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## Facial Age Estimation

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*Abstract-* Age estimation based on the human face remains a significant problem in computer vision and pattern recognition. In order to estimate an accurate age or age group of a facial image, most of the existing algorithms require a huge face data set attached with age labels. This imposes a constraint on the utilization of the huge amount of human photos in the social networks. These images may provide no age label, but it is easily to derive the age difference for an image pair of the same person. To improve the age estimation accuracy, we propose a novel learning scheme to take advantage of these weakly labeled data via the deep Convolutional Neural Networks (CNNs). For each image pair, Kullback-Leibler divergence is employed to embed the age difference information (MS. SWATHI THILAKAN). The entropy loss and the cross entropy loss are adaptively applied on each image to make the distribution exhibit a single peak value. The combination of these losses is designed to drive the neural network to understand the age gradually from only the age difference information. Experimental results on two aging face databases show the advantages of the proposed age difference learning system and the state-of-the-art performance is gained.

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# Facial Age Estimation

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**Abstract-** Age estimation based on the human face remains a significant problem in computer vision and pattern recognition. In order to estimate an accurate age or age group of a facial image, most of the existing algorithms require a huge face data set attached with age labels. This imposes a constraint on the utilization of the huge amount of human photos in the social networks. These images may provide no age label, but it is easily to derive the age difference for an image pair of the same person. To improve the age estimation accuracy, we propose a novel learning scheme to take advantage of these weakly labeled data via the deep Convolutional Neural Networks (CNNs). For each image pair, Kullback-Leibler divergence is employed to embed the age difference information (MS. SWATHI THILAKAN). The entropy loss and the cross entropy loss are adaptively applied on each image to make the distribution exhibit a single peak value. The combination of these losses is designed to drive the neural network to understand the age gradually from only the age difference information. Experimental results on two aging face databases show the advantages of the proposed age difference learning system and the state-of-the-art performance is gained.

## CHAPTER 1

### I. INTRODUCTION

#### a) Overview

Face recognition is developed for various purposes and helped in the development of artificial recognition by computer systems. For recognizing human faces, defining age classifier is a major step in this project. This project aims to increase the accuracy of the identification of human faces. The basic concept of images is drawn from pixels. Pixels are the basic forming patterns for any sort of images. Images can be segmented into pixels based on colour patterns. The process of segmenting involves various types such as binary, gray, color. Binary type is a 1-plane pattern having values 0 and 1. Grey type is having shades of black and white and it is a 1- plane pattern and having values from 0 to 255. Color is having 3-plane pattern and designed from value range 0 to 256. Image processing mainly depends on this type of colour images. It is having red, green, blue planes. These planes are considered as the origin of all colour patterns . For example, Red + Green = Yellow, Red + Blue = Magenta, Green + Blue = Cyan, Red + Green + Blue = White, and secondary colours are combined to form black, Magenta + Cyan + Yellow = Black. We can possibly form 25 lakhs of colour patterns using these

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colours. Recognising these colours from images are the basic requirement. This process involves various process such as Acquisition, Enhancement, Segmentation, Recognition, Retrieval, Restoration, Fusion, Compression, Watermarking, Cryptography, Steganography, etc. Automatic recognition is one of the emerging areas of artificial intelligence. There are various types of recognition such as Handwritten recognition, Face recognition, Fingerprint recognition, Voice recognition, etc. The process of recognition gets better with years of research and development. The need for identifying human ages with more accuracy motivates the research on this project. Images are acquired from various formats such as GIF, JPG, JPEG, etc. Images can be acquired through face camera or a file of any image format. The product is developed with the implication of GLCM matrix and the KULLBACK LEIBLER divergence formula. Using these techniques, the process of recognition continues and CNN network is used to estimate the age. The process will be updated and learned with every input images.

Preprocessing



Figure 1.1: Black and White image

Positional Ternary Pattern



Figure 1.2: Gray scale image



Figure 1.3: Colour image

CHAPTER 2

II. LITERATURE SURVEY

a) *Image Acquisition*

In Data Acquisition (DAQ) or Image acquisition, the recognition system acquires a scanned image as an input image. The image should have a specific format such as JPEG, BMP etc. This image is acquired through a scanner, digital camera or any other suitable digital input device. Data samples for the experiment have been collected from different individuals.

b) *Face recognition*

In this process of identification of ages using human faces involves segmentation of left eye, right eye, nose and mouth. In this process of identification first the boundaries of face happens and the process of identifying each parts will be continued. firstly the whole face will be identified and segmented and convert into 256\*256 pixels. Then use the process of using cvision toolbox and call the face detection function to capture the image boundary and surrounded it with red rectangle (Rowley et al., 1996). Hold it for more time.

c) *Preprocessing*

Preprocessing involves the process of converting image required for face detection. To enhance the image, converting into black and white is essential. Finding four vectors for face detection namely x,y,w,h are essential. Then crop the target face into 180\*180 pixels with four vector features obtained. Then convert the image having colour into grey image. Obtain the figure and hold the figure using image processing toolbox in MATLAB.

d) *Face and Landmark detection*

By the same way finding the face using function in image processing toolbox, face and landmark detection also obtained from the toolbox functions. Use detect face parts function for the process of identifying face parts. The parameters used are bbox, bbx, faces, bbfaces. bbox is used to bound parts of each part such as left eye, right eye, nose and mouth. Finding faces with box is used for the development of program. And also images with found faces determined into array are contributed into bbx. Faces is used for the found faces stored as cell array. bbfaces is used for the found faces with boxes stored as cell array. Each part having different cropping technique. Each part obtaining four essential features such as contrast, correlation, entropy and homogeneity (Chang and Chen, 2015). Contrast stands for the effect of pixels on the basis of colour depth. Correlation stands for the connection between two things. Entropy stands for the change in two differential functions. Homogeneity stands for the similarity in pixels. For left eye, the segmented ratio will be 5:8. For right eye, segmented ratio will be 9:12. For nose, segmented ratio will be 17:20. For mouth,

segmented ratio will be 13:16. Display all these images combinely and calculate gray level co occurrence matrix. Display the ternary image of the GLCM matrix.

e) *Loading Databases and Training datasets*

Using mathematical equations define the output by describing the amount of age present in the system input. Firstly, find the Least Square (LS), Mean Absolute Error (MAE) and the mean shifted input images. Then calculate the eigen vectors and eigen values. Then retain the top eigen vectors. Then project the image into subspace to generate the feature vectors. Then save the loaded data and then train the network and display the age classified using the network.



Figure 2.1: Face Detection



Figure 2.2: Preprocessing

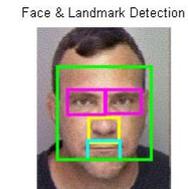


Figure 2.3: Face and Landmark Detection

Positional Ternary Pattern



Figure 2.4: Positional ternary Pattern

CHAPTER 3

III. EXISTING SYSTEM

a) *Local Binary Pattern*

The original LBP operator was introduced by Ojala et al. This operator works with the eight neighbors of a pixel, using the value of this center pixel as a threshold. If a neighbor pixel has a higher gray value than the center pixel (or the the same gray value) than a one is assigned to that pixel, else it gets a zero. The LBP code for the center pixel is then produced by concatenating the eight ones or zeros to a binary code. Later the LBP operator was extended to use neighborhoods of different sizes (Md. Abdur Rahim, 2013). In this case a circle is made with radius R from the center pixel. P sampling points on the edge of this circle are taken and compared with the value of the center pixel. To get the values of all sampling points in the neighborhood for any radius and any number of pixels, (bilinear) interpolation is necessary. If the coordinates of the center pixel are (xc, yc) then the coordinates of his P neighbors (xp, yp) on the edge of the circle with radius R can be calculated with the sinus and cosines.

b) *Artificial Neural Network*

Artificial Neural Network (ANN) system operates in two stages: it first applies a set of neural network-based filters to an image, and then arbitrates the filter outputs. The filters examine each location in the image at several scales, looking for locations that might contain a face. The arbitrator then merges detections from individual filters and eliminates overlapping detections. The first component of our system is a filter that receives as input a 20x20 pixel region of the image, and generates an output ranging from 1 to -1, signifying the presence or absence of a face, respectively. To detect faces anywhere in the input, the filter is applied at every location in the image. To detect faces larger than the window size, the input image is repeatedly sub sampled by a factor of 1.2, and the filter is applied at each scale.

1. Create an initial set of non-face images by generating 1000 images with random pixel intensities. Apply the preprocessing steps to each of these images.
2. Train the neural network to produce an output of 1 for the face examples, and -1 for the non-face examples. The training algorithm is standard error backpropagation. On the first iteration of this loop, the network weights are initially random. After the first iteration, we use the weights computed by training in the previous iteration as the starting point for training.
3. Run the system on an image of scenery which contains no faces. Collect subimages in which the network incorrectly identifies a face (an output activation 0).
4. Select up to 250 of these subimages at random, apply the preprocessing steps, and add them into the training set as negative examples. Go to step 2.

*Drawbacks over existing systems:*

1. In appearance based methods, less accurate of features description because of whole image consideration.
2. In geometric based methods, the geometric features like distance between eyes, face length and width, etc., are considered which not provides optimal results.

CHAPTER 4

IV. CODING, TESTING

In this chapter, the program coding related to our work using MATLAB is designated.

a) *Image Acquisition*

In Image acquisition, the recognition system acquires a scanned image as an input image. The image should have a specific format such as JPEG, BMP etc.

cd Image

```
[file,path] = uigetfile('*.*jpg;*.png','pick an image file');
img = imread(file);
```

b) *Face recognition*

In this process of identification of ages using human faces involves segmentation of left eye, right eye, nose and mouth. In this process of identification first the boundaries of face happens and the process of identifying each parts will be continued.

```
Fdetect = vision.CascadeObjectDetector;
Bvectors = step(Fdetect,tinp);
figure('Name','Face Detection','MenuBar','none');
imshow(tinp);
hold on;
```

c) *Preprocessing*

Preprocessing involves the process of converting image required for face detection. To enhance the image, converting into black and white is essential. Finding four vectors for face detection namely x,y,w,h are essential.

```
Freg = imcrop(tinp,Bvectors(1,:));
Freg = imresize(Freg,[180,180]);
if size(Freg,3)>1
Freg = rgb2gray(Freg);
end
figure;
imshow(Freg);
title('Preprocessing');
```

d) *Face and Landmark detection*

By the same way finding the face using function in image processing toolbox, face and landmark



detection also obtained from the toolbox functions. Use detect face parts function for the process of identifying face parts. The parameters used are bbox,bbx, faces,bbfaces.

```

detector = buildDetector();
[bbox,bbimg,faces,bbfaces] =
detectFaceParts(detector,img,3);
figure;imshow(bbimg);
title('Face Landmark Detection');
leye = imcrop(img,bbox(:,5:8));
PTPleye = ptp(leye);
[cont1;corr1;En1;Homo1] = GLCM(PTPleye);
Feat1 = [cont1;corr1;En1;Homo1];
    
```

e) Loading Databases and Training datasets

Using mathematical equations define the output by describing the amount of age present in the system input. Firstly, find the mean image and the mean shifted

input images. Then calculate the eigen vectors and eigen values. Then retain the top eigen vectors.  $i = 1:size(Dfeatures, 2)$

```

if M==0
N =N + 1;
M = 0;
else
M = M-1;
end
T(1,i) = N;
end
disp('Training Feature Vectors :');
disp(Dfeatures);
helpdlg('Training Process Completed');
    
```

The following picture demonstrates the total output of the system being developed.

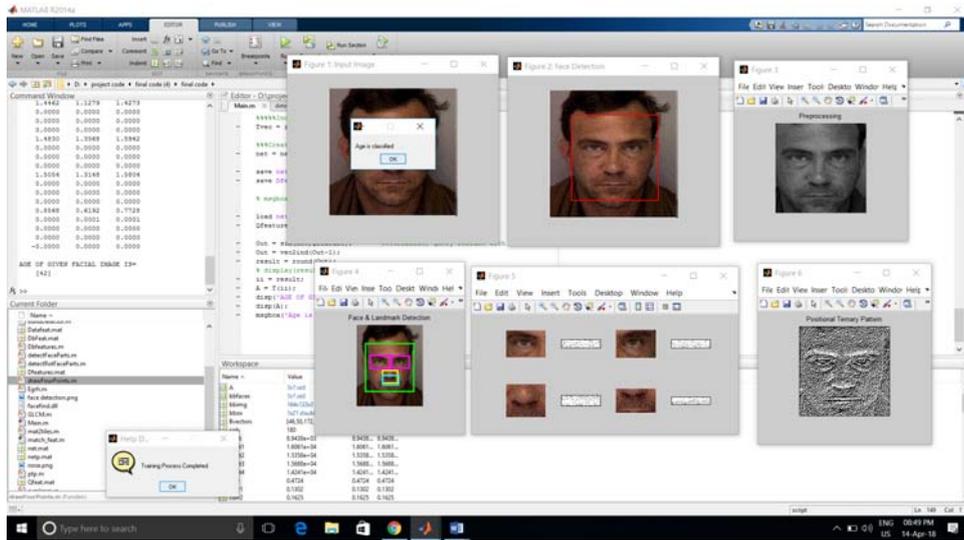


Figure 4.1: Final output screenshot

CHAPTER 5

V. CONCLUSION

Facial age recognition becomes one of the emerging technologies and the necessary one in the emerging computer world. to be correct on its own, it requires a 100 percent accuracy and develop the system with lots of training systems. Thus the developed systems are constrained towards the process of developing the accuracy of systems. The system developed in further steps of high definition. It helps in the higher sort of proposed definition. Network is developed for identifying further images with no label. The combination of these losses is designed to drive the neural network to understand the age gradually from only the age difference information. We also contribute a

data set, including more than 100 000 face images attached with their taken dates. Each image is both labeled with the timestamp and people identity. Experimental results on two aging face databases show the advantages of the proposed age difference learning system, and the state-of-the-art performance is gained. Estimating human age from images is a problem that has recently gained attention from the computer vision community due to its numerous applications as well as the challenges that face a satisfactory solution. Beside traditional challenges in captured facial images under uncontrolled settings such as different lighting, varying poses and expressions, aging effects on appearance depends on many other factors such as life style. In this thesis, a new automatic age estimation framework is proposed. A single image is required as input for the subject of interest to estimate his age.

## CHAPTER 6

## VI. FUTURE ENHANCEMENT

The work can be used for enhancing the age estimation through the performance of assigning the adaptive weights to MLBP features of each sub block based on fuzzy systems. In addition, other effects of race, image resolution, and focusing condition on the performance of age estimation will be studied. From the experiments it can be encountered that it can be recommended that age group prediction algorithm could be effectively employed in many applications such as Age- Specific Human Computer Interaction, web application in order to prevent the under- age from, not to have access or from buying the adult contents or materials, and Security and Surveillance system for locating animals. This work can also be focus on testing the video for age estimation.

*Abbreviations*

ANN Artificial Neural Network

DAQ Data Acquisition

LS Least Square

MAE Mean Absolute Error

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