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# FACE RECOGNITION BASED DOWN SYNDROME IDENTIFICATION USING MACHINE LEARNING TECHNIQUES

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## ABSTRACT

*Down syndrome is a condition in which a child is born with an extra copy of their 21st chromosome. This leads to physical as well as mental developmental delays and disabilities. Many of the disabilities are lifelong, and they can also shorten life expectancy. Recent medical advances, as well as cultural and institutional support for people with Down syndrome and their families, provides many opportunities to help overcome the challenges of this condition. In recent years, the development of new Machine Learning models has allowed for new technological advancements to be introduced for practical use across the world. Even today, there are still many research initiatives that are continuing to develop new models in the hopes to discover potential solutions for problems such as autonomous driving or determining the emotional value from a single sentence. One of the current popular research topics for Machine Learning is the development of Facial Expression Recognition systems. These Machine Learning models focus on classifying images of human faces that are expressing different emotions through facial expressions which helps us to identify whether the person is normal or having down syndrome. In this paper, the approach for facial expression analysis for identification of down syndrome identification using k-means clustering method which is the unsupervised machine techniques is presented.*
***Keywords:*** *Down syndrome, k-means clustering, Machine Learning, facial recognition.*

## INTRODUCTION

Face recognition is used for naturally distinguishing and confirming a man from a picture. In general way, face recognition consider as identification. Recognizing of any individual from

a picture is just conceivable with the assistance of facial features. Feature values are further put away in database in the PC framework to make bio-metric application. The vast majority of the bio-metric applications are utilized for security reason in airplane terminal security, get to control, travel permits, and so on. One of the ways to do this is by extracting the features from the set of images and training this set of images considered as training database using some learning strategies. Once training is complete, the new images can be recognized using the information learnt during the training process. The greater part of the facial recognition strategies recognize facial features by extricating highlights, from a picture face. These elements were then used as a part of training and used to look for different images with coordinating features. Some algorithms standardize confront pictures and compress the face data, just recording the elements in the picture that is helpful for face recognition .One of the effective frameworks depends on layout coordinating methods connected to an arrangement of notable facial elements, giving a kind of compacted face representation.

Face recognition must be hearty as for changeability over an extensive variety of conditions to catch the basic similitude for a given human face. Some statistical approaches implemented for this task but these are based on dimensionality reduction to remove redundant information from the original images. Some of the popular neural network techniques includes: back propagation neural network, radial basis function network, self organizing map etc [1]. The fundamental goal of this proposed work is to comprehend the capacity and ability of some artificial neural network system procedures for face recognition task. Recognition algorithms can be classified into two main approaches, geometric, which look at distinguishing features, or photo metric, which is a statistical approach that distills an image into values and compares the values with templates to eliminate variances.

Outside changes can likewise impacts the face recognition system, as natural light, individual's position and separation from the camera, make-up, look, and so on. To beat these outer changes most of the researchers have used neural system strategies for face recognition. Both supervise and unsupervised learning systems have been used in the past. The benefit of utilizing the neural systems is its capacity to capture the complexity of patterns.

To implement any technique for face recognition system, there are two basic requirements:

Extract the face values for data set

Train the network for recognizing the face

**II. LITERATURE SURVEY**

Ashoka S.B. had carried out a research on "Face detection and recognition using k- means and neural network methods". He had implemented k-means with back propagation neural network technique for solving face recognition task. He had used k-means for face classification and back propagation technique for face recognition. He observed that his face detection system was 82.8% efficient and his face recognition system was 72.35% efficient.[12]

Nancy smith had carried out a research on "k-means clustering for detection of human faces in database". In this research she had used k-means to segment eye and mouth candidates within the face candidates. she had used principle components eigen vectors for training the system. She had trained the system for three components: one to classify faces, one to classify eyes, one to classify mouth. She observed the success rate of classification was: 88.9%, 85.4%, 97.8%. In her research 20% of the images failed to generate any valid eye or mouth candidates. She observed that k-means algorithm was able to segment valid candidates in 97% of the cases.[13]

Yuanfenggao had carried out a research on " face recognition based on radial basis function and clustering algorithm". In his research he had implemented RBFN using K-means clustering. He had proposed a new method for classifying faces on the basis of subtractive clustering algorithm. He had tested his system on ORL database and he observed that RBFN using SCA was better than RBFN using K-means.[14]

Rohit pal et al had carried out a research on "facial expression recognition based on basic expressions and intensities using K-means clustering". In their system k-means clustering method was applied on cohnkanade image database. They had usedfacial expressions like: happy, angry, fear, natural, sad and surprise. They had implemented k-means for face classification andback propagation for face recognition and their system was 98% accurate.[15]

I.Sudha et al had carried out a research on "face image retrieval using facial attributes by k-means". They had proposed anapproach to achieve immediate retrieval in a large scale dataset. They had used k-means for clustering of images on the basis oftheir attributes and proposed a novel technique for face recognition. They observed that their proposed system was accurate forface recognition task.[16]

## III. PROPOSED WORK

In the proposed work, K-Means Algorithm is implemented. There are four stages involved:

- Preprocessing
- Feature extraction

- Training of the network
- Recognition of faces

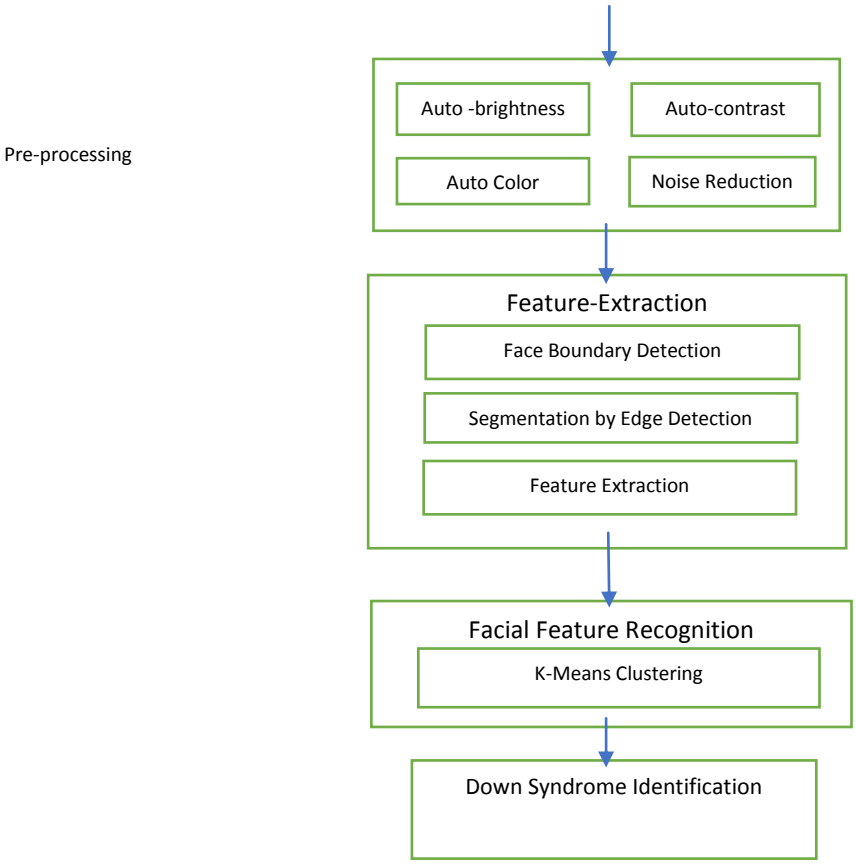


Figure 1 : Proposed system

**Pre-processing**

Preprocessing is the most important and the required step of the image processing. It is performed to get uniform and noise free image for further processing. This step includes the following functions:

- Auto Brightness- Auto brightness function adjust the brightness of the image.
- Auto Contrast- Auto contrast function automatically calculates the favorable contrast for the image will increase the brightness of the image.
- Auto Color- Auto color function adjusts the color of the image.

- Noise Reduction- Noise reduction will eliminate the unnecessary noise from the image.

**Facial Feature Extraction**

**i) Face Boundary Detection**

Face boundary detection phase is also a very important step for the facial expression recognition. In this phase, the face boundary is detected and for that Successive Mean Quantization Transform (SMQT) features is used.The Successive Mean Quantization Technique performs an automatic structural breakdown of information. This information will be applied on local areas in an image to take out illumination insensitive features.

**(ii) Segmentation by Edge Detection:**

Segmentation of image means partitioning the image into multiple parts. In this system, segmentation is used to detect the interested regions such as eyes and mouth from images and for that edge detection method is used. After edge detection the region of interest is then cropped for feature extraction. Six edge detection methods are tested, named as: Roberts, Sobel, Prewitt, Laplacian of Gaussian, Zero-Cross and Canny. Canny method is chosen because it gives best results for edge detection.

**(iii) Feature Extraction:**

In this phase, the features of cropped interested region will be extracted and stored for classification. Mouth is taken as the region of interest and the features will be extracted. Two features will be calculated: first is density of pixels and second is ratio of height to width of cropped boundary regions. The calculation of ratio is done by dividing the cropped mouth region into three zones: upper, middle and lower zones. Smile expression falls in the upper and middle zone, neutral expression falls in the middle zone and the sad expression falls into the middle and the lower zone. These values will be used in the next and the last component of system for expression recognition.

Features of face such as f1= distance between the eyes, f2= distance between left eye and centre of nose, f3=distance between right eye and centre of nose and f4 = width of mouth are determined by using geometric transformations.

**Figure 2.** Facial Features

Some of the extracted features of abnormal objects are shown below

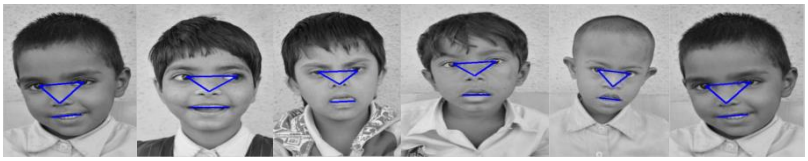

**Figure 3.** Features of abnormal children

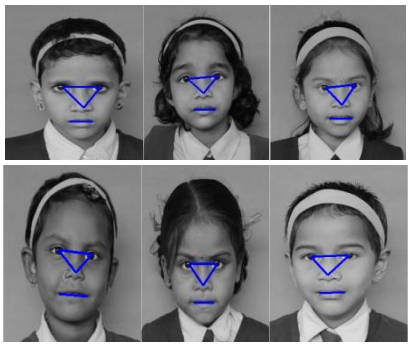

**Figure 4.** Features of Normal children

The K-Means is a simple clustering algorithm used to divide a set of objects which is based on their attributes or features, into the k-bunches in which the k is a predefined or client characterized steady. The centroid of a bunch is shaped in a manner that it is firmly related (as far as comparability capacity) to all objects of that group. Since we know the numbers of bunches to be formed, the objects which are in the input list are initially divided into random groups, that is, each and every object is assigned to a random bunch. K-means bunching plans to parcel n perceptions into k groups in which every perception has a place with the group with the mean which is the closest, filling in as a vital model of every group.

K-Means Algorithm for clustering in face recognition task:

1. Cluster centers 'c' are selected randomly

2. Distance between each data point and cluster centers is calculated.

3. Data point is assigned to the cluster center whose distance from the cluster center is minimum of all the cluster centers.

The new cluster center was recalculated using:

$$vi = (\frac{1}{ci})\sum xi$$

where, '$c_i$' represents the number of data points in $i^{th}$ cluster.

5. The distance between each data point and new obtained cluster centers was calculated.

6. If no data point was reassigned then stop, otherwise repeat from step 3).

**Architecture of K-Means**

K-means is an unsupervised learning technique. We have only two layers input and output layer in k-means algorithm. Infigure 2,we have six inputs in the form of face feature values from x1 to x6 and we have chosen five number of centroids. Sothat system made five number of clusters ( c1 - c5)of the face values in the database .

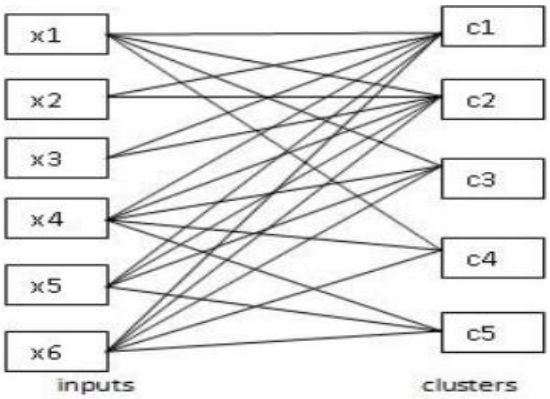


fig1 network topology of K-Means

**Results and Observations**

Experimentation is carried out on different test images. Table I shows the result of human identification. We have displayed the values of various geometric features of face images. Symbol A represents Abnormal face and N represents Normal face.

TableI :Efficiency Table of K-Means Clustering

| Number of epochs | Number of Training data | No. of Centroids | Success Rate (%) |
|---|---|---|---|
| 100 | 100 | 5 | 75 |
| | | 10 | 78 |
| | | 15 | 80 |
| | | 20 | 82 |
| | | 25 | 84 |

| Number of epochs | Training Size | Accuracy (%) |
|---|---|---|
| 100 | 90-10 | 79 |
| | 80-20 | 82 |
| | 60-40 | 86 |
| | 40-60 | 90 |

## CONCLUSION

In this proposed work, K-means techniques for face recognition is reviewed. We have been approving exactness of k-means in face recognition framework for down syndrome identification. When we have large number of face pictures indatabase then framework was less exact as contrast with little database of face pictures. k-means technique was accurate for faceclassification technique was accurate for face recognition. The system work impeccably on still pictures.

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