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FACE RECOGNITION THROUGH CASCADE CLASSIFIER USING EIGENFACES ALGORITHMS

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ABSTRACT

The easiest way to distinguish each person's identity is through the face. Face recognition is included as an inevitable pre-processing step for face recognition. Face recognition itself has to face difficulties and challenges because sometimes some form of issue is quite different from human face recognition. There are two stages used for the human face recognition process, i.e. face detection, where this process is very fast in humans. In the first phase, the person stored the face image in the database from a different angle. The person's face image storage with the help of Eigenvector value depended on components - face coordinates, face index, face angles, eyes, nose, lips, and mouth within certain distances and positions with each other.

There are two types of methods that are popular in currently developed face recognition patterns, the Cascade Classifier method and the Eigenface Algorithm. Facial image recognition The Eigenface method is based on the lack of dimensional space of the face, using principal component analysis for facial features. The main purpose of the use of cascade classifiers on facial recognition using the Eigenface Algorithm was made by finding the eigenvectors corresponding to the largest eigenvalues of the facial image

KEYWORDS: Face detection, Eigenface, Cascade Classifier , Face recognition, Matlab

1. INTRODUCTION

Face recognition is the errand of distinguishing a previously identified item as a known or obscure face. Frequently the issue of face recognition is mistaken for the issue of face detection Face Recognition then again is to choose if the "face" is somebody known, or obscure, utilizing, for this reason, a database of faces so as to approve this info face.

1.1. A GENERIC FACE RECOGNITION SYSTEM

The contribution of a face recognition framework is consistently an image or video stream. The yield is a recognizable proof or confirmation of the subject or subjects that show up in the image or video. A few methodologies [2] characterize a face recognition framework as a three stage process - see Figure 1. Starting here of view, the Face Detection and Feature Extraction stages could run at the same time.

Figure 1: A generic face recognition system.

Face detection is characterized as the way toward removing faces from scenes. In this way, the framework emphatically recognizes a certain image locale as a face. This strategy has numerous applications like face following, present estimation or pressure. The subsequent stage - include extraction-includes getting applicable facial highlights from the information. These highlights could be sure face districts, varieties, edges or measures, which can be human-important (for example eyes dividing) or not. This stage has different applications like facial component following or feeling recognition.

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1.2. FACE TRACKING

Many face recognition systems have a video sequence as the input. Those systems may require to be capable of not only detecting but tracking faces. Face tracking is essentially a motion estimation problem. Face tracking can be performed using many different methods, e.g., head tracking, feature tracking, image -based tracking, model-based tracking. These are different ways to classify these Algorithms [2]:

- Head tracking/Individual feature tracking:-The head can be tracked as a whole entity, or certain features tracked individually.
- 2D/3D:- Two dimensional systems track a face and output an image space where the face is located. Three dimensional systems, on the other hand, perform a 3D modelling of the face. This approach allows estimating pose or orientation variations.

The basic face tracking process seeks to locate a given image in a picture. Then, it has to compute the differences between frames to update the location of the face. There are many issues that must be faced: Partial occlusions, illumination changes, computational speed and facial deformations.

2. FACE CASCADE CLASSIFICATION

Once the features are extracted and selected, the next step is to classify the image . Appearance-based face recognition Algorithms use a wide variety of classification methods. Sometimes two or more classifiers are combined to achieve better results. On the other hand, most model-based Algorithms match the samples with the model or template. Then, a learning method is can be used to improve the Algorithm. One way or another, classifiers have a big impact in face recognition. Classification methods are used in many areas like data mining, finance, signal decoding, voice recognition, natural language processing or medicine. Therefore, there is many bibliography regarding this subject. Here classifiers will be addressed from a general pattern recognition point of view.

2.1. APPROACH FOR FACE RECOGNITION ALGORITHMS

Image s of faces, represented as high-dimensional pixel arrays, often belong to a manifold of lower dimension. In statistical approach, each image is represented in terms of d features. So, it's viewed as a point (vector) in a d-dimensional space. The dimensionality -number of coordinates needed to specify a data point- of this data is too high. Therefore, the goal is to choose and apply the right statistical tool for extraction and analysis of the underplaying manifold. These tools must define the embedded face space in the image space and extract the basis functions from the face space.

Many of these statistical tools are not used alone. They are modified or extended by researchers in order to get better results. Some of them are embedded into bigger systems, or they are just a part of a recognition Algorithm. Many of them can be found along classification methods like a DCT embedded in a Bayesian Network [8] or a Gabor Wavelet used with a Fuzzy Multilayer Perception [9].

2.2. EIGENFACES FACE RECOGNITIONS METHOD

A few grey scale face image I(x,y) consisting of a MxM array of strength values might also be consider as a vector of M^2. For example, a typical 150x150 image used in this theory will have to be changed into a 10000 eigen vector!

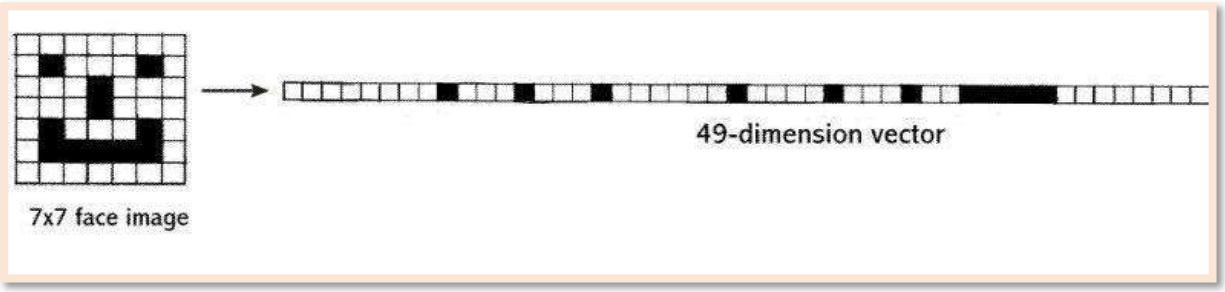

Figure 2: A 7x7 face image transformed into a 49 dimension eigenvector

This vector can likewise be viewed as a point in 10000 eigenvale space. In this way, all the image s of subjects' whose faces are to be perceived can be viewed as focuses in 10000 egien value dimension space. Face recognition

ISSN: 2277-9655
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utilizing these image s is bound to disappointment since all human face image s are very like each other so totally related vectors are near one another in the 10000-measurement space.

3. FACE RECOGNITIONS RESULT ANALYSIS

- Preparing dataset
- Loading the dataset

Preparing dataset

This is one of the most important phase. Faces are detected using a Cascade Classifier and image s are stored in a database and saved by the instructor to create a .pgm file and then to identify a face from a real-time image in the database Face recognition using the Eigenfaces Algorithm is accepted. Shown in the figure 3.

Loading the dataset

Step 1: open database folder
Step 2: run the load_database file
Show in the figure 4 on loading database image locations.

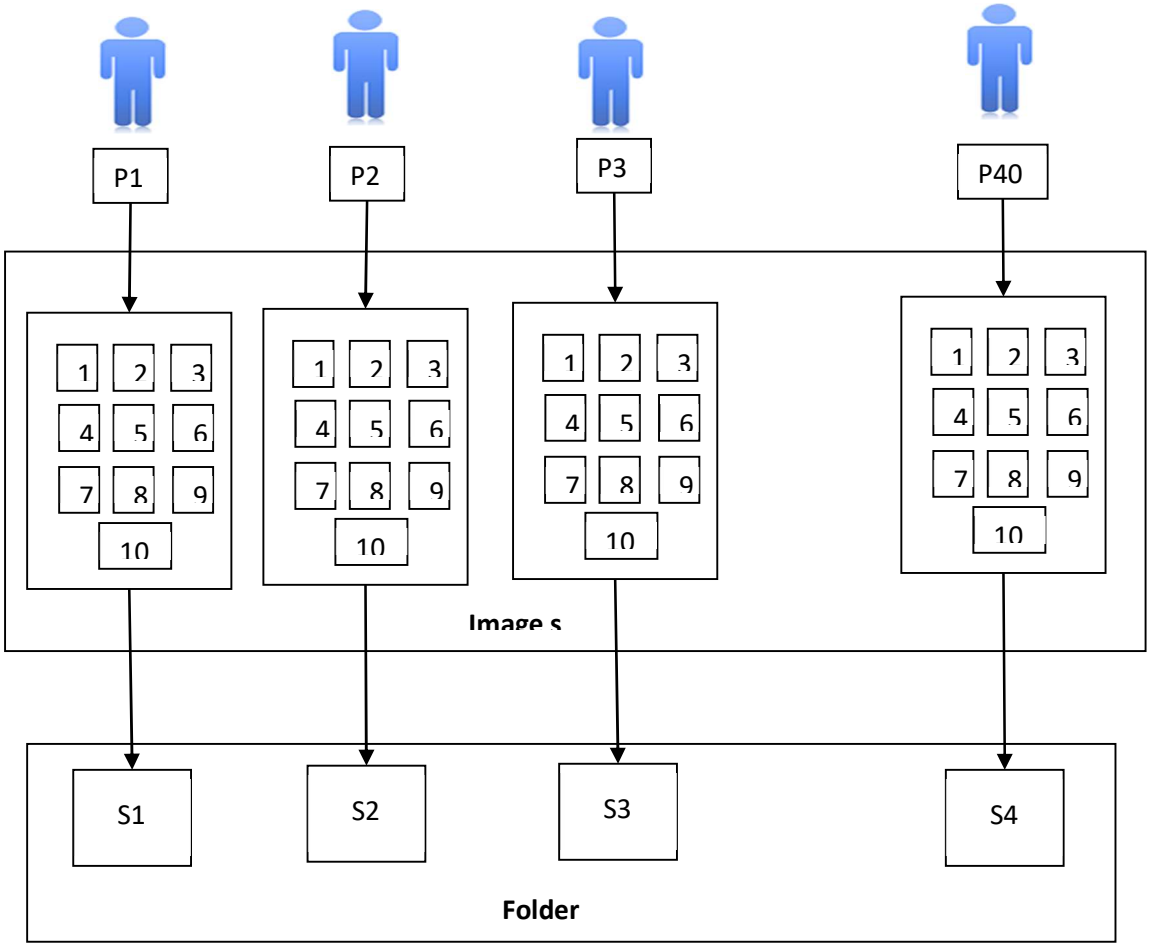
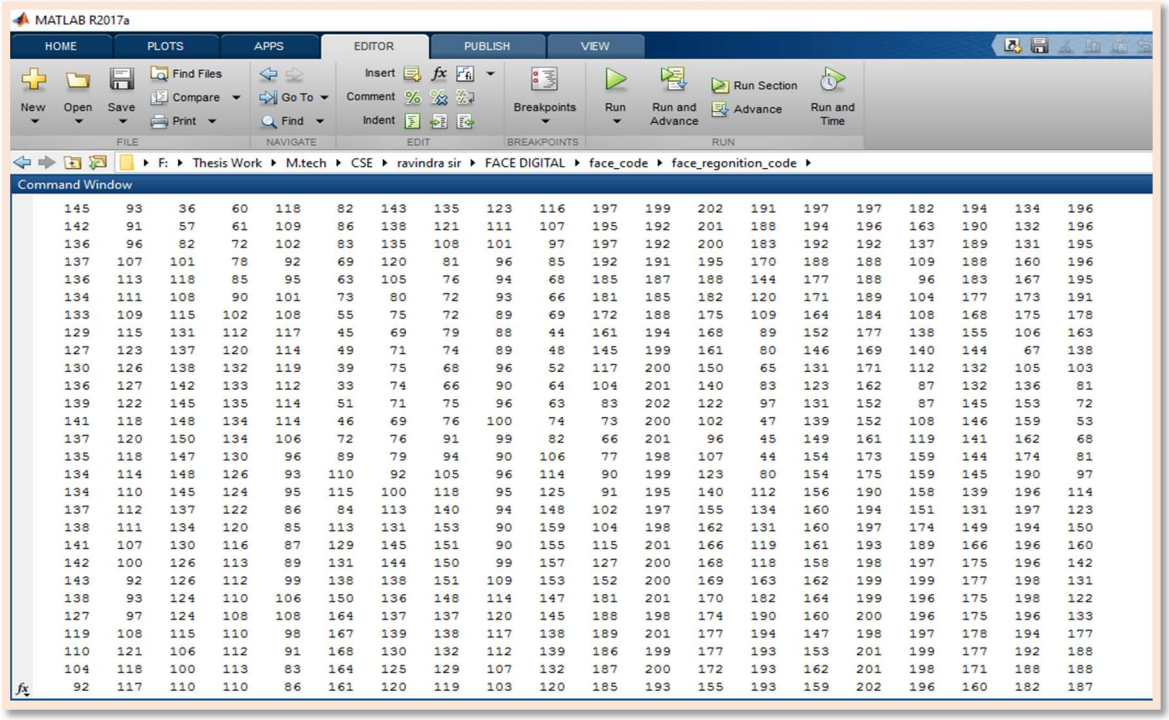


Figure 3: Preparing dataset Face recognition

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7



145	93	36	60	118	82	143	135	123	116	197	199	202	191	197	197	182	194	134	196
142	91	57	61	109	86	138	121	111	107	195	192	201	188	194	196	163	190	132	196
136	96	82	72	102	83	135	108	101	97	197	192	200	183	192	192	137	189	131	195
137	107	101	78	92	69	120	81	96	85	192	191	195	170	188	188	109	188	160	196
136	113	118	85	95	63	105	76	94	68	185	187	188	144	177	188	96	183	167	195
134	111	108	90	101	73	80	72	93	66	181	185	182	120	171	189	104	177	173	191
133	109	115	102	108	55	75	72	89	69	172	188	175	109	164	184	108	168	175	178
129	115	131	112	117	45	69	79	88	44	161	194	168	89	152	177	138	155	106	163
127	123	137	120	114	49	71	74	89	48	145	199	161	80	146	169	140	144	67	138
130	126	138	132	119	39	75	68	96	52	117	200	150	65	131	171	112	132	105	103
136	127	142	133	112	33	74	66	90	64	104	201	140	83	123	162	87	132	136	81
139	122	145	135	114	51	71	75	96	63	83	202	122	97	131	152	87	145	153	72
141	118	148	134	114	46	69	76	100	74	73	200	102	47	139	152	108	146	159	53
137	120	150	134	106	72	76	91	99	82	66	201	96	45	149	161	119	141	162	68
135	118	147	130	96	89	79	94	90	106	77	198	107	44	154	173	159	144	174	81
134	114	148	126	93	110	92	105	96	114	90	199	123	80	154	175	159	145	190	97
134	110	145	124	95	115	100	118	95	125	91	195	140	112	156	190	158	139	196	114
137	112	137	122	86	84	113	140	94	148	102	197	155	134	160	194	151	131	197	123
138	111	134	120	85	113	131	153	90	159	104	198	162	131	160	197	174	149	194	150
141	107	130	116	87	129	145	151	90	155	115	201	166	119	161	193	189	166	196	160
142	100	126	113	89	131	144	150	99	157	127	200	168	118	158	198	197	175	196	142
143	92	126	112	99	138	138	151	109	153	152	200	169	163	162	199	199	177	198	131
138	93	124	110	106	150	136	148	114	147	181	201	170	182	164	199	196	175	198	122
127	97	124	108	108	164	137	137	120	145	188	198	174	190	160	200	196	175	196	133
119	108	115	110	98	167	139	138	117	138	189	201	177	194	147	198	197	178	194	177
110	121	106	112	91	168	130	132	112	139	186	199	177	193	153	201	199	177	192	188
104	118	100	113	83	164	125	129	107	132	187	200	172	193	162	201	198	171	188	188
92	117	110	110	86	161	120	119	103	120	185	193	155	193	159	202	196	160	182	187

Figure 4: All image database coordinate

3.1. EXPERIMENTAL Result

The experiment was performed using Matlab Simulation @017a on Windows 10 operating system running on the Intel core processor. The first column in fig. 5.4 displays *"Identify This Face"* image s and the second column to accurately identify faces from a database with different angles, showing the face of the first column *" Face Recognition Success"* emerges by showing the image s in figure 5.

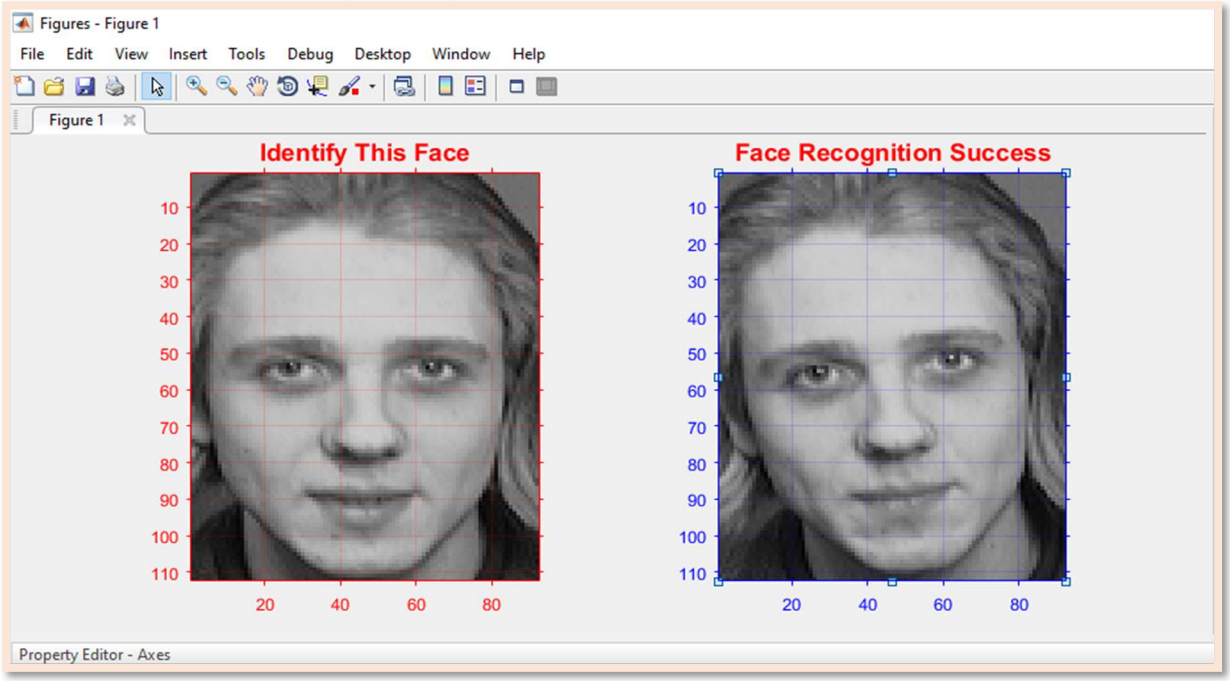


Figure 5: Matlab Simulation Face Recognition Successfully

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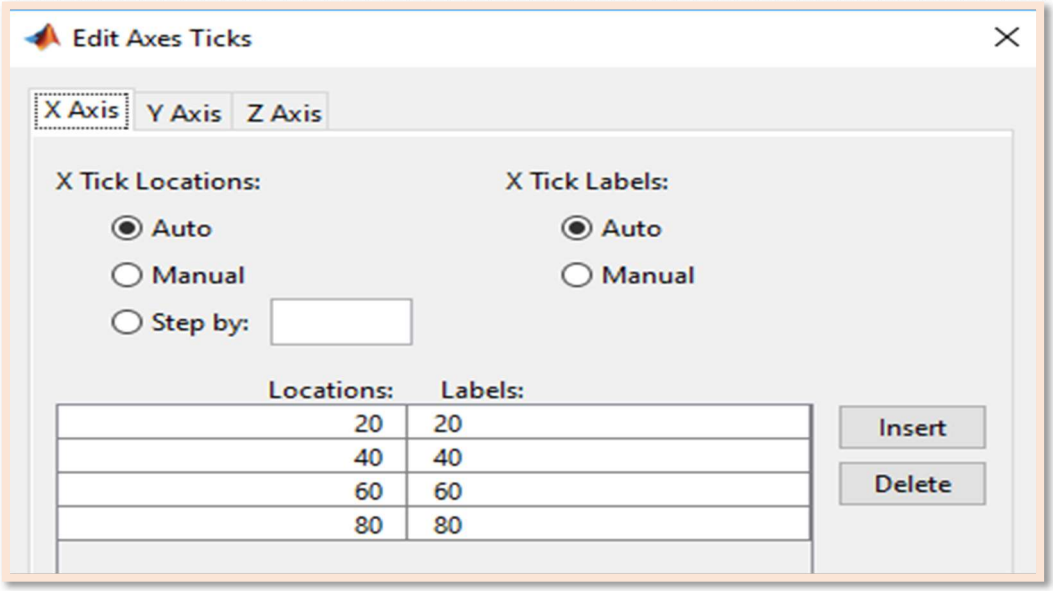

Figure 6: Matlab Simulation Face Recognition Successfully x-axis location coordinate

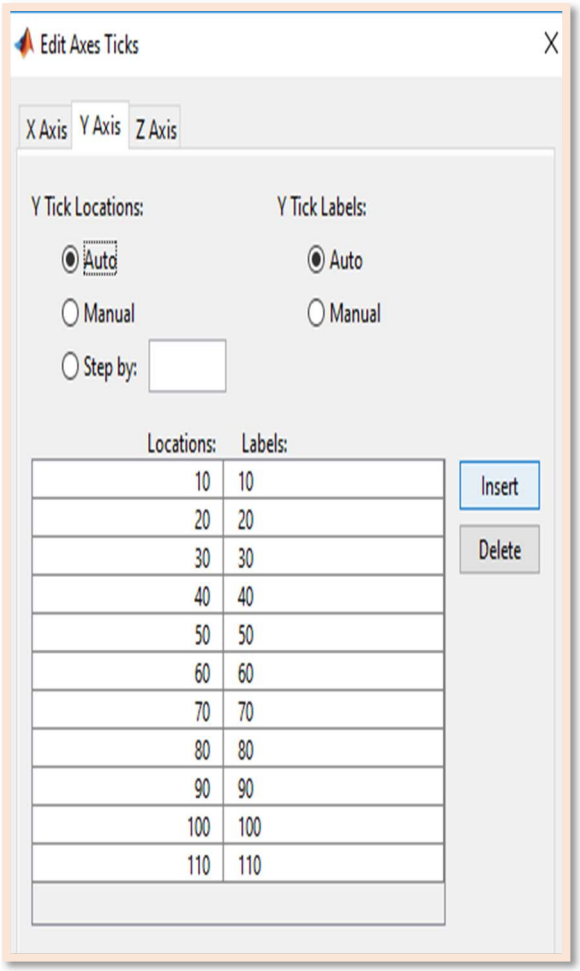

Figure 6: Matlab Simulation Face Recognition Successfully y-axis location coordinate

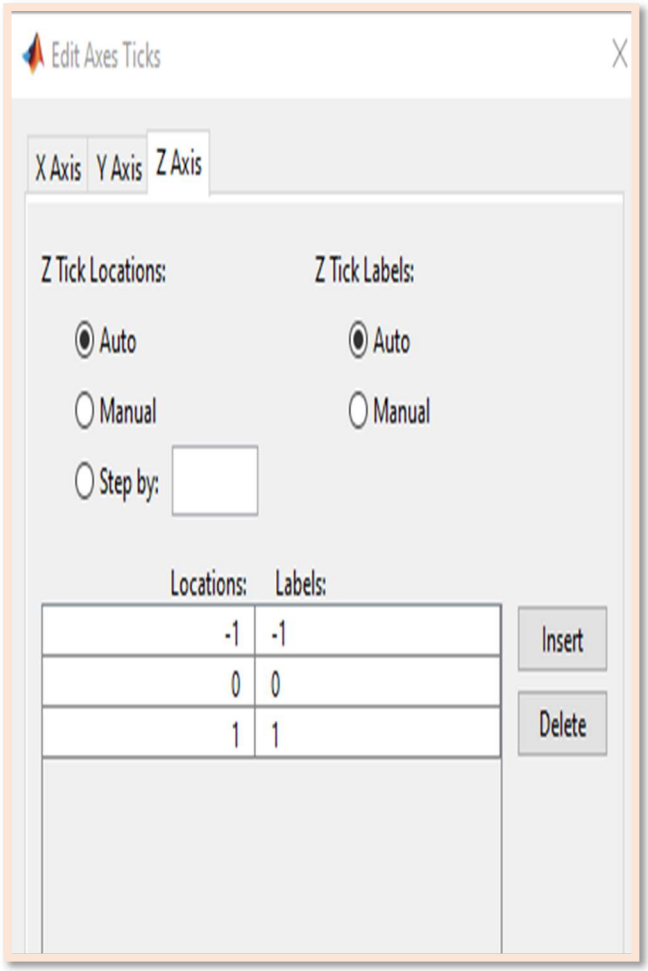

Figure 7: Matlab Simulation Face Recognition Successfully z-axis location

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

The correctness Identifying of the face based on eyes, face coordinate, and lips detection show that face recognition Algorithms display image performance parameter shown in the table 5. Self-time is the time spent in a function excluding the time spent in its child functions. Self-time also includes overhead resulting from the process of profiling.

Table 1:
Identify for Face Recognition Algorithm display timing parameters

Function Name	Calls	Total Time	Self Time*	Total Time Plot (dark band = self time)
Face Recognition	1	1.956 s	0.563 s	
Image s show	21	1.178 s	0.589 s	
Basic Image Display	21	0.249 s	0.173 s	
New plot	42	0.189 s	0.019 s	
Cla	42	0.148 s	0.010 s	
Image Display Parse Inputs	21	0.031 s	0.002 s	
Image Display Validate Params	21	0.024 s	0.009 s	
Graphics \ private \ claNotify	42	0.017 s	0.013 s	
Clear Notify	19	0.004 s	0.004 s	
Repmat	1	0.002 s	0.002 s	

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

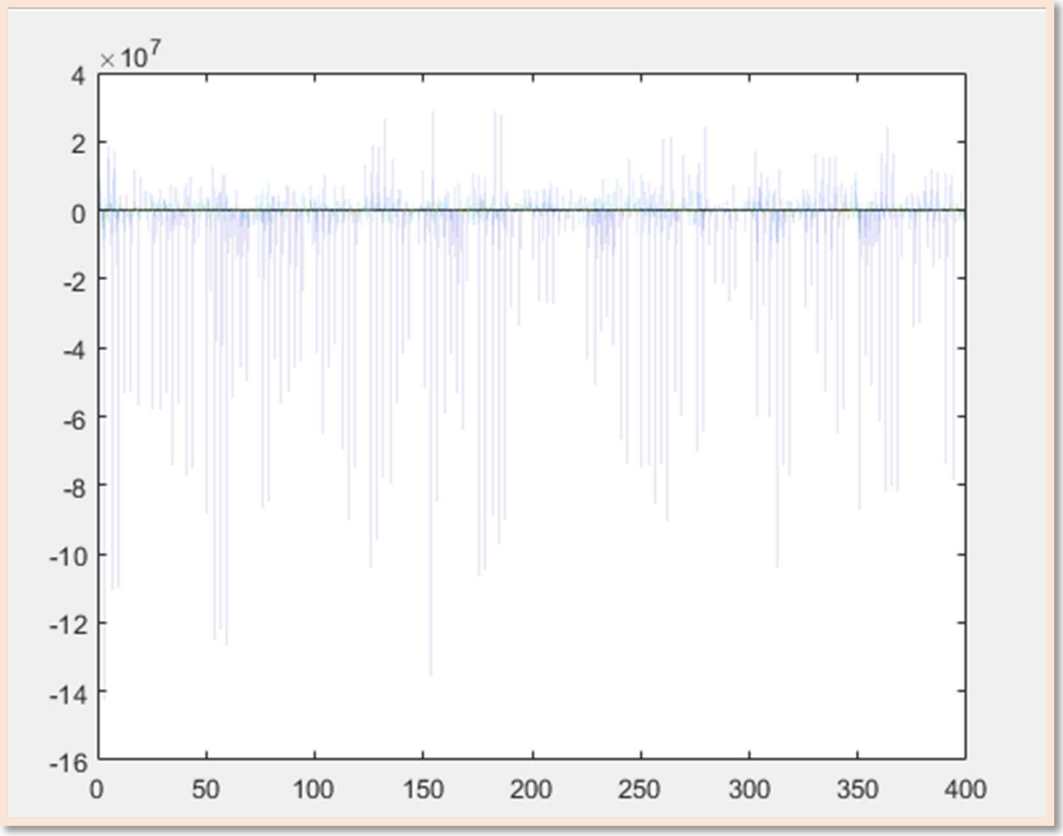

Figure 8: Face Recognition Algorithm profile display plot-timing graph

Face and hollow circles represent non-face. The face is concentrated in one area while the non-face is widely distributed. In the initials, only the horizontal and vertical lines can exclude the majority of the non-face, while later the face and the rest are distributed to the non-face, it is difficult to separate the two classified by the line. This requires the eigenvector to be linear after the Cascade Classifier transforms the samples into a linearly separable state. In Figure 9 and Figure 10, the missing and correctly classified face image s are shown, respectively. Figure 9 shows that the result of detection is relatively sensitive to Face angles, grin, and a larger molar. HOG is primarily an edge-direction feature, matching the grin, face angles, and large molar face occlusion, which can cause a strong edge effect, and HOG calculations can affect the results is. Figure 10 shown in while the eigenvector EV = 1 face is the perfect correct identity.

Figure 9: Part of missing faces in test dataset.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

Figure 10: Person face image s correctly recognition as faces in database.

3.2. COMPARISON WITH EXISTING ALGORITHM

The face recognition accuracy of the previous standard PCA and gaPCA Algorithms was 94.14% and 93.33%, respectively. For the proposed Cascade Classifier using Eigenface Algorithm, the face recognition accuracy accuracy is 95.66%. The proposed Algorithm would work on each of the sample image s (not the average value) and store databases that would compare the image coefficients of the new faces. When the dataset exceeds 4000, the proposed Cascade Classifier using the Eigenface Algorithm will be more accurate. Shown in table 2 and figure 11.

Table 2: face Recognition Accuracy measurement

Method	Recognition accuracy
Standard PCA	94.14%
gaPCA	93.33%
Eigenfaces	95.66%

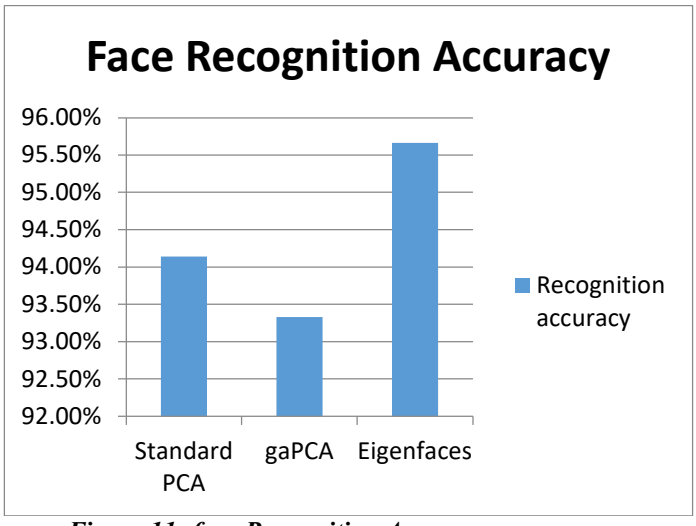

Figure 11: face Recognition Accuracy measurement

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

4. CONCLUSION

We considered a multi-stage cascade classifier detection technique, which gradually excluded non-faces. On the one hand, we adjust the parameters of the support vector machine to adapt to this change, according to different distributions between faces and non-faces at different stages; On the other hand, we use histograms of gradients oriented to construct different-granularity features, which observation the image to detect from thick to thin. For various pattern recognition problems, individuals set forward related features and classification techniques as indicated by the characteristics of the problem. A comparative analysis of face recognition using Standard PCA, gaPCA, and cascade classifier based on Eigenfaces algorithms have been discussed in this research. Firstly, face detection is carried out using a standard PCA, gaPCA, which produces an accuracy of around 94.14% & 93.33% from still images. Using cascade classifier based on Eigenfaces algorithm, an accuracy of 95.66% still images. Thus, it can be concluded that a cascade classifier based on Eigenfaces algorithm for face recognition produces better recognition accuracy than standard PCA, and gaPCA algorithm.

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