THE MODELING OF FACIAL RECOGNITION PROCESS

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Abstract- Biometrics is a practical way of studying and broadcasting that brings a host of supplying domains in an combination way to generate products that find different applications particularly in creating an individual's identity. Modelling biometric processes reveals a number of discussions in different fields, mainly in medicine and in the digital image processing field. These conversation range from the simulation levels of these models to those of application and concrete products that use biometric systems for identifying individuals. Indeed, over various biological parameters of an individual to be identifiable, there is the face that generates numerous information about the physical data of the individual. As per , particular studies, facial components merged according to different methods that ,can be used to design simulation models that come in support of generating closed-source and dedicated programs of biometric recognition (Das, 2018). This paper assign with a simulation model, through the mathematica 0.727035(Matlab) test-bench, of the facial recognition process. The model is generated at the proposal level for the subject field and gives the limits and guidance for improvements and further developments of this simulation method. The modelling methodology includes two parts; the first part is the mathematica 0.727035(Matlab) program that has been coded in such a way that it takes some images that represent the faces of different people advertised in the open source database on the Internet or Website; the second part is the formation of a database that retains these images to allow face identification when entering a new image program. The facial search and retrieval process are assemble through some built-in functions that the latest versions of mathematica 0.727035(Matlab) offer. Finally, the simulation model provides a new facial identification model that leaves room for further discussion and limits to the similarly small number of face images that can support the database in mathematica 0.727035(Matlab).

INTRODUCTION

Face recognition is a operation under which persons are subject to biometric verification and authentication for objective such as camera surveillance, biometric passports, biometric facial identification for research and development purposes, and so on (Buhrow, 2016). As one of the biometric identification methods, facial identification is more famous and has a lot of benifits over others where the main one comprise in relatively large distance identification comprise to other methods such as eye iris, sound, trace of fingers, etc (Bourlai, 2016). Among the 6 biometric identifying methods compare, facial identification has appeared greater suitability in a Machine-Readable Travel Documents (MTRD) system based on several evaluation influence such as: perception and suitability to the population, adaptability to electronic data processing equipment, etc. (Chityala et al, 2014).

The following figure shows the appropriateness of facial identification in comparison to other biometric methods (Datta et al, 2015). As a biometric system, a system of face recognition utilize in two methods: face verification and face identification. Face verification involves matching a one-to-one approach that compares an image to another image whose identity is known. An application of this procedure is the use of a biometric passport. Face identification includes one-to-many matching where a face image is differentiated to some face images that are collect on a database. Also, this method finds useful when it is important to identify a face image that is closer to the face image being tested (Newman, 2009). Further face recognition development has brought a lot of development of image processing software in the perception of the parameters of these information processing machines, such as development of memory suitable for storing images with higher levels than just textual information. In addition, requests and advances in this regard are also represented in database developments, their management as well as storage of visual and multimedia data; it is natural that in this case the budg-

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ets and the financial capacities for these purposes are imposed.

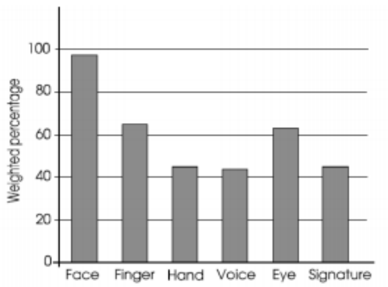


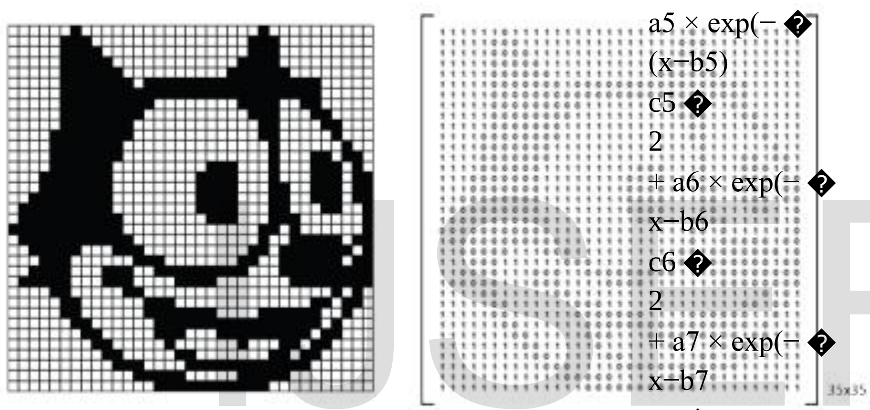
Figure 1:<u>Level of suitability to an MTRD system of 6 biometric Identification attributes.</u>

The use of face recognition comprise a series of defined algorithms which, through the development and simulation by particular programs, move on these identification processes The conclusion developed in face recognition processes: are Eigen face, Gabor jets, Fisher face, etc. In this paper we consider and complicated the Eigen face method in terms of its improvement in the simulation software environment and the providing of further proposals for the performance of this method. Finally, automatic face identification dealing with multiple challenges with various technical aspects such as when we have an environmental impact on an image such as damage to the figures that will be identified, photographing under unacceptable effects of light, making pixel elements prevent to perform with images, etc.

ii. METHOD :-

The face images, presented as multidimensional matrices, are subject to image processing through algorithms that have shown high interest in the computer vision in general. Surveys on this subject include algebraic and statistical methods for extracting and further elaboration these images. In concrete applications, rather than simulation environments, the facial identification consists on some processes that are taken into consideration. In principle, as input of the system, the facial image is subjected to observation by a sensor that records the values of facial image pixels; image pixels can be monochromatic or colored and for each image type, specific attributes are required for image identification and recording as inputs in the system. Facial image is considered as a two-dimensional matrix that, after switching to the scanning of the sensor, requires normalization in fixed dimensions of the mxn size of matrix and this is predetermined for each facial image that may have different dimensions, depending on the distance when the face image was taken from the sensor.

Face image and image processing generally, specifies and analyzes each pixel of the image in question and the dimensions of the photographs that are subject to normalization and greatly affect the processing capabilities of the electronic computers; the aim of the computing machine is to normalize the image in fixed dimensions mxn. As a result, processing methods face this challenge because in high values of dimensions, several disadvantages arise where the foremost commonly required costly calculation capabilities just in case of these high-dimensional images. The most common face image processing model is that the Principal Component Analysis (PCA) dimensioning technique; the primary component of this approach is that the linear combination of the initial image dimensional dimensions. The most familiar case in simulation and application development benefit is multiple analysis assuming that the extraction processing and therefore the principal manifold are linear. Once facial image is assign and extracted from the facial image database, it behaves as a linear subspace from the image subspace. In the case of our simulation model, we've considered one amongst the foremost common methods of linear analysis that's the Eigenface technique which is subject to probabilistic models. The Eigenface method was proposed for the primary time by Turk/Pentland. within the case of our study, an improved version wastaken under consideration by highlighting the benefits it includes and therefore the limits it pursues under this modified model. The simulation environment is Matlab R2017, which has already built-in functions that support image processing applications and, consequently, the biometric case. The simulation takes into consideration a database of 400 face images that are included within the program; this database is valid for performing the identification of face images that may be inserted for matching. The developed code adapts the Eigenface method with a treatment apart from classic approach within the sense of the scale of the database in terms of the quantity of facial images supported. Also, the other improvement that's applied to the classical Eigen face method compare of the time of execution of face recognition. The simulation model consists of two parts: the creation of the database execution code and therefore the main code used to read this database required for the popularity process (Jain et al, 2011). The face recognition simulation considers 400 different persons within the modeling process. The modification consists on intervening the 2 cycles needed to complete the creation of the database and introducing a subset for every cycle resulting in the minimization of the time of reading the database within the main code of the face recognition and further increasing the quantity of supported of face images within the database. Also, for every execution of 400 face images, the time of execution was measured as within the case of the Eigenface class method and therefore the improved version of this method. Finally, the graphical presentation of each case is enabled thus showing the comparison between the 2 Eigenface methods regarding the time execution.



iii . RESULTS:-

In the simulation discussed during this paper, the methodology is reflected very well within the results section where the findings and determining elements discussed within the above sections are provided. Specifically, in our simulation we've used 400 face images which are placed as input on the improved model of Matlab simulation; against the quality simulation model in question, the performance of every simulation model is set in period of the time needed for executing the face image recognition process for the database the least bit. In function of this approach, we've found the execution time for every image's recognition of 400 images per standard and improved algorithm. Moreover, through Matlab simulations we've defined the trendline for every simulation model; this trend-line is of the "General Model Gauss8" form of the eighth order.

The approximation equation by the "General Model Gauss8" method is theoretically the following:

$$f(x) = a1 \times \exp\left(-\left(\frac{x-b1}{c1}\right)^2\right) + a2 \times \exp\left(-\left(\frac{x-b2}{c2}\right)^2\right) + a3 \times \exp\left(-\left(\frac{x-b3}{c3}\right)^2\right) + a4 \times \exp\left(-\left(\frac{x-b4}{c4}\right)^2\right) + a5 \times \exp\left(-\left(\frac{(x-b5)}{c5}\right)^2\right) + a6 \times \exp\left(-\left(\frac{x-b6}{c6}\right)^2\right) + a7 \times \exp\left(-\left(\frac{x-b7}{c7}\right)^2\right) + a8 \times \exp\left(-\left(\frac{x-b8}{c8}\right)^2\right)$$

where, the coefficients a1, b1, etc. contains the approximation line determinants per the

"General Model Gauss8" method. The values of the above stable are introduce below for both the simulation model and therefore the upgrade simulation.

Coefficients (with 95% confidence bounds)	The values Standard Algorithm	The values Improved Algorithm
a1	2.229 (-114.7, 119.1)	1.491 (-24.18, 27.16)
b1	320.4 (200.2, 440.5)	339.3 (281, 397.5)
c1	320.4 (200.2, 440.5)	38.3 (-127.3, 203.9)
a2	320.4 (200.2, 440.5)	[illegible]
b2	107.4 (-1490, 1705)	[illegible]
c2	128.4 (-3073, 3330)	25.69 (-80.65, 132)
a3	2.336 (-40.91, 45.59)	0.2948 (-3.196, 3.786)
b3	218.1 (134.5, 301.8)	79.68 (40.61, 118.8)
c3	27.72 (-110.5, 165.9)	[illegible]
a4	2.136 (-38.29, 42.56)	[illegible]
b4	-5.647 (-146, 134.7)	200 (126.7, 273.3)
c4	51.78 (-287.9, 391.4)1.086 (-1.765, 3.937)	37.51 (-237.7, 312.8)
a5	1.086 (-1.765, 3.937)	2.746 (2.54, 2.952)
b5	172 (165, 178.9)	[illegible]
c5	13.04 (-5.923, 32)	105.3 (-34.39, 245)
a6	1.192 (-42.31, 44.69)	1.591 (-6.449, 9.632)
b6	367.4 (316.5, 418.2)	129.1 (-35.42, 293.6)
c6	21.2 (-159, 201.4)	[illegible]
a7	1.498e+12 (-4.008e+17, 4.008e+17)	[illegible]
b7	4823 (-4.472e+07, 4.473e+07)	[illegible]
c7	858.8 (-4.351e+06, 4.353e+06)	[illegible]
a8	2.552 (-103.3, 108.4)	[illegible]
b8	273.9 (206.3, 341.4)	[illegible]
c8	30.49 (-197.2, 258.2)	[illegible]

Below we have presented the applicablet trend charts for each model, the standard and the upgrade one

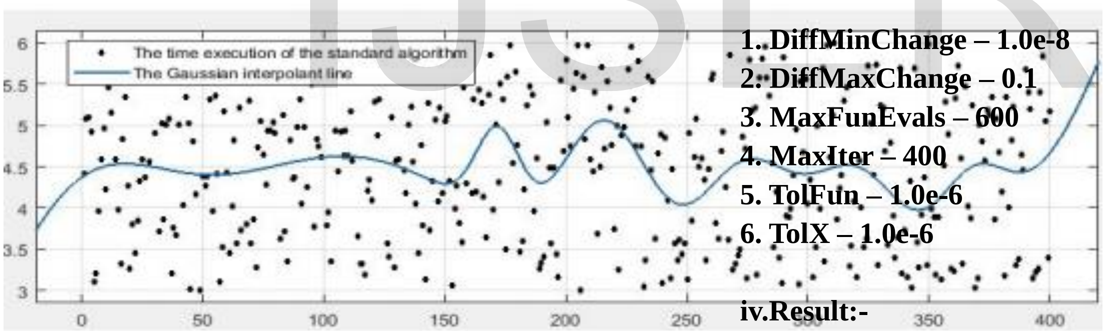


Figure 3: A graph showing the relying of the execution time for the recognition of each face image for the standard model

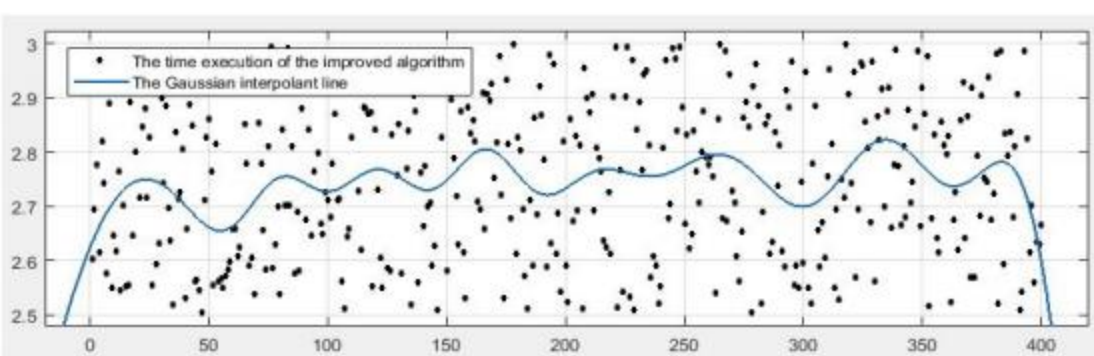


Fig. A graph showing the relying of the execution time for the recognition of every face image for the improved

pattern.

We can confirm, from the graphs presented above, the time execution needed to perform the popularity process for the improved model of the simulation, is lower compared to the classical model. In the corresponding graph of the improved simulation model the largest value of the time execution needed to perform the popularity doesn't exceed 2.9 sec whereas within the standard model graph the lowest execution time is above 3.5 sec. Also, presented below are the supporting data of the trend-line performance and therefore the execution time of which 400 imaging images of the simulation model.

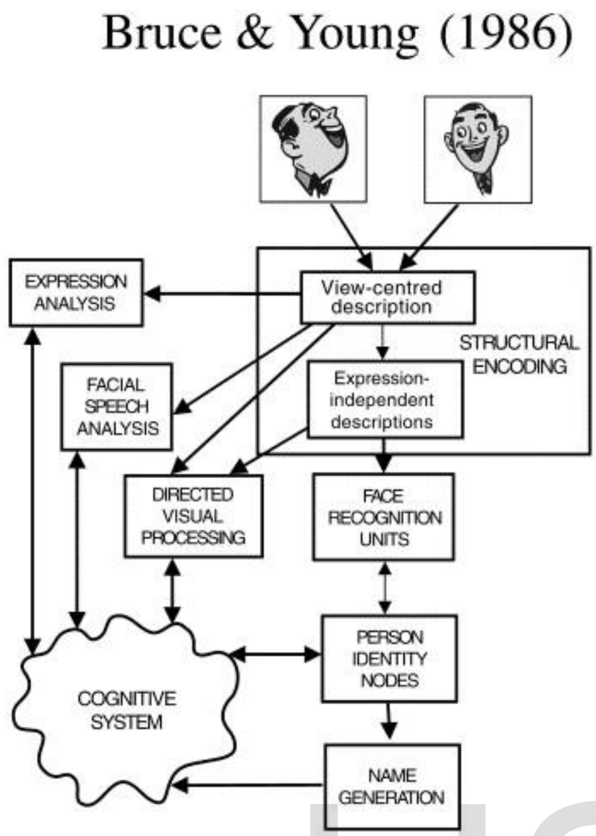
- A table showing the performance data of two models:

	SSE_Standard Algorithm	R-squared_Standard Algorithm	Adjusted R-square_Standard Algorithm	RMSE_Standard Algorithm
Standard Algorithm	268.8	0.06352	0.006235	0.8456
Improved Algorithm	7.484	0.06752	0.01048	0.1411

Both simulation models support the "NonLinear-LeastSquares" method and are not robust. The algorithm used to program the approximation method "Gauss8" is "Trust-Region". Further details are as follows:

1. DiffMinChange – 1.0e-8
2. DiffMaxChange – 0.1
3. MaxFunEvals – 600
4. MaxIter – 400
5. TolFun – 1.0e-6
6. TolX – 1.0e-6

iv.Result:-
for example:



v. CONCLUSIONS AND DISCUSSIONS:-

In this paper we discussed about the sector of biometric face recognition regarding performance of the Eigenface algorithm (Gonzalez et al, 2018). The importance of the Eigenface model, as an algorithm for biometric facial identification processes, plays a crucial role and provides space for continuous reconfigurations and modifications that improve the performance of the models in question in several terms where one among them is that the time of facial identification execution versus a particular database. In our model we've implemented a simulation model through Matlab software (R2017a), which realizes the face recognition process including an open source database of 400 facial images (Solomon et al, 2011). The purpose of this paper was to present a simulation model that deals inside it with a modified version of the Eigenface algorithm; the modeling was intended to provide the results of this improvement of the Eigenfaces algorithm in terms of the execution time of identifying a facial image. The modification, applied within the Eigenface algorithm, was the intervening within the respective cycles by introducing a subset into the algorithm. Also, the modification of this modeling was the intervention standard code that creates it possible to read the database that's further applied within the basic model algorithm (Nixon et al, 2013). Also, to reflect the ends up in time, we simulated through Matlab a "Gauss8 approximation" algorithm model that generates a threefold reflection performance of the quality Eigenface algorithm versus the improved algorithm (Bolle et al, 2004). together with the graphical data of Gauss8 approximation, specific and supporting parameters are given, where they're considered as computable coefficients (Petrou et al, 2015). Because of the Gauss8 method simulations, it's concluded that the execution time of the facial image identification process for the quality Eigenface algorithm has extremes that show greater time values compared to the improved pattern (Vacca, 2007). Disputes and discussions that arise from this study leave spaces for improvements within the terms of your time needed to perform facial identification process performances furthermore because the size of the database needed to stay the face images; in relevancy the database arises the challenge of designing models that go hand in hand with the development of the model's quality in relevancy the execution

vi. REFERENCES:-

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