healthcare etc., for public security, marketing, banking etc. Social media platforms have advanced algorithms capable to perform various functionalities in facial recognition in order to attract a wider user base. For example, Snapchat animated lenses use facial recognition technology, which allows users to add filters to change the way they look which redefines selfie. It has also gone to another level of predicting human emotions from their facial expressions in the image. The recent works carried away in this category is to detect a face from an image in instagram social platform to apply filters using haar cascade classifiers.

III. DISADVANTAGES OF EXISTING SYSTEM

Face detection, age and gender prediction and emotion recognition are three different models which have their own defects of detecting the human face, for example if the face is not placed at an angle of 35 degree to the camera. And there is no such application which has inherited emotion recognition for ASD children to learn human emotions.

The existing systems pre-trained models have included a dataset for each of their models, if those models contains any negative samples (images that do not contain faces and they are taken from arbitrary images which do not contain the object you want to detect. There is an existing system to recognize the emotions of the children in real time while playing on their tablets, which will help the parents or teachers to monitor their emotional level.

IV. PROPOSED SYSTEM

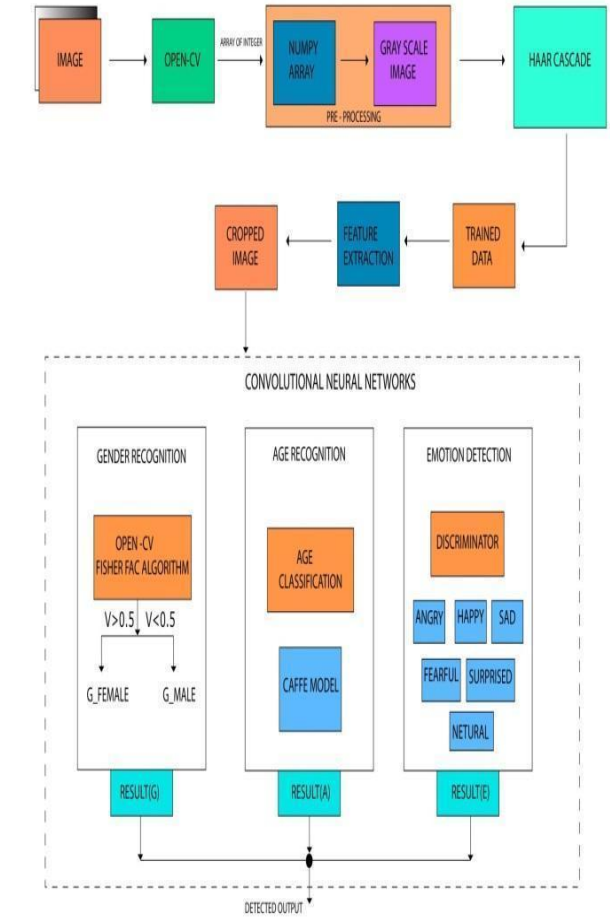

Fig.1. System Architecture

The main objective of this system is to capture an image in real time and then recognize whether it is a human face. After detecting the human faces from an image age, gender and emotion of the face is produced from which the children with autism spectrum disorder will understand and learn emotions. The two fundamental sections of the system are detection and prediction.

A. DETECTION

In this project the model is trained to spot the human faces from an image and to predict the age, gender and emotion from the detected faces. When an image is given as input to the project, the preprocessing of the image will be performed by OpenCV. The image will be converted into an array of integers and sent as numpy arrays for preprocessing. Then it is converted into a gray scale image. Using Haar Cascade from Cascade classifiers, the Haar feature extraction is carried out from the trained data and it generates a rectangular box around the face as it detects the human face. The detected face is then crops the face from the whole image to perform further operations.

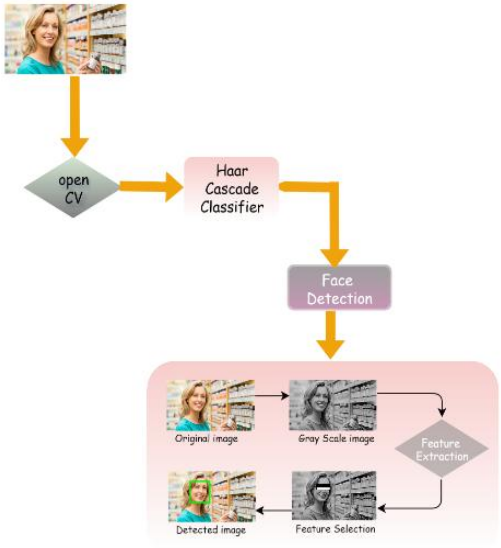

Fig.2. Face Detection

The detection of human faces from an image is processed by using Haar Cascade Classifier. It is a machine learning based approach. The Haar Cascade Classifier is the first object detection framework proposed in 2001 by Paul Viola and Michael Jones which is later known as Viola Jones algorithm.

The algorithm is the first object detection framework used to detect objects in real time. The haarcascade_frontalface_default.xml is a haar cascade designed by OpenCV (library containing programming functions for real-time computer vision) to detect the frontal face.The motive of using this algorithm in my project is to detect human faces as the detection rate is very high.This algorithm is used to differentiate between faces and non-faces. The four stages of this algorithm are

- Haar feature selection
- Integral image
- Adaboost training
- Cascading classifiers

Fig.3. Haar Cascade Algorithm

1.HAAR FEATURE SELECTION

All human faces share some similar properties. These regularities could also be matched by using Haar Features. a couple of properties common to human faces like the attention region is darker than the upper checks or the nose bridge regions brighter than the eyes. Composition of the properties forming the matchable countenance like location and size like eyes mouth or bridge of the nose. And for values like oriented gradient of pixel intensities. The four features matched by this algorithm are then sought within the image of the face.

Rectangle features:

Value=Σ(pixel in black area)-Σ(pixel in white area)

Size: Two ,Three,Four rectangle.

Location: utilized in two rectangle features.

The difference in brightness between the white & black rectangle over a selected area. Each feature is said to a special location within the sub window.

Fig.4. Haar feature selection

Fig.5. Haar feature selection

2.INTEGRAL IMAGE

The integral image is the illustration of an image, which evaluates the rectangular features in constant time. The rectangular area of each feature is always adjacent to the other rectangle. Any two rectangle features can be computed in six array references.The integral image at location (x,y), is the sum of the pixels above and to the left of the (x,y) .

3.ADABOOST

Adaboost training is used to create strong classifiers from weak classifiers.It is used to train weak learners. It is obtained by building a model from the training dataset, then another model is created which attempts to correct errors of the previous model.

4.CASCADE CLASSIFIERS

In OpenCV cascade classifiers are used for effective object detection. Here we use a cascade classifier to extract Haar features from an image. The cascade classifiers are trained with several positive samples (images which provide a lot of variations which manually crop and normalize each face into a standard size) and negative samples (images that do not contain faces and they are taken from arbitrary images which do not contain the object you want to detect).

B.PREDICTION

To predict age, gender and emotion, the project uses python Convolution Neural Networks. For age and gender prediction, py-agender is used which works under OpenCV. To predict the gender fisher face algorithm is used, which generates the value in fractions. If the value is lesser than 0.5, then it indicates male and if the value is greater than 0.5, then it indicates female. To predict age CAFFE model is used for age classification. The expression of the human face reflects their emotions. The emotions are predicted using facial expression by using FER, which works under fisher face algorithm. The result is generated as a ratio for following emotions such as anger, happiness, surprise, neutral, fear and sadness. The emotion which has the highest is displayed on the output screen. Thus the project is made on the given problem statement.

1.AGE AND GENDER PREDICTION

Age and gender prediction is performed out by py-agender which is done by Tensorflow and OpenCV. Age prediction works under CAFFE model and gender prediction is done by fisher face algorithm. As the human face is detected from the image using py-agender , it predicts the age from the trained images. And it generates a threshold value for gender, if the value is lesser than 0.5 then it denotes the male gender and if the value is greater than 0.5 then it denotes the female gender.

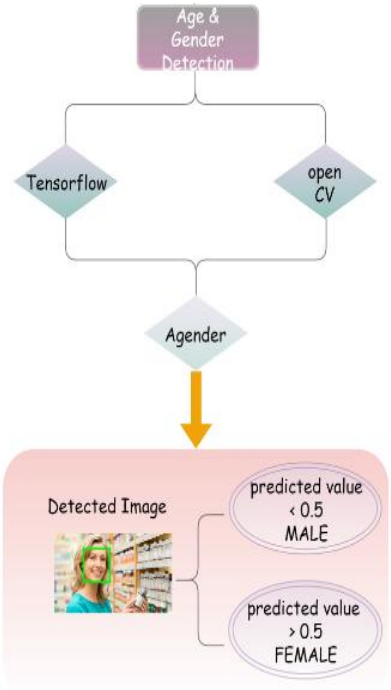

Fig.6. Age and gender prediction

2.EMOTION RECOGNITION

The model is used to recognize the facial expression of the human faces from the given image. The emotion of the human face is predicted using FER (Facial Expression Recognition). It works using Keras, Tensorflow ,OpenCv ,dlib and numpy. The model used to detect emotion in fractions, the trained model will detect the following expressions from human faces, they are anger, happiness, surprise, neutral, fear and sad. The project will generate the output and display which emotion has the highest value.

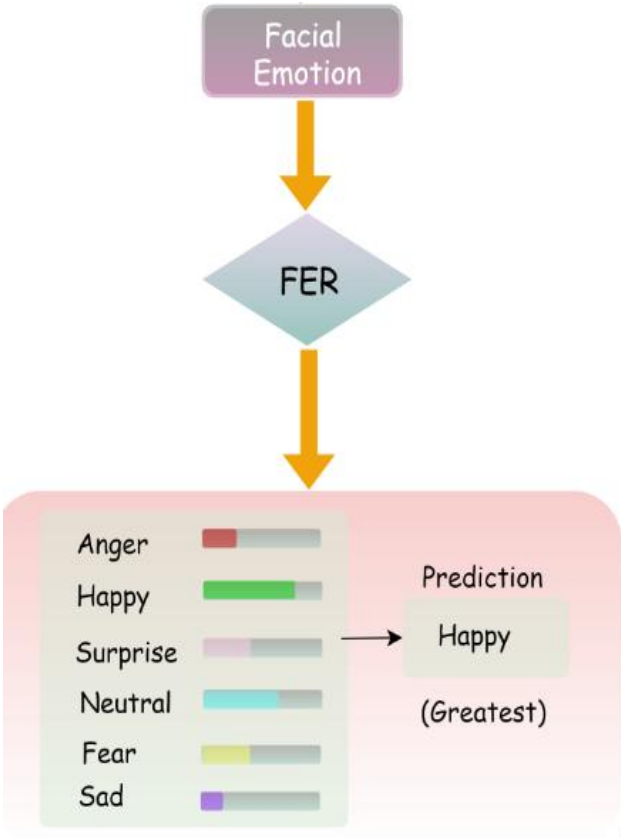

Fig.7. Emotion Recognition

V. EXPERIMENTAL RESULTS

The solution to the issues are carried away by this system which is capable of detecting more than one face in an image and face recognition process can be done when the target is facing the camera at least an angle of 45 degree while capturing. There is no such application which has inherited emotion recognition for autism spectrum disorder children to learn human emotions and this will help the children with ASD to improve their behaviours and skills.

VI. CONCLUSION

Thus by doing face recognition through the above process we can certainly improve or enhance the User experience and make the children with autism spectrum disorder to learn about emotions which will help them to interact with people. This is more accurate and has better functionalities as it uses OpenCV than MATLAB. As the child observes the expressions often, it will make human faces familiar and also the child might try to imitate the expressions by learning from it. While there is no cure for autism, this application will make a huge difference in their lives. This will help them to improve their behaviors and skills.

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