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Artificial Intelligence Face Recognition for applicant tracking system

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ABSTRACT

The technology impact more in the organization, it is forcing to change their basic functions, irrespective of industry functions. To catch the requirement, the companies forcing to hire human resources. The aim of the is to find duplication of applicant's face through the principal component analysis algorithms. The study tested the pre-corded images of the applicants and concluded with further research ideas.

Key words: artificial intelligence, face detection, face recognition, face tracking and human sensing.

Classification: Technical paper.

1. INTRODUCTION

As we all know the progress of technology, machines are beneficial and sophisticated, machines-based tools introduced in all service sectors. Artificial intelligence (AI) applications are extensively using by society. Most of the areas occupied such as computer science, education, finance, ecology, health care, e-commerce, customer service, transportation and so on, furthermore, enhancing the professional life of many.

Nowadays, artificial intelligence has infiltrated in the recruitment market, and many services are offering by own-made AI applications to help in job searching and other recruitment-related works.

The recruitment process has many activities involved [1], but the present study is proposed to identify duplication of the applicant in a while shorting resume with the help of face recognition.

2. REVIEW LITERATURE

The technology 4.0 version was accommodating many of the facilities to create active with human-computer interaction and overcoming with traditional devices in the industry. Furthermore, the recruitment industry also is a part of using devices in the activities. The face detection via many images in the process is complicated, therefore, need to develop a new algorithm to solve the problem.[2]. The identification of human activity in the organization is critical to know suspicious behaviour, besides, required to recognize the of accuracy and minimum processing time of image of target applicant, and this will integrate with support of hardware and their applications.[3], [4].

The skin will differ based on region segmentation, the facial image of the candidate will make change drastically, [5]**.** In the process of face recognition use varieties of style to keep data to administer, the concluded their comparative study is every method is correct as per the environmental factor.[6].

Using of the Biometrics systems in the identification of human face, store pf physical properties of people in electronic form, focused more on face recognition detecting by using of principal component analysis algorithms and based that it will pre-record the face image samples..[7] As per the [8] eigenspace technique is used to identify face recognition and another piece of work stated that using of eigenspace method formulate real-time images with two-dimensional way of the image characteristic,[9]. The applicant while searching employer's database, the applicant tracking system required to provide user queries, that will be possible with a combination of semantic search and concluded that it is like a database search of applicants. [10].

After precise observation of the literature review, the author found that there is a scope to study on artificial intelligence face recognition for the applicant to reduce the gap in practice and literature and developed following statement for the study. The system must take the face of a person as an input image. It will be as input image is compared with available training images already present in the database. Similar images of a person are add in a class. A class contains a similar image that is of one person's images with slight variations. Then the system should reply the input image is match with which class image. The study used principal component analysis and MATLAB to get desired results.

3. SYSTEM ARCHITECTURE

Below figure 1 shows the basic steps used in digital image processing.

- Image restoration focusing on to improve image appearance
- Processing of colour image importance for significant in digital image to insert internet.
- Using wavelets representing the image resolution
- Dealing with the compression method minimizes the storage demand and save the image as per the bandwidth.
- Dealing with the morphological process used for extracting image components and represent the shape of the image
- The procedure of segmentation inserts partition of the image into objects or parts of the constituent.
- Out of description is the segmentation stage, which includes raw data pixel, boundary regions of the image.
- The process of recognition assigns an object into descriptors.

Figure 1: Basic process in digital image processing

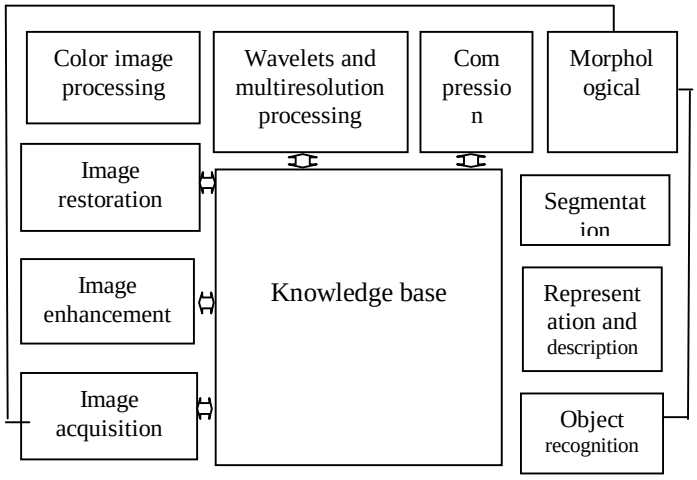


Figure 1 :Basic process in digital image processing

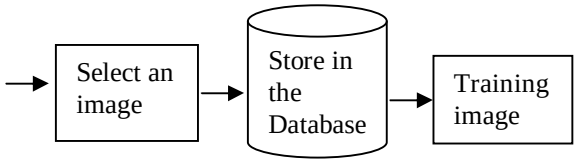


Figure 2 :Training image storage process

Figure 2 for training images, here the study select one image, will store in the database. This will be considered as training images.

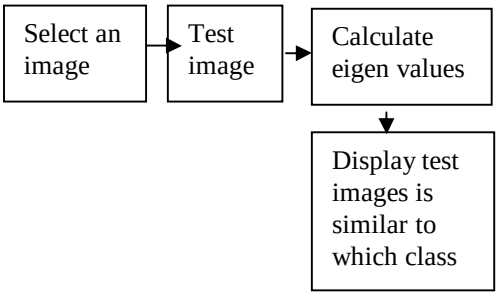


Figure 3: Testing image storage process

Figure 3 Image testing process. In this select image used for testing purpose. Moreover, the image will not storage in database. This image will calculate eigen values and display results as a class.

3.1 Flow chart for image testing

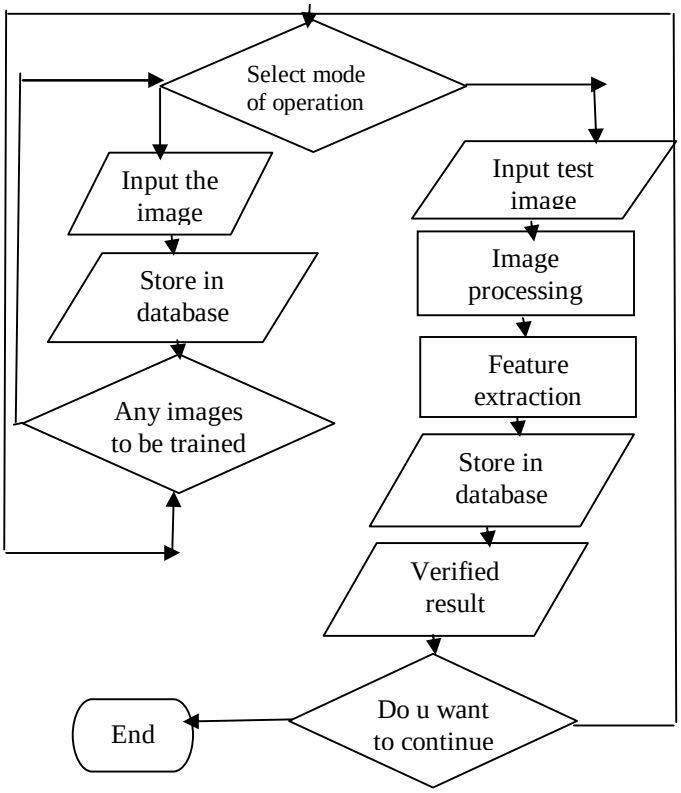


Figure 4 : Flowchart designed for training and testing images

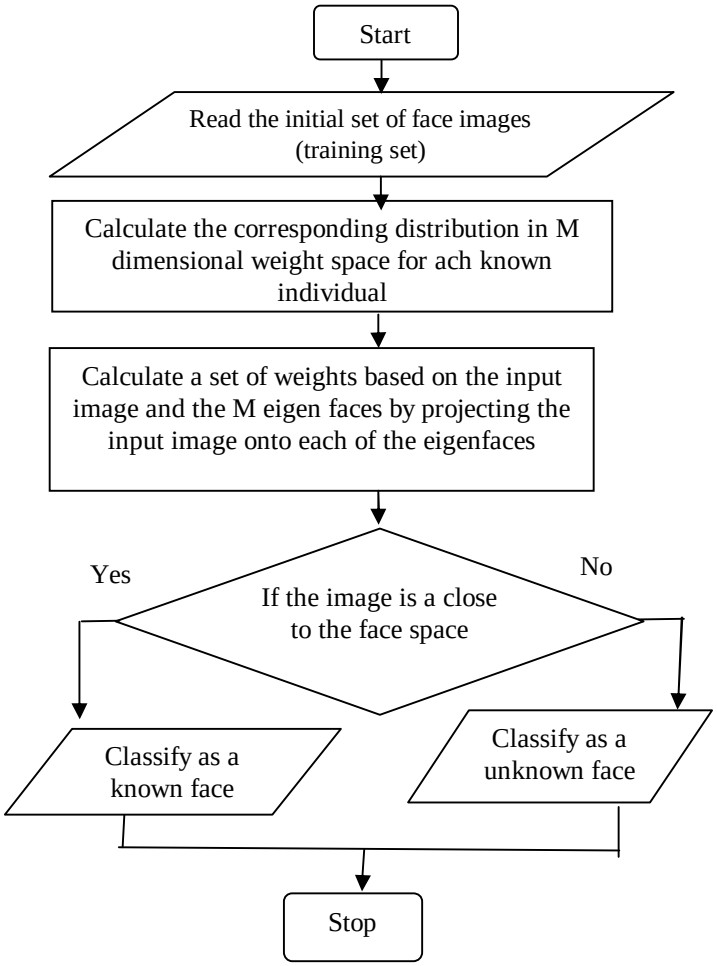


Figure 5: Flow chart for face recognition from face space

3.2 Tracking Algorithm

Step 1: obtain face images $I_1, I_2, ..., I_M$ (training faces)
(the face images must be *centered* and of the same *size*)

Step 2: represent every image *Ii* as a vector τ_i

Step 3: compute the average face vector Ψ:

Step 4: subtract the mean face $\psi = 1 / M \sum_{i=1}^{M} \tau_i$

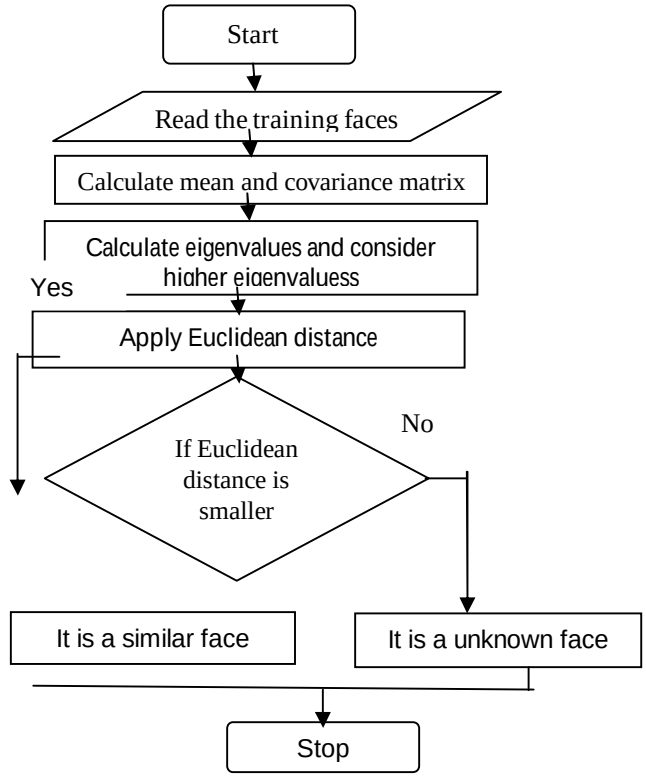


Figure 6 : Flowchart for face recognition using eigen values

Step 5: compute the covariance matrix C:

$$C = 1 / M \sum_{n=1}^{M} \phi_n \phi_n^T - AA^T$$

where $A = [\Phi_1 \Phi_2 ... \Phi_M]$ ($N^2 \times M$ matrix)

Step 6: compute the eigenvectors *ui* of AA^T
The matrix AA^T is very large.

Step 6.1: consider the matrix $A^T A$ (M*x*M matrix)

Step 6.2: compute the eigenvectors *vi* of $A^T A$
$A^T Avi = \mu i\ vi$

What is the relationship between *usi* and *vi* ?

$A^T Avi = \mu i\ vi => A A^T Avi = \mu i\ Avi$
$CAvi = \mu i\ Avi$ or $Cui = mi\ ui$ where $ui = Avi$

Thus, AA^T and $A^T A$ have the same eigenvalues and their eigenvectors
are related as follows: $ui = Avi$

Note 1: AA^T can have up to N^2 eigenvalues and eigenvectors.

Note 2: $A^T A$ can have up to M eigenvalues and eigenvectors.

Note 3: The M eigenvalues of $A^T A$ (along with their corresponding eigenvectors) correspond to the M *largest* eigenvalues of AA^T (along with their corresponding eigenvectors).

Step 6.3: compute the M best eigenvectors of AA^T: $ui = Avi$ **(important:** normalize ui such that $||ui|| = 1$)

Step 7: Keep only K eigenvectors (corresponding to the K largest eigenvalues)

Face Recognition Using Eigenfaces

Given an unknown face image ┬(centered and of the same size like the training faces) follow these steps:

Step 1: normalize ┬: $\Phi = ┬ - \Psi$

Step 2: project on the eigenspace

$$\hat{\phi} = \sum_{i=1}^{K} w_i u_i \quad \left(w_i = u_i^T \phi \right)$$

Step3: represent Φ as $\Omega = \begin{bmatrix} w1 \\ w2 \\ .... \\ wK \end{bmatrix}$

Step 4: find $er = \min l \, ||\Omega - \Omega l||$

Step 5: if $er <$ Tr, then ┬ is recognized as face l from the training set.

The distance er is called distance within the face space (difs)

Face detection using Eigenfaces

Given an unknown image ┬

Step 1: compute $\Phi = ┬ - \Psi$

Step 2: compute

$$\hat{\phi} = \sum_{i=1}^{K} w_i u_i \quad \left(w_i = u_i^T \phi \right)$$

Step 3: compute $e_d = ||\Omega - \Omega||$

Step 4: if $e_d < T_d$, then ┬ is a face.

The distance e_d is called distance from face space(dffs)

3.3 Tracking syntax for reading all applicant images

Tracking syntax for reading all applicant images

Face recognition is done by using eigen values. We can classify the faces by using the below eigen values.

S1

Faces	Eigen values
Face 1	0.2272
Face2	0.2710
Face3	0.2342
Face4	0.2975
Face5	0.2935
Face6	0.2516
Face7	0.2433
Face8	0.2544
Face9	0.2643
Face10	0.2596

S2

Face1	0.1715
Face2	0.1704
Face3	0.1722
Face4	0.1696
Face5	0.1742
Face6	0.1777
Face7	0.1806
Face8	0.1762
Face9	0.1758
Face10	0.1815

S3

Face1	0.1915
Face2	0.1951
Face3	0.1948
Face4	0.1977
Face5	0.1984
Face6	0.2128
Face7	0.2075
Face8	0.2089
Face9	0.2150
Face10	0.2096

If the eigen values range from 0.23-0.29 then these faces are classified as class 1 faces. If the eigen values range from 0.17-0.21 then these faces are classified as class 2 faces. If the eigen values range from 0.19-0.21 then these faces are classified as class 3 faces and similarly for other faces.

Reading all the images

```
% Load the ATT image set
  k = 0;
  for i=1:1:6
     for j=1:1:10
        filename =
sprintf('C:\\MATLAB\\att_faces\\s%d\\%d.pgm',i,j);
        image_data =imread(filename);
        k = k + 1;
        x(:,k) = image_data(:);
        anot_name(k,:) = sprintf('%2d:%2d',i,j);   %
for plot annotations
      end;
  end;
```

Calculating mean

```
nImages = k;                                    %total
number of images
imsize = size(image_data);          %size of image (they all
should have the same size)
nPixels = imsize(1)*imsize(2);    %number of pixels in image
x = double(x)/112;                   %convert to double and
normalize
%Calculate the average
avrgx = mean(x')';
for i=1:1:nImages
   x(:,i) = x(:,i) - avrgx;                    % substruct the
average
end;
subplot(2,2,1); imshow(reshape(avrgx, imsize)); title('mean
face');
```

Calculating covariance matrix and finding eigen values

```
cov_mat = x'*x;
[V,D] = eig(cov_mat);              %eigen values of cov matrix
V = x*V*(abs(D))^-0.5;
subplot(2,2,2); imshow(ScaleImage(reshape(V(:,nImages
),imsize))); title('1st eigen face');
subplot(2,2,3);
imshow(ScaleImage(reshape(V(:,nImages-1),imsize)));
title('2st eigen face');
subplot(2,2,4); plot(diag(D)); title('Eigen values');
```

Reconstruction of the image

```
image_index = 12;  %index of face to be reconstructed
reconst = V*KLCoef';
diff = abs(reconst(:,image_index) - x(:,image_index));
strdiff_sum = sprintf('delta per pixel:
%e',sum(sum(diff))/nPixels);
figure;
subplot(2,2,1);
imshow((reshape(avrgx+reconst(:,image_index), imsize)));
title('Reconstructed');
subplot(2,2,2); imshow((reshape(avrgx+x(:,image_index),
imsize)));title('original');
```

Applying Euclidean distance

```
image_index = 40;
for i=1:1:nImages
   dist_comp(i) =
sqrt(dot(KLCoef(image_index,:)-KLCoef(i,:),
KLCoef(image_index,:)-KLCoef(i,:))); %euclidean
   strDist(i) = cellstr(sprintf('%2.2f\n',dist_comp(i)));
```

4. RESULTS

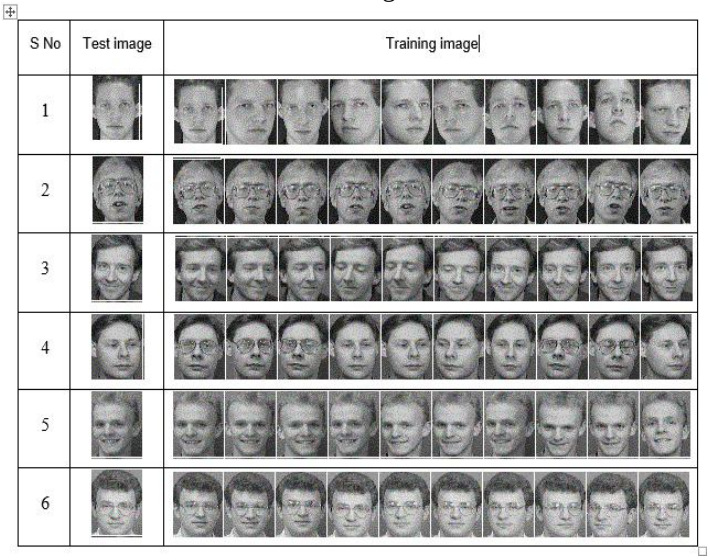
The testing strategies classified as black-box testing and white-box testing, the black-box mainly aim to interface level and white-box testing the software and predicting on close examination of details of procedural.

Testing Strategies:

Training is the most crucial period of the system. It is training of images that decide how well the system is going to work. Number of test samples must be optimal. It should not be more, thus increasing the burden on the user, neither it should be so small that it is not able to recognize the image. To test this optimal number here we have considered 60 images of six persons. Each persons 10 images are considered with some variations in each of the face. Here we are selecting individual images and adding these images to the database. These images are considered as training images.

Sample images:

Sample images shown below were collected from the ORL database available in the internet. 400 images are available in this database we have taken 60 images.



The results of all the faces are taken as test images individually and then compared with other faces already present in the database and then Euclidean distance is calculated and distance from face space is also calculated.

S.no	Images	Class	Euclidean Distance	Distance from facespace
1	face1	1	5.2742e+003	2.33456+003
2	face2	1	6.5801e+003	1.8946e+003
3	face3	1	4.2707e+003	2.74756+003
4	face4	1	5.4086e+003	1.8056e+003
5	face5	1	3.6036e+003	1.9174e+003
6	face6	1	3.6036e+003	1.9174e+003
7	face7	1	2.1142e+003	2.4646e+003
8	face8	1	3.7614e+003	2.2800e+003
9	face9	1	5.0469e+003	2.3498e+003
10	face10	1	3.9000e+003	2.3745e+003
11	face1	1	1.3312e+003	2.1282e+003
12	face2	1	908.0876	1.7267e+003
13	face3	1	592.3151	1.9892e+003
14	face4	1	992.6756	1.7416e+003
15	face5	1	914.7324	2.1271e+003

The above are 20 images of two classes. Each class contains ten images of a particular person taken with slight variations. The individual image is taken as test image, and its Euclidean distance and distance from face space are calculated. It also displays that a particular face is similar to which class face.

Sample outputs:
Input : select 1 face image

After performing face recognition
Output:
The nearest class is number
1
with a distance equal to
5.2742e+003
The distance from Face Space is
2.33456+003

5. CONCLUSION

The study aims to know the facial recognition of an applicant to avoid duplication in the process of recruitment, especially in shortlisting of curriculum vitae and resume of the applicant. The study has adopted principal component analysis, MATLAB and eigenface approach to achieve desired outcomes.

5.1 AVENUES FOR FUTURE RESEARCH.

The study has limitation in its sample applicant images. The researchers can extend their study using taking more applicant images, with facial expression, iris, eyes and noise. There are sophisticated tools can be used as mobile sensor network and robotics automation process, to evaluate curriculum vitae, scheduling, sourcing, digital foot print, personality screening and applicant emotional intelligence.

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USER MANUAL

Main Menu

After selecting an image