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Emotion Detection of Autistic Children using Support Vector Machine: A Review

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Abstract:- Facial Emotion Detection is the way toward recognizing human emotion from facial expressions. Autism Spectrum Disorder is complex neurobehavioral condition. In this condition autistic people are not able to do social communication. The autistic people have rigid and repetitive behaviors.People with autism have difficulty in recognition of emotions. This study works on emotion detection of autistic children from facial expression. This study works on happiness, angry, disgust and neutral emotions. With image processing and machine learning algorithms proved that the detection of emotion of autistic children can be possible. This study implements Local Binary Pattern to extract features from images and uses machine learning algorithm for training and testing of emotions. It implements Support Vector Machine algorithm for classify the emotions.

Keywords:- *Emotion Detection, Image Processing, Local Binary Pattern, Machine Learning, Support Vector Machine.*

I. INTRODUCTION

The detection of emotion is the challenging field for researchers for very long. With facial expressions we are expressing our emotions. When we interacted with others, our expressions shows some important cues like as level of interest, our longing to take part in speaking and provide continuous feedback. It helps in improvement of social

Communication. But people with autism have difficulty in recognition of emotions. ASD is complex neurobehavioral condition that includes impairments in social interaction, developmental language and communication skills combined with rigid, repetitive behaviors. Traditional approaches require trained specialists and intensive support. But people with autism have difficulties to take this approach due to lack of intervention costs and trained specialists. So, this study will develop emotion detection system for autism based on image processing.

The rest of the article is organized as follows. In section 2, Image Processing is introduced and how image processing is used in emotion recognition. In section 3, Feature Extraction is introduced and how LBP is used in feature extraction. In section 4, Support Vector machine is introduced. Section 5, implements training of classifier and classify emotions. Section 6 discusses the open issues that can be explored in future. Section 7 contains the concluding remarks.

II. EMOTION DETECTION SYSTEM

Image processing is a quickly developing area of computer in computer science. Its development has been fuelled by the technological advances in computerized imaging, computer processors and mass storage gadgets. There are three stages in detection of emotions.

- Image Selection
- Training Of Database
- Classification of Emotions

A. Image Selection

For Selection of image there is core problem: face detection in image. For still images, we take only images of face. This solves the problem of face detection. If we have images of other body parts then we have to manually crop face from the images and stored as 256*256 pixel image. But in this study we take only face images of autistic children. The image is of gray scale and has extension of gif.

B. Training of Database

For training of database the folder with samples of face images is selected. After selection of images the face features are extracted with the help of Local Binary pattern algorithm. The features are stored in commas separated values (.CSV) file.

C. Classification of Emotions

For classification of emotions it is divided into 3 steps: first step is to train the classifier with vector features of images. The training is successful in this study to SVM classifier. Second step is to extract the test file features. The extraction is done in this study with local binary pattern algorithm. The third step is to classify the emotions. The classification is done by comparing the test file features with vector features of images. If classification is successful then it will show detected emotion message.

III. LOCAL BINARY PATTERN FOR FEATURE EXTRACTION

Local Binary pattern was first presented in 1990.It is incredible methodology in feature extraction. LBP is utilized in an assortment of undertakings, for example, facial features extraction, face recognition, classification and so forth. In the previous couple of years, LBP has been progressively utilized in different PC vision and image processing tasks. This method is unfeeling toward monochrome grayscale images.

LBP first partition the picture into sub pictures at that point makes the histogram for each sub picture. After that all are joined to shape the feature vector. The feature extracted by utilizing LBP is exceedingly discriminative because of the various dimensions of region included. LBP is an extremely effective procedure because of its fast of calculation and is likewise robust against illumination variations. With Local Binary Pattern the pixels of image are described by decimal value which is called as LBP code. The following steps below are used to generate LBP code.

A. Algorithm

1. Read the image. Divide the entire image into 16*16 cells.
2. Apply the mask of 3*3 on that image.
3. Comparing the neighboring values with the center pixel.
4. If neighboring value is greater or equal to center pixel value put 1.
5. Else
6. Put 0
7. By combining these 0's and 1's we get binary codes. Those binary codes are concatenated in clockwise direction beginning from left side top to bottom to form a binary number.
8. Those binary numbers are converted to decimal values. These decimal values represent each pixel and we called them LBP codes.

IV. CLASSIFICATION OF EMOTION USING MACHINE LEARNING ALGORITHM

Emotion classification, the method by which one may differentiate one emotion from another. After Feature extraction classification of emotion is important for recognition of autistic children emotions. Classification of emotions is performed with the help of machine learning algorithms. Let's begin first Introduction of Machine Learning.

A. Machine Learning

Machine Learning is the general term for when computers learn from data. Machine learning is the application/subset of artificial intelligence. Machine learning centers on the advancement of PC programs, and the essential point is to enable PCs to adapt consequently without human intervention. There are various algorithms that machine can learn. The information that you feed to a machine learning algorithm can be input-output sets or just inputs. Supervised learning calculations require input-output sets (i.e. they require the output).Unsupervised learning requires just the input information (not the output).The following diagram shows different algorithms of learning

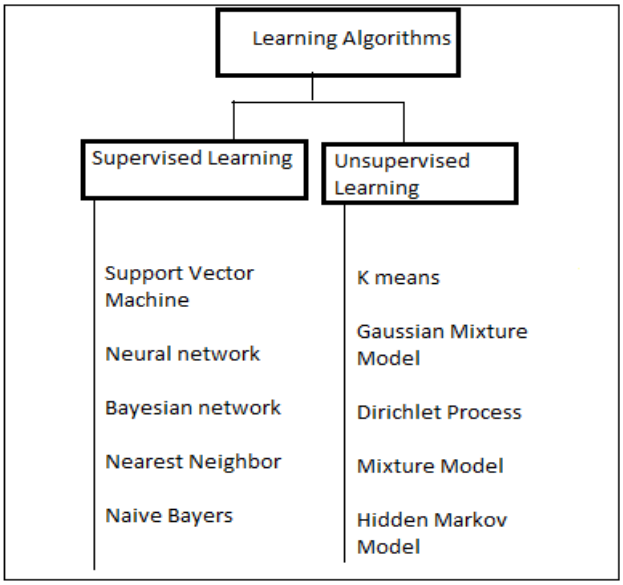

Fig. 1:- Machine Learning Algorithms

B. Supervised Algorithm

1. Here we feed it an example input, then the associated output.
2. We repeat the above step many times.
3. Eventually the algorithm picks up a pattern between inputs and outputs.
4. Now we can feed it a brand new input and it will predict the output for us.

C. Unsupervised Algorithm

1. We feed it an example input without the associated output.
2. We repeat the above step many times.
3. Eventually the algorithm clusters our given input into groups.
4. Now we can feed it a brand new input and the algorithm will predict which cluster it belongs with.

D. SVM Classifier

SVM is a machine learning algorithm utilized for characterization and regression examination. The current SVM standard was proposed by Vapnik and Cortes in 1993, and released in 1995. In addition, it is viewed as one of significant hyper-plane grouping strategies that rely upon statistical learning theory so as to guarantee superior. Also, SVM accomplishes a superior characterization regardless of whether the accessible preparing information is basic sum, making it uncommonly especially suitable for classification. SVM calculation is described by numerous preferences that make it a standout amongst the most significant classifiers in PC vision, for example, images classification can be executed by SVM. Aftereffects of analyses demonstrated that the SVM accomplished higher execution than conventional methods in images classification fields. Moreover, SVM can perceive on the characters which have composed by hand. In addition, SVM is utilized broadly in

different organic sciences, and demonstrated its effectiveness. In SVM component the nearest point between the two classes of information in training set is determined, which is classified "Optimal Separating Hyper-plane". By expanding the space between these classes, SVM can catch more objects from these classes, which are found in a hyper-plane. In addition, SVM can decrease both auxiliary and observational hazard that prompts diminish the quantity of unsurprising mistakes despite the fact that the samples in the training set are a few.

V. IMPLEMENTATION

A. Implementation of Support Vector Machine as classifier

Machine learning algorithms get input information during a training stage, fabricate a model of the input and output a hypothesis work that can be utilized to foresee future information. Support Vector Machine depends on results from statistical learning hypothesis, pioneered by Vapnik , rather than heuristics or analogies with natural learning frameworks. These outcomes set up that the generalization performance of future inconspicuous information relies upon the complexity of the class of functions it is looked over instead of the unpredictability of the capacity itself.

By bounding this class complexity, hypothetical certifications about the generalization performance can be made. SVMs play out a certain inserting of information into a high dimensional element space, where straight polynomial math and geometry might be utilized to isolate information that is just distinguishable with nonlinear standards in input space. To do as such, the learning calculation is detailed to utilize kernel functions, permitting effective calculation of internal items straightforwardly in highlight space, without requirement for explicit embedding.

SVM calculations separate the training information in feature space by a hyper plane characterized by kernel functions used. The SVM approach is profoundly modular, permitting domain specific determination of kernel function used.

B. Algorithm

1. Load feature vector of images that are saved in CSV file.
2. Create data, a two-column matrix containing sepal length and sepal width.
3. From the feature vector, create a new column vector namely groups to classify data into two groups: data and non-data.
4. Randomly select training and test sets.
5. Train an SVM classifier using non linear kernel function.
6. Use the svmclassify function to classify the test set.
7. Evaluate the performance of the classifier.

C. Data Collection

The dataset of images are downloaded from Google .The dataset is of 25 images. The 40% of dataset is used to testing purpose and 60% of dataset used for training purpose. This technique works on four emotions i.e. (Neutral, Happy, Angry, and Disgust). If we are using 40% from dataset for testing purpose then total 10 images used for testing purpose and rest are used for training purpose.

D. Experiments and Results

After giving sample of test images to SVM classifier the classifier is trained with SVCclassifier function. After training we get the emotion results as shown below:

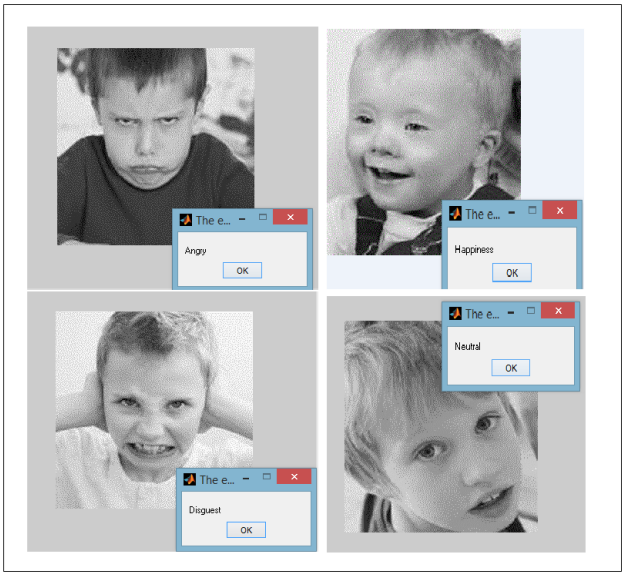

Fig. 2:- SVM Classifier Results

VI. FUTURE WORK

In this paper, the proposed method proved their effectiveness through achieving high performance. However, I documented some suggestions that may lead to improve the proposed system and its performance, and proving its quality.

These suggestions are:

- Instead of utilizing the proposed system to detect emotions of autistic children from facial expressions, a conceivable recommendation is to utilize this system to improve face recognition system which can be utilized in various security models, for example, criminal detection. Investigating the likelihood of utilizing other feature extraction algorithms rather than LBP. Subsequently, the effectiveness of different algorithms can be compared with the algorithm that is used in this study. Thus, utilizing different classifiers rather than SVM is likewise another field of study and assessment.
- Applying the proposed system to improve the performance of age expectation and gender orientation system which could predict the age from facial expressions and also gender.
- Using the databases that incorporate facial pictures from various ethnic and applying the proposed system on these databases so as to ethnic forecast.

VII. CONCLUSIONS

In this paper, an emotion detection system from facial expressions for autistic children is examined by utilizing one technique. Be that as it may, emotion detection system from facial expressions isn't a simple undertaking analyzing data still suffer from difficulties, therefore classifying data is difficult operation too.

The experiments achieved different performances, and the overall accuracy was 90% which is achieved by LBP+SVM method.

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