STRATEGIC IMAGE RETRIEVAL SYSTEM USING FACIAL RECOGNITION

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ABSTRACT - *Content based image retrieval (CBIR) is a technique that takes single non-annotated query image and retrieves similar images from the image database .The work proposes a facial recognition system through machine learning where the face detection is accomplished using local binary pattern histogram algorithm (LBPH). In LBPH method each image is characterised in the dataset locally, and when a new unknown image is provided, the same analysis is performed on it and then compare the result to each of the images in the dataset. Facial image data are stored in the database through process of identification and facial recognition. Face recognizer method is used in which complete face region is taken as input data. This system extracts the image features from the input data and later returns similar images. The obtained result confirms the effectiveness of proposed system in the field of CBIR.*

Key Words: Content Based Image Retrieval (CBIR), Local Binary Pattern Histogram (LBPH), Face Detection, Similar images, Query image, Image dataset

1. INTRODUCTION

In today's world, face recognition has spread its wings across many areas including authentication for software applications, social platforms and public places like airports. Face recognition involves searching and matching a facial image from a existing database.

Content based image retrieval is based on matching of the features of the query image with that of image database through image-image similarity evaluation. To search in image collections based on visual content is potentially a very powerful technique. Conventional databases allow for textual searches on metadata only. Choosing the adequate annotation for a given image might be a difficult task, especially when this image contains a big quantity of information. The choice of image description is subjective, the same image may have multiple annotations depending on the person describing it. Hence CBIR is a more approachable and efficient technique.

A CBIR system involves at least these four main steps

- Feature extraction and indexing of image database according to the chosen visual features, which form the perceptual feature space, e.g., color, shape, texture or any combination of the above
- Feature extraction of query image.
- Matching the query image to the most similar images in the database according to some image-image similarity measure. This forms the search part of the CBIR.
- User interface which governs the display outcome.

Face recognition is a combination of machine learning and CBIR techniques, that holds the qualities of both high precision and reliability. For automatically detecting the human's face from the databases this system can be used. This paper focuses on CBIR approach to face recognition, detection of face in a query image and display similar images with the matching face using CBIR techniques.

2. RELATED WORKS

Navjot Kour and Naveen Gondhi focuses on the different approaches that can be used in image retrieval based on content. In CBIR , a large database is searched for a query image and using efficient machine learning algorithm an exact match is retrieved. The algorithms used here include support vector machine, firefly network, swarm optimization algorithm, genetic algorithm. These algorithms are reviewed and their performance parameters are compared[1].

S.Rubini et al., considers efficient feature extraction and accuracy of retrieval of similar images to be the vital parameters on which the performance of a CBIR system depends. The work also depicts the color features using color descriptor thereby having a better retrieval efficiency from large database using the feature vector and leading to the retrieval of matched images[2].

Aasia Ali and Sanjay Sharma concentrates on visual features for feature extraction of an image and applies SIFT feature extraction algorithm. To increase the efficiency and optimization technique Bacteria foraging optimization algorithm is used which reduces the cost complexity, time consumption and energy. A Deep neural network is trained by the authors for

similarity check, and then the validation is done to obtain a better performance as compared to previously done techniques[3].

A. Obulesu and Jangala. Sasi Kiran , in their work have proposed a median based multi region local binary pattern i.e., a facial image is divided into non overlapped region. Then the values are evaluated by dividing those regions into sub regions. The LPB values of nine sub region are sorted and the median LBP code is considered as the feature vector of the region. For efficient image retrieval the usage of minimum and maximum based regional LBP method are also mentioned[4].

3. SYSTEM DESIGN

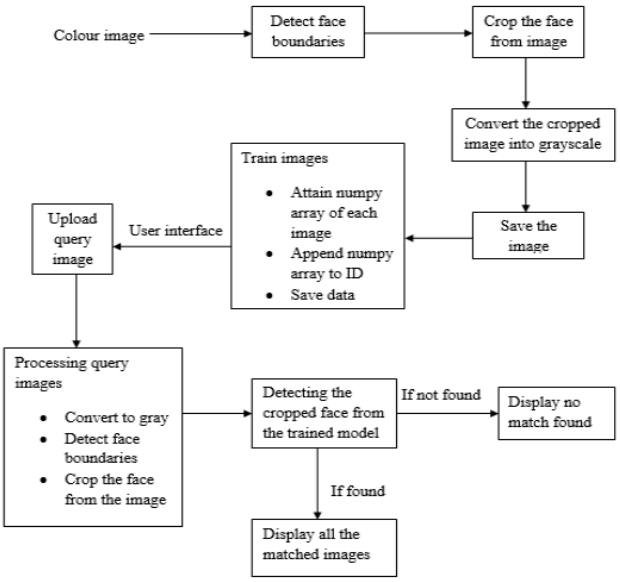

Fig. 1: Block Diagram

For every color image in the dataset the boundaries of the face is detected and then the background of the image will be cropped. Then convert the cropped images to gray scale and save the image in faces_gray folder. The images will then be trained by attaining the numpy array of each image and appending it with the respective image ID. This trained data is saved in trainingData.yml.
Through the user interface a query image is uploaded which is processed to obtain the cropped image in grey scale. The next step is to search faces_gray folder to see if the cropped image is present or not.

- If the cropped is present, all the images in faces folder are displayed.
- If the cropped image is not present, an error is displayed.

4. IMPLEMENTATION

4.1. Creating dataset

The dataset consists of images of each individual in a folder dedicated to that person. When the command to create gray image is run it converts every image to gray scale images. Since the images are in RGB color model it is unable to identify the face of the person easily. The standard practice is to convert it to gray scale which makes it easy to use the face for analysis. Along with gray scaling we are cropping the individual faces from the dataset and storing it in a greyscale folder. All the functions are performed by OpenCV. OpenCV creates a boundary around the face and once it identifies that the image inside the boundary is a face, it crops it and converts to greyscale.

Pseudo code
Purpose: To create a dataset of gray face images
Input: Color images
Output: Gray scale images in dedicated folders

For id_folders in Parent_directory **do**
  For image_file in id_folders **do**
    Detect the faces in the image_file using Cascade Classifier
    If any faces are detected **then**
      Crop the image to only the detected face dimension
      Convert the coloured cropped image to gray image
      Store the converted cropped gray face image to *dataset_directory/id_folder/ image_file* directory
    endif
  endfor
endfor

4.2. Training Dataset

After pre-processing, using cv2.face.LBPHFace Recognizer_create( ), the training of the images is done. Since the machine doesn't know the difference between different faces and also other objects it is needed to train for the same. Using cv2.face.LBPHFaceRecognizer_create( ) pre-trained model the machine is trained to understand different faces. Through this the machine understands that the face has unique parameters like eyes, nose etc. The system uses this model and segregates each face based on its unique features like eyes, nose size, width, height etc Once converted to binary language it is stored in a matrix format in a .yml file .At this stage the system understands the difference between each face. The accuracy is always 80-90 percent. Similarly it extracts individual images from a group photo and saves it in gray scale and then trains it. This helps it in the next step.

Pseudo code
Purpose: To train the dataset
Input: Dataset
Output: Trained dataset

Create an empty list called Faces[ ]
Create an empty list called Ids[ ]
For id_folders in Path_to_save dataset_directory **do**
For image_file in id_folders **do**
Append the image_file in Faces[ ] list
Append the id_folder name in Ids[ ] list
endfor
endfor
Train the models, Faces[ ] and Ids[ ] dataset using the LBPH algorithm
Store the trained model in *recognizer/trainingData.yml* directory

4.3. Detection

The image to be queried is saved in a query folder. While detecting, the query image is converted to gray scale and the face is cropped which is analysed and all the features i.e., x-y axis, width, height is analysed in detail. After analysis, it is converted to a machine language. This is validated with the xml matrix. Once it finds a pattern matching the face it collects the images and populates the screen with both group and individual images.

Pseudo code
Purpose: To detect the matched faces
Input: Query image
Output: Images matching the query image

Load the trained model from *recognizer/trainingData.yml* directory
Read the image from the input image directory
Convert the input image to gray image
Detect the faces in the gray input image
Crop the gray input image to only the detected face dimension
ID=Detect the Id of the cropped image by giving it as an input to the loaded trained model.
For image_file in *dataset_directory/id_folder/image_file* **do**
Save the image_file in *Output/imagefile* directory
end for

4.4. User Interface

In this paper, using flask a web application framework is developed. Flask is a small and lightweight Python web framework that provides useful tools and features that make creating web applications in Python easier[12]. It is easier for new developers to build a web application as it provides flexibility and it is a more accessible framework. The query image is uploaded on the web page created and the final outcome will be displayed on the page.

5. RESULTS AND DISCUSSION

The user uploads a query image on the webpage. On uploading, the features of the image are extracted and compared with those of the images from the dataset. Later, similar images are retrieved and displayed on the webpage as the final result.

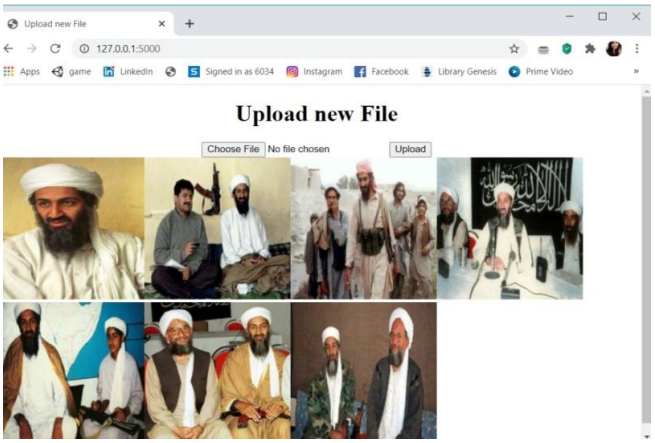

Fig. 2: Output

The use of color descriptor increases the efficiency of image retrieval from a large database thus maximising the accuracy of the system. The division of facial image into pixels by local binary pattern histogram makes feature extraction easier. The use of LBPH algorithm makes the proposed system more efficient than certain related works referred to. The inclusion or usage of better and more complex algorithms (similar to those referred to) can optimize the system and might provide better result.

6. CONCLUSION AND FUTURE SCOPE

CONCLUSION

The CBIR technology is used worldwide not only as a research topic but also applied in various fields. It is an exciting technology but yet it's unripe. At present this technology has its limits. As of now CBIR systems are used in very specialist areas to a significant extent and one such area is crime prevention which is proposed in our paper. The CBIR system in this paper is an integration of the traditional content based image retrieval techniques and face recognition techniques. Before the development of CBIR, retrieving images was usually done using the textual annotations but later image retrieval was done based on content and that's where content based image retrieval came into picture. CBIR uses visual features such as colour, texture, shape to form a histogram which is used in the LBPH algorithm to retrieve the images that match the query image. So, it can be said that there are many potential benefits of using CBIR though it has certain limitations at present. Thus, CBIR

is an upcoming technology which can be enhanced in the future and implemented in various fields.

FUTURE SCOPE

The number of pixels contributing to the query image retrieval can be considered as one of the limitations of the CBIR technique. When Match Points are taken into consideration it uses selected pixels for image retrieval whereas in Eigen Values only diagonal elements are used. The image retrieval time for eigen value is the least and maximum for histogram technique which is used in this paper and for match point the retrieval time is in between that of eigen value and match point. Thus, the retrieval efficiency can be increased by using techniques involving some pre or post processing works. So it can be said that CBIR is a technique open to future enhancements in many forms which will increase its application in various fields.

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