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PROJECT REPORT

Technical Report Writing

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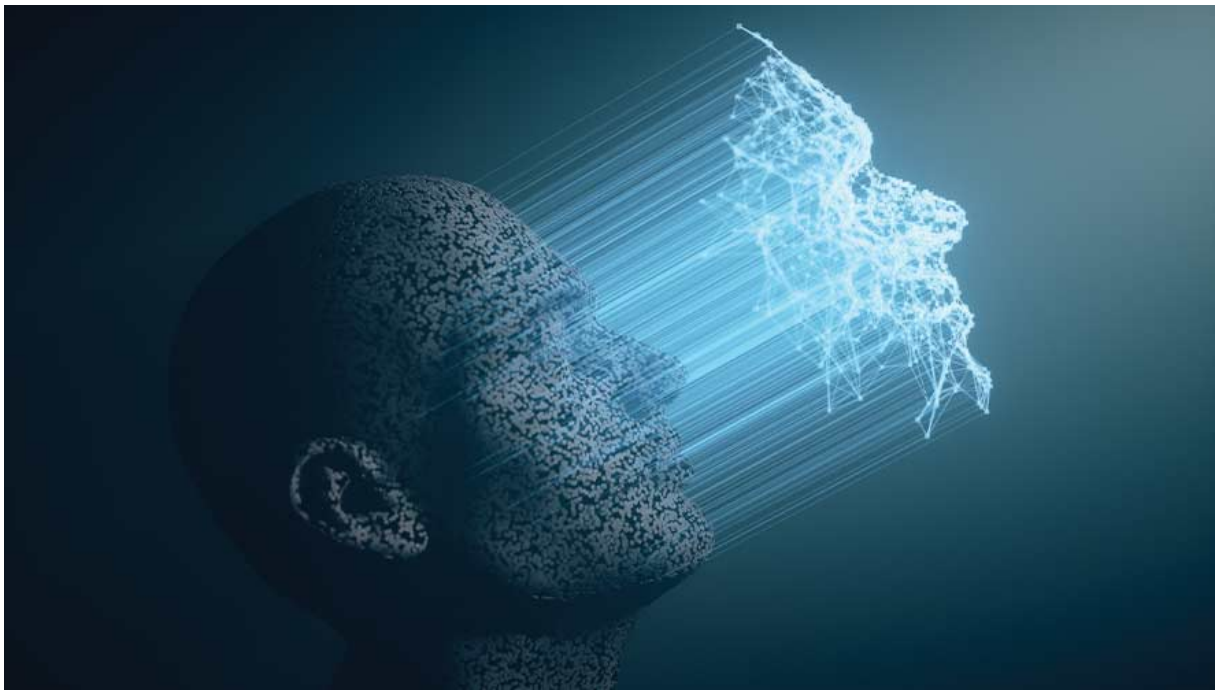
Complex Engineering Assignment



Real-Time Face Identification and Detection

ABSTRACT

Face recognition is a kind of personal identification innovation that determines a person's identity based on personal characteristics. The human face recognition technique is divided into two stages, face detection, which occurs relatively quickly in humans unless when the item is positioned at a short distance away, recognizes a visual as a person. For the purpose of evaluation, two popular approaches, the eigenface method and LEM, will be implemented. The eigenface of the verified representation is input into trained neural networks, which find the best match while taking into consideration the threshold value for rejecting cruel and unfamiliar characters. The basic purpose is to identify the face and retrieve information stored in the database. Gray Scale Algorithm and others mentioned above engage best in real-world applications like mugshot identification and inspection, such as ATM security.
Keywords: Face Recognition, Eigen face, Gray Scale Algorithm, Mugshot.

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1 INTRODUCTION

Face recognition is among the most productive and practical uses of image processing and biometric systems. It involves the classification of an already determined item as a recognized face or an undefined body. Face recognition is frequently mistaken for face detection. The geometrical and mathematical differences between photographs of the same face resulting from lighting and viewing direction are nearly always greater than image fluctuations due to deviations from face identity which creates a significant obstacle to facial recognition. MATLAB and Python are expected tools to be used.

1.1 Objective

Design a real-time recognition system that can reliably detect faces for biometric analysis and monitoring where a person is recognized on the spot and permitted entrance to a building or property while avoiding security issues.

1.2 Research objectives

- Develop a real-time recognition system with improved accuracy and reliability.
- Research Paper Publishing

1.3 Scope of the study

Considering an example of a child who can accurately identify a face but for a computer, it is a complicated task. As a result, the fundamental idea is to create a system that can mimic what a youngster can attain. Advances in processing capacity over the last few decades have successfully enabled equivalent recognizing capabilities from such built systems. All facial recognition algorithms have two essential components:

- Face detection and normalization
- Face identification

Algorithms with both components are known as fully automated algorithms, whereas those with only the second element are known as partially automatic algorithms. Table 1 taken from reference [7] explains the stages for the dataset creation;

Stage	Aim	No of Persons	No of images per person	total Images	Annotation effort	EER
1	Candidate list generation	5,000	200	1,000,000	-	-
2	Rank image sets	2,622	1,000	2,622,000	-	96.90%
3	Near dup. removal	2,622	623	1,635,159	-	-
4	Final manual filtering	2,622	375	982,803	10 days	92.83%

Table 1: STAGES OF PROCESSING

1.4 Significance and Applications

Human face recognition has been an important study subject since early 1990, corresponding with the increased interest in the development of human-computer interfaces and biometric identification. Face recognition is a significant research subject that spans many domains and disciplines. This is due to the fact that, in addition to having multiple practical uses such as bankcard identification, access control, Mug shots searching, security monitoring, surveillance and criminal identification, etc. It has theoretical applications and serves a purpose in many areas nowadays which includes picture-hosting services and social networking sites.

1.5 Literature survey

- Line Edge Map approach
- Linear Discriminant Analysis
- Eigen faces Method

Face detection is a computer mechanism that identifies the location and size of human faces in a picture, either digital or real-time. Only facial characteristics are recognized whereas other things such as trees and buildings are neglected. This paper explains a method for recognizing human face expressions for human-robot interaction. The facial characteristics, particularly the eyes and mouth, are retrieved and approximated utilizing eigenfaces for this purpose. Color segmentation based on the unique principle of fuzzy classification which manipulates color ambiguity, has been used for face identification. Table 3 shows supported formats take from reference [4]

Table 2: List of Supported Formats

Format	Full Name	Description	Extension
GIF	Graphics Interchange Format	A standard for compression of images of photographic quality	.gif
BMP	Windows Bitmap	Format used mainly for simple uncompressed images	.bmp
PNG	Portable Network Graphics	Compresses full color images with transparency	.png

2 Methods & Materials

Following are the two approaches for face-detection:

- Face detection in images
- Real-time face detection

Eigenface is a method for reducing dimensionality and uses the variances in the dataset to represent the face visuals. It computes feature vectors for various facial positions and generates a column matrix from these vectors. After obtaining the feature vector, the mean of the

face is calculated and each input face picture is normalized by subtracting from the mean face before determining the covariance matrix for it. The Eigenvalues of the covariance matrix are calculated again and only the greatest eigenvalue is considered. Afterward using that matrix, the eigenvector for the covariance matrix is produced and the projected image is computed by interacting with the finest information of the face image. These extracted facial image projections are then sent into neural network models for training and testing. The distinctive characteristics of the face visuals are extracted that contain the most information with classified dimensions. Extracted features are used to generate eigenfaces which are then fed into Artificial Neural Networks to educate the networks for learning. For the purposes of evaluation, the eigenface of the verified portrayal is fed into the trained neural networks, which identify the best match while taking into account the threshold value for rejecting inhumane and unknown avatars. Our future goal is to use local feature selection approaches coupled with neural networks to strengthen our study of Face Recognition Systems.

2.1 Rationale for this selection

The designed face recognition system will have good accuracy and success rates even in noisy face photos. Experiment findings show that this approach can reliably distinguish between skin and non-skin areas. To determine whether or not the skin area is a face. Eigen space-based recognition of faces has proven to be one of the most successful approaches for recognizing faces in both digital pictures and in real-time.

2.2 Detecting Curves using Eigenfaces and LEM

An example of the procedure is illustrated in Figure 1 and 2 taken from reference [1].

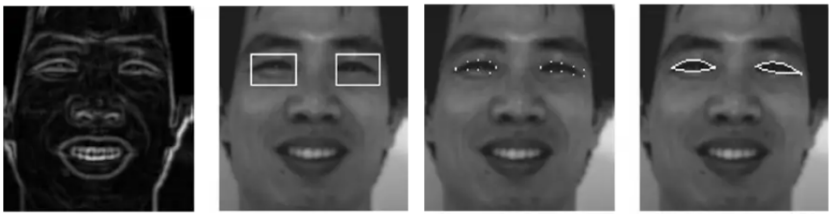

Figure 1: Eye Extraction

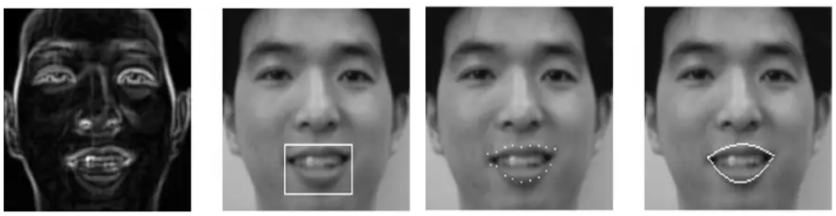

Figure 2: Mouth Extraction

2.2.1 LEM

Line Edge Map technique is used to extract lines as features from a face and will work alongside eigenfaces to achieve desired goals. Example of a human frontal face LEM in Figure 3 taken

from reference [8].

Figure 3: An illustration of a face LEM

3 Results & Discussion

We will offer two contributions to this project: first, we have built a process that can identify and recognize a human after collecting large-scale data collection comprising photographs captured at various angles and resolutions. The second effort will be to use an eye detection approach with proper training to recognize two identical faces based on their iris. Figure 4 represents the process taken from reference[3].

Figure 4: Summarized Flow Chart

As mentioned, we used the discussed algorithm for face detection that can detect facial features like face line, front face, nose, eyes, ear etc. Figure 5 and 6 show the final product using the desired algorithm taken from reference [8] and [3] respectively.

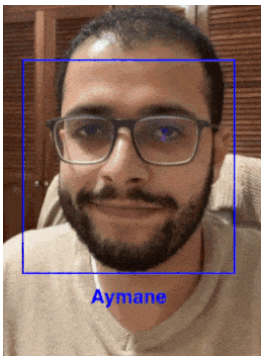

Figure 5: Face Detection

Figure 6: Face Identification

As per expectations, Results will clearly state how Eigenfaces are resistant to noise and fluctuations in lighting, position and facial emotions. Eigenfaces have been proven to be very accurate in recognizing faces, even in big datasets with numerous participants.Eigenfaces may be simply constructed using basic linear algebra techniques, making them accessible to scholars and practitioners in the area.

4 Conclusion

The ultimate goal of researchers in this area is to enable computers to emulate the human visual system. The algorithms used in this study were selected after thorough research. The current automated face detection and identification technology is insufficiently robust to attain high recognition accuracy. This study suggests a novel way to recognize facial emotions. We built expression models from numerous people using EigenFaces and LEM. Because of the use of such models, only four control locations are required to depict a curve. Although the EigenFaces approach was used for identification, mistakes were still seen for twin persons. Following further data processing, an eye detection approach was added to further normalize the segmented facial picture and performance would improve to the required levels.

4.1 Future directions

In the near future, we have a vision to combine local feature extraction methods such as Eye-Lip detection with neural network algorithms for further advancements in the development of Face Recognition Systems.

5 References

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