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Deep Learning-Based Analysis of Facial Expression in Children with Autism

Piyush Choudhary[1], Sheik Imran[2], Hemashree H C[3], Nagashree J A[4], Dhananjaya G M[5]

Intern Analyst, Deloitte Consulting India Private Ltd., Bangalore, Karnataka, India[1]

Assistant Professor, Department of Information Science and Engineering,

Bapuji Institute of Engineering and Technology, Davangere, Karnataka, India[2,3,4,5.]

ABSTRACT: Individuals can recognize a common face and comprehend a look at a single glance. However, children with autism spectrum disorder (ASD) sometimes have difficulties communicating with their families, educators, and other children. We provide a creative approach for perceiving glances in children with ASD during recess in this research. Children are observed while playing or using tablets or computers, and specialists keep an eye on their appearance. We use Convolutional neural network (CNN) calculations in deep learning to track facial tourist places using a webcam or data set as input, allowing us to improve our framework by perceiving appearances.

KEYWORDS: ASD, CNN, TD, Inpainting, Morphological operations, Connected component labelling.

I. INTRODUCTION

Individuals can precisely distinguish a standard face and comprehend face appearance during a solitary look. Nonetheless, kids with Mental imbalance Range Issue (ASD) regularly have issues conveying and mingling. It is hard for them to communicate with their folks, educators and different children. Additionally, they don't communicate their feeling and furthermore they are ignorant of others sentiments as well. A creative framework to perceive looks from human faces that is caught continuously from which youngsters with ASD can learn other's emotions. In this task a web application is delivered which catches the human face and predicts the constant facial expression Emotions are communicated in an assortment of ways, like looks, voices, physiological signs, and text Among them, physiological signs contain huge information about emotions. Physiological signals change quickly relying upon changing emotions. In mental hypothesis, passionate conditions of an individual can be characterized into six fundamental classifications: shock, dread, disdain, outrage, bliss and bitterness. Programmed extraction of these feelings from the face pictures can help in human PC collaboration just as numerous other applications. Facial Demeanour Acknowledgment (FER) predicts the feeling rate for every standard six feeling and shows the most elevated level of them. The feelings advanced in human face affect choices and contentions about different subjects AI calculations and particularly profound neural organization can learn complex provisions and group the extricated designs. In our venture, a profound learning-based structure is proposed for human feeling acknowledgment. The proposed system utilizes Convolutional Neural Organization (CNN) for arrangement.

II. RELATED WORK

According to Camellia Ray et.al [1], within recent decades the chances of a child being diagnosed with autism spectrum disorder have increased dramatically. Individuals with autism disorder have markedly different social and emotional actions and reactions than non-autistic individuals. It is a chronic disorder whose symptoms include failure to develop normal social relations with other people, impaired development of communicative ability, lack of imaginative ability, and repetitive, stereotyped movements.

According to Suzan Anwar et.al [2], People can accurately identify a common face and understand a facial expression in a single glance. However, children with autism spectrum disorder (ASD) often have problems communicating with their parents, teachers, and other kids. In this paper, we present an innovative system to recognize facial expressions in children with ASD during playtime. Children are observed while playing or using their tablets or laptops while the researchers track the child's facial expressions.

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According to Minseop Lee. et.al [3], Emotion recognition research has been conducted using various physiological signals. In this paper, we propose an efficient photoplethysmogram-based method that fuses the deep features extracted by two deep convolutional neural networks and the statistical features selected by Pearson's correlation technique. A photoplethysmogram (PPG) signal can be easily obtained through many devices, and the procedure for recording this signal is simpler than that for other physiological signals.

According to Soichiro Matsuda. et.al [4], Atypical gaze behavior in response to a face has been well documented in individuals with autism spectrum disorders (ASDs). Children with ASD appear to differ from typically developing (TD) children in gaze behavior for spoken and dynamic face stimuli but not for nonspeaking, static face stimuli. Furthermore, children with ASD and TD children show a difference in their gaze behavior for certain expressions. However, few studies have examined the relationship between autism severity and gaze behavior toward certain facial expressions.

According to Md. Forhad Ali. et.al [5], Human emotions are mental states of feelings that come off spontaneously rather than through conscious effort and are accompanied by physiological changes in facial muscles which imply expressions on the face. Non-verbal communication methods such as facial expressions, eye movement, and gestures are used in many applications of human-computer interaction, which among them facial emotion is widely used because it conveys the emotional states and feelings of persons

According to V. Tümen. et.al [6], Nowadays, deep learning is a technique that takes place in many computer vision related applications and studies. While it is put in the practice mostly on content-based image retrieval, there is still room for improvement by employing it in diverse computer vision applications.

According to Deepak Kumar Jain. Et.al [7], Humans use facial expressions to show their emotional states. However, facial expression recognition has remained a challenging and interesting problem in computer vision

III. METHODOLOGY

In this paper, we have demonstrated that there are numerous strategies to perceive the sort of Look being communicated by mentally unbalanced youngsters, however the yield at last relies upon the exactness of the calculation and there is one more case should have been thought of, if the calculation predicts the probabilities of various articulations similarly it is hard to choose the right expression The precision should be worked on to accurately arrange the expression This should be possible utilizing Convolutional Neural Organization (CNN).

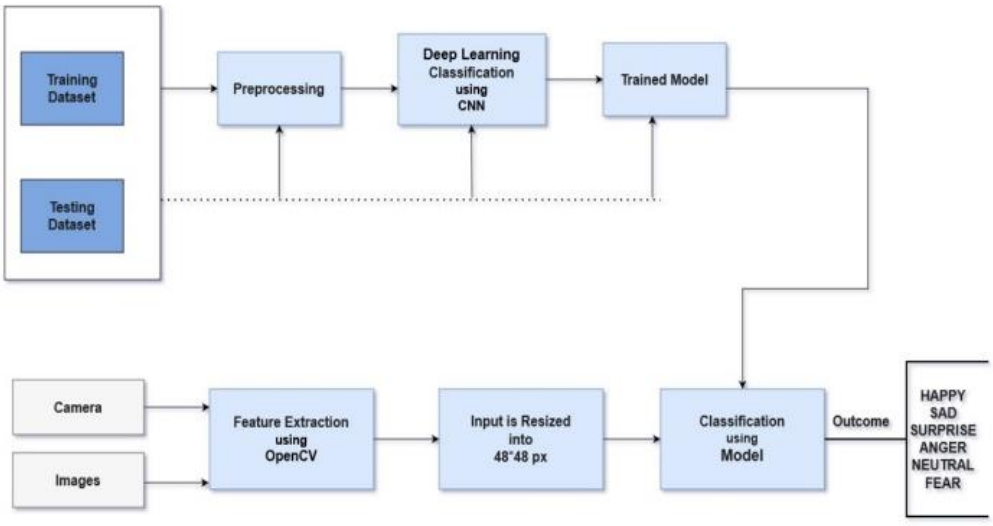

Fig. 1. System Architecture

Generally, there are many methods to recognize the type of emotion being expressed, but theoutput ultimately depends on the accuracy of the algorithm and there is another case neededto be considered, if the algorithm predicts the probabilities of different emotions equally it isdifficult to decide the emotion.We need to improve the accuracy in order to correctly classify the emotion, this can be doneusing Convolutional Neural Network (CNN).

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The main objective of face emotion recognition (FER) is identifying emotions of a human.The emotion can be captured either from face or from verbal communication. Other Psychological characteristics such as heartbeat and blood Pressure, speech, handgestures, body movements, Facial expressions identify emotions of a person.Facial emotion recognition is one of the useful tasks and can be used as a base formany real-time applications.It can be used as a part of many interesting and usefulapplications like Monitoring security, treating patients in medical field, marketingresearch, E-learning etc. We humans can easily identify the emotion of other humanswithout any effort

The Dataset used in this Project is FER2013 available in the Kaggle. It contains 24008 image data (pixels) of size 48*48 in a csv file.The user first collects emotion datasets from various sources such as from children facial expression stored in cloud. These datasets containvarious expressions of people associated with emotions. The datasets collected contain 5 different emotion with their expression. The system is trained with 2100 various datasets. The datasets are used to train the model, which is further used to predict the set of expression. The training datasets are used to train the model, which is further used to predict the expression. The file is loaded and Pre-processed using Python libraries and then the images are classified into their respective emotion i.e., Happy, Sad, Anger, Surprise, Neutral, Fear, after classification we use CNN algorithm which uses sequential for building a model which will classify the emotion of the image given by the user.

After successfully building of the model, we created an interactive frontend in which the user will input the image for the classification. After the image is loaded it undergoes feature extraction using OpenCV library. And the facial part of image is cropped and resized to 48*48 pixels. Then the model loaded which will classify the image into one of six gestures.The model is tested using certain set of test datasets for correct outcomes. The test datasets contain emotion of a children which is fed into the model. The model is supposed to give the correct expression.

IV. CODE USED

Code for CNN model to predict accuracy:

```
model = Sequential()
input_shape = (48,48,1)
model.add(Conv2D(64, (5, 5), input_shape=input_shape,activation='relu',padding='same'))
model.add(Conv2D(64, (5, 5), padding='same'))
model.add(BatchNormalization())
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Conv2D(128, (5, 5),activation='relu',padding='same'))
model.add(Conv2D(128, (5, 5),padding='same'))
model.add(BatchNormalization())
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Conv2D(256, (3, 3),activation='relu',padding='same'))
model.add(Conv2D(256, (3, 3),activation='relu',padding='same'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Flatten())
model.add(Dense(6, activation='softmax'))
model.compile(loss='categorical_crossentropy',metrics=['accuracy'],optimizer='adam')
model.fit(X, y_new, epochs=22, batch_size=64, shuffle=True, validation_split=0.2)
model.save('model.h5')
```

Code for identifying the expression:

```
face_haar_cascade = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')
test_img = cv2.imread('0085.jpg', 0)
plt.imshow(test_img, cmap='gray')
plt.show()
test_img = cv2.resize(test_img, (48, 48))
plt.imshow(test_img, cmap='gray')
plt.show()
```

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```
test_img = test_img.reshape(1, 48, 48, 1)
print(model.predict(test_img))
if model.predict(test_img)[0][0] == 1:
  print("Anger")
elif model.predict(test_img)[0][1] == 1:
  ("Neutral")
elif model.predict(test_img)[0][2] == 1:
  print("Fear")
elif model.predict(test_img)[0][3] == 1:
  print("Happy")
elif model.predict(test_img)[0][4] == 1:
  print("Sad")
else:
  print("Suprise")
```

V. EXPERIMENTAL RESULTS

```
try:
    image = cv2.imread('static/cropped.jpg', 0)
except:
    image = cv2.imread('static/file.jpg', 0)

image = cv2.resize(image, (48, 48))

image = image / 255.0

image = np.reshape(image, (1, 48, 48, 1))

model = load_model('mode4.h5')_# loading model for crasification

prediction = model.predict(image)

label_map = ['Anger', 'Neutral', 'Fear', 'Happy', 'Sad', 'Surprise']

prediction = np.argmax(prediction)

final_prediction = label_map[prediction]
```

(a) Code Snippet for Classification

(b) Front End of the System

(c) Output of the System Classifying Emotions as Happy

(d) Output of the System Classifying Emotions as Neutral

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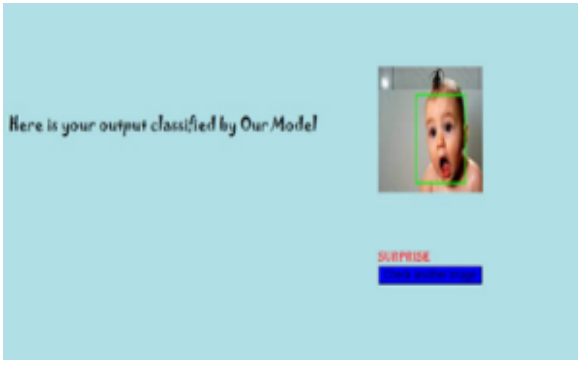

(e) Output of the System Classifying Emotions as Surprise

(f) Output of the System Classifying Emotions as Anger

Fig. 2. (a) Code Snippet for Classification (b) Front End of the System (c) Output of the System Classifying Emotions as Happy (d) Output of the System Classifying Emotions as Neutral. (e) Output of the System Classifying Emotions as Surprise (f) Output of the System Classifying Emotions as Anger.

VI. CONCLUSION

Look is characterization of facial components into six essential feelings dread, outrage, cheerful, nausea, misery and shock. Explicit provisions from the countenances are removed and arranged dependent on specific calculations. Look assumes a significant part in correspondence and subsequently distinguishing the right articulation is just about as fundamental as knowing the specific matter of the correspondence. This task proposes a methodology for perceiving the classification of looks. Face Identification and Extraction of demeanours from facial pictures has been accomplished effectively and is valuable in numerous applications, like mechanical technology vision, video observation, advanced cameras, security and human-PC association.

This venture includes look pre-handling of caught facial pictures followed by highlight extraction utilizing highlight extraction utilizing Nearby Parallel Examples and grouping of looks dependent on preparing of datasets of facial pictures dependent on Help Vector Machines. This undertaking perceives more looks dependent on Haarcascade face data set. The proper feeling is distinguished and shown at the situation of each face in the casing.

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