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New Large System for Face Recognition (NLS)

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Abstract

Face Recognition according to (NLS), result from two previous system put them to gather to become (NLS), this system is very useful and depends on (Essam.H system and Novel System), (NLS) applied on two types of databases (ORL) and (FEI) and its give a good result for Face Recognition ratio, when applied on ORL its give 100%, (FEI) consist of 2800 images, put each 700 images to become sub_database_FEI, first_sub_database will give 98%, second_sub_database will give 100%, and finally (third_sub_database+ 14 poses for me) will give 98.039216%.

Keywords: _ Standard_detection, Features_Extraction, Features_Selection, NLS, Face_Classification, and Face_recognition.

INTRODUCTION

Face Recognition plays an important role in life because it is an important element in identifying people and knowing people .And the system works the same principle of human discrimination in people .A person with a naked eye automatically recognizes a person. [1] Face recognition is critical thing in our live so we should fabricate a framework its capacity as like the capacity of human, to do that we presented wise framework its errand perceive individuals without impact from human in do fundamentally assignment , yet human impact in assemble a framework. [2] Confront acknowledgment has dependably been an exceptionally difficult assignment for explores. From one perspective, its applications might be extremely helpful for individual confirmation and acknowledgment. [3] Confront acknowledgment is a standout amongst the most well-known biometric frameworks in operation fundamentally as a result of its non-meddling and high level of security. Programmed confront acknowledgment has across the board applications in biometric security, observation and criminal identification. [4]

RELATED WORK

There are two systems as previous work that used for face recognition that I build them to do face recognition.

Essam.H system for Face Recognition:

New system for face recognition .The name of (E.H system) according to (essam haider) consist of Singular Value Decomposition and Gray Level Co_Ocuuerence Matrix and 12 Features are taken and modified legendre and modified SSIM modified correlation and new equation for face classification and new equation apply when we use only ne loop for read database(this is new way for read (previously they are used two loop)),So the E.H system are(SVD_GLCM_twelve features_ essam classification _H equation _modified SSIM_modified correlation).

Novel System for Face Recognition Based on SVD and GLCM

This system depends on four parts, each part to do purpose and then collect to gather to become whole system.

Initial Segment

Before apply anything I produced equation to decide if person inside this called Multiple_standerdevation

$$\text{Multiple}_{\text{standerdevation}} = \text{standerdevation of database} - \text{standerdevation of input image} \quad (1)$$

Second Part

Call for GLCM with angle 45º, the reason behind that is to allow us to differences between person's poses from each other.

Third part

Using new distance as Essam Distance for internal classification, this equation is very useful to do classification

$$Essam(a,b) = \left(\frac{a-b}{M}\right)^2 \quad (2)$$

Fourth part

Modified SSIM, depends on original SSIM to modify SSIM, depends on threshold, the value of threshold is (0.3643), is SSIM is greater than or equal to this become 1 O.W become the same.

PRE_PROCESSING

In this section show all things to do it before apply any methods

Convert to double

Mat lab deals with double so must convert to double.

Re_Size

In ORL size image of 112X92, become 92X92. In FEI the size 640X480 become 480X480.

Face_detection

The standard detection is to set a square to detect the face for each database. Since the system will be implemented on databases with conditions, this is because the standard definition is not a problem because each base has its own box, each detection for face depends on (cropping according to square and this square contain four lines), so build method depends on standard detection (cropping).In ORL because the image incomplete image, so does no need to face detection, using new method for face detection called (Standard_detection), the algorithm and steps for standard detection is below:_

Standard detection scheme

This detection depends on four points for (Brazilian) database this four points produce square face to crop it , this four points apply after convert image into binary and then find similarity of square in binary with original image to crop face part as:

A- Point one contain two parts first part is (150,150). For this part find summation as value (300). And second part is (100,400).

B- Point two contains two parts first part is (500,500). For this part find summation as value (1000). And second part is (100,400).

C- Point three contains two parts first part is (150,500). For this part find summation as value (650). And second part is (100,100).

D- Point four contains two parts first part is (150,500). For this part find summation as value (670). And second part is (400,400).

Plot of Four lines

Depends on points in Standard detection scheme show the all line produced square in figures (figure (1), figure (2), figure (3), figure (4) and figure (5)).

Face Area Detection

Use crop for square from (Plot of Four Lines), any cropping need to X and Y point and width and height so this following equation to find them

$$X = \mathrm{a} + \mathrm{b} + \mathrm{c} + \mathrm{d} - (2450) \quad (3)$$

$$Y = \mathrm{b} + \mathrm{c} + \mathrm{d} - (2200) \quad (4)$$

$$W = \mathrm{c} + \mathrm{d} - (950) \quad (5)$$

$$H = \mathrm{d} - (350) \quad (6)$$

Where (a) is summation of part one of point one, b is summation of part one of point two, c is summation of part one of point three and d is summation of part one of point four.

$$crop = [\, x\ y\ w\ h] \quad (7)$$

Note, at first steps for our system we used viola jones for face detection, but in some case it loses the center of image, so we used the previous method for face detection

Algorithm of Standard Detection

If apply face detection as Standard detection for database load images of database persons and if for test image load only image to be test it.

Step1: - input the Brazilian database image.

Step2: - Assume Four Points as square for detect only the area of face.

Step3: - Each point contain Two parts , one for start line and second part for end of line, so plot all point as line.

Step4:- face area detection; detect the area by using four parameters X, Y start point, W width and H height.

Step5: - From previous step the result will be plot square, this leads to be the area of face, so cut just this square. As crop(X, Y, W and H).

Step6: - The square if Face. And the output only face image.

End of Algorithm

DATABASE NAMES

Folder of databases images must contain all images need to training with all images names should be sorted in alphabetic, this mean that the for loop call images depends on names, to avoid interference must sort, to call images of first person and then of person two and so on. In ORL (AT@A) database

contain 400 images , so all images must be one after one (names) , so need to 400 alphabetic symbol to do that. In (Table (1)) show how the person names for ORL database and FEI database that consist of 700 images.

Table 1: New Database Names (ORL and FEI)

Database name	Order of character
FEI	a, b, d, …, z: - 25 persons za, zb, zc, …, zx: - 25 persons a, … zx: - 50persons as total
ORL	aaa, bbb, …, z: - 26 persons zzza,zzzb, …, zzzn: - 14 persons aaa, … , zzzn: - 40 persons as total

FEATURES EXTRACTION

Features extraction call it's the same features in previous system (Essam.H system and Novel system) Using (SVD, GLCM, Modified_Legendre).

FEATURES SELECTION

Select only 12 features from 14 features for GLCM method.

NLS

NLS mean New Large System for face recognition is combines of two previous two systems to become NLS for Face Recognition; NLS call all the sections (Related work, Pre_processing (Standard detection), features_extraction and features selection, Multiple_standerdevation, Essam Distance). The final part for NLS is Dis_Similarity below its equation

$$\mathrm{Dis}_{\mathrm{Similarity}} = \sum\sum(image1 - image2) \qquad (8)$$

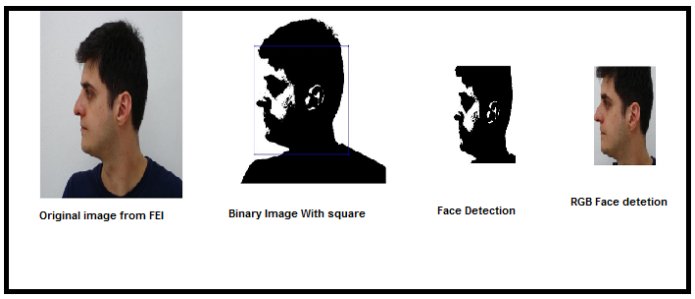

Figure 1: Face Detection according to standard detection

Algorithm of NLS

The NLS for Face Recognition depends on many steps and for FEI call Standard detection and the steps below

First Part for training

Step1:- Call the folder of database image if ORL (400 images), if FEI (700) images for each sub database.
Step2:- Start Loop from 1 to end of each folder.
Step3:- Pre_processing.
Step4:- Apply Features_Extraction for previous step.
Step5:- Apply Features_Selection for previous step.
Step6:- If database is ORL go to step8, else if database is FEI go to step7.
Step7:- Apply Standard detection for face detection.
Step8:- Find Mean for 12 features.
Step9:- Save two matrices the first one for Mean features and the second for Modifies Legendre, if database ORL, the two Matrices become of (40*10), if database FEI, the two matrices will be (50*14).

Second Part for testing

Step1:- Read the test image.
Step2:- Pre_processing.
Step3:- Apply Features_Extraction for previous step.
Step4:- Apply Features_Selection for previous step.
Step5:- If database is ORL go to step7, else if database is FEI go to step6.
Step6:- Apply Standard detection for face detection.
Step7:- Find Mean for 12 features.
Step8:- Save two values V1 (Legendre for input image as single value) and V2 (mean values as single).
Step9:- Apply Essam Distance between (V1 and the Matrxi1 of training), and Essam Distance between (V2 and matrix2 of training).
Step10:- Find means Distance for (step9) to become only on matrix for distance.
Step11:- Find minimum value for each row in (step10) to become only one column, size of column for ORL (40*1), and for FEI (50*1).
Step12:- If image (test image) is training take only 10 minimum persons from (step11) and then apply modified_SSIM else if image (test image) is not training take 40 minimum persons from (step11) and then apply modified_SSIM.
Step13:- Find the person with Large similarity is the recognize person.
Step14:- Find Performance for test image, if the recognize image is the correct person so the performance is 0 else 1.
Step15:- If Performance is 0 so go to (step18), else if Performance is 1 go to (step16)

Step16:- Apply Dis_Similarity between test image and 40 minimum persons from (step11).

Step17:- Find person with low similarity is recognizing person.

Stp18:-End

End of Algorithm

NLS analysis

To analyze the NLS must compare it with previous two systems that I build them and another system. There are low error rate for NLS when compare it with another systems. Table (2) show that.

Table 2

System	**Face detection**	**Distance classifier**	**Databases that used**	**Recognition rate**		
Face Detection and Recognition Using Viola-Jones with PCA-LDA and Square Euclidean Distance	Viola Jones	Square Euclidean distance	MUCT Database,	Training	Testing	Recognition
				7	1	60.71 %
				6	2	66.67 %
				5	3	82.5 %
				4	4	84.38 %
				3	5	85 %
			Face94 Database	2	6	87.5 %
				1	7	87.5 %
				Training	Testing	Recognition
				3	1	91.67 %
				2	2	100%
				1	3	100%
Proposed system as new system for face recognition SVD,GLCM, Modified Legendre ,Essam Distance and Modified SSIM as new system with MODIFIED SSIM	Standard detection	Essam distance	ORL	Training	Testing	Recognition
				5 10	5, 10 (in database)	100%
				9	1 (out database)	82.5%
				6	4 (out database)	73.125%
				5	5 (out database)	70% hard case
				1	5 (out from database)	74% very hard case
			FEI	Training	Testing	Recognition
				13	1 (out database)	96%
				10	4 (out database)	71.5%
Proposed System (NEW SYSTEM with MODIFIED SSIM) under Gaussian Noise	ORL database			92.5%		
	FEI database			88%		
New system with DISSIMILARITY	ORL database			100%		
	FEI database			90%		
Large System System _MSSIM and Dis_Similarity	First 50 persons FEI			98%		
	Second 50 persons FEI			100%		
	Third as 50 persons FEI +1 additional person (me)			98.039216%		

CRITERIA FOR EVALUATION FACE RECOGNITION

In this section show the modified performance criteria, and proposed criteria. Show as below

Modified Criteria

These criteria are ready to use by anyone to evaluate his or her method or system: -

$$Perforance = \frac{false\ image}{total\ \ images} \quad (9)$$

$$Mean\ absolute\ error(MAE) = \frac{No.of\ test\ image\ true}{actual\ no.of\ images} \quad (10)$$

$$Mean\ squar\ error(MSE) = (MAE)^2 \quad (11)$$

$$Root\ Mean\ square\ error = \sqrt{MSE} \quad (12)$$

$$Relative\ error = MAE * (100\%) \quad (13)$$

Mean Percentage error

$$= \left(\frac{100\%}{total\ no.of\ images}\right).* MAE \quad (14)$$

$$Peak\ signal\ to\ noise\ ratio\ (PSNR) = 20Log10\left(\frac{225^2}{MAE}\right) \quad (15)$$

$$Run\ time\ of\ total\ algoritm\ , measure\ in\ second \quad (16)$$

Proposed Criteria

In this section show proposed criteria by me for evaluate my system not in curve but in another way: -

Run time of each step of algorithm such as

In this equation can find each step time by divided the whole time on number of steps and result time (for each step) and then divided this time on total time : -

$$\text{Algotithm\_steps\_performance} = \frac{run\ time\ of\ each\ step}{run\ time\ of\ total\ algorithm} \quad (17)$$

Performance algorithm depends on no of steps: -

If number of step high good algorithm ,but should take care of time, leads to be high number of steps with less time such as: -

$$\text{Performance algorithm} = No.Of\ (algorithm\ steps) \quad (18)$$

Where (Steps) of algorithm refer to instance.

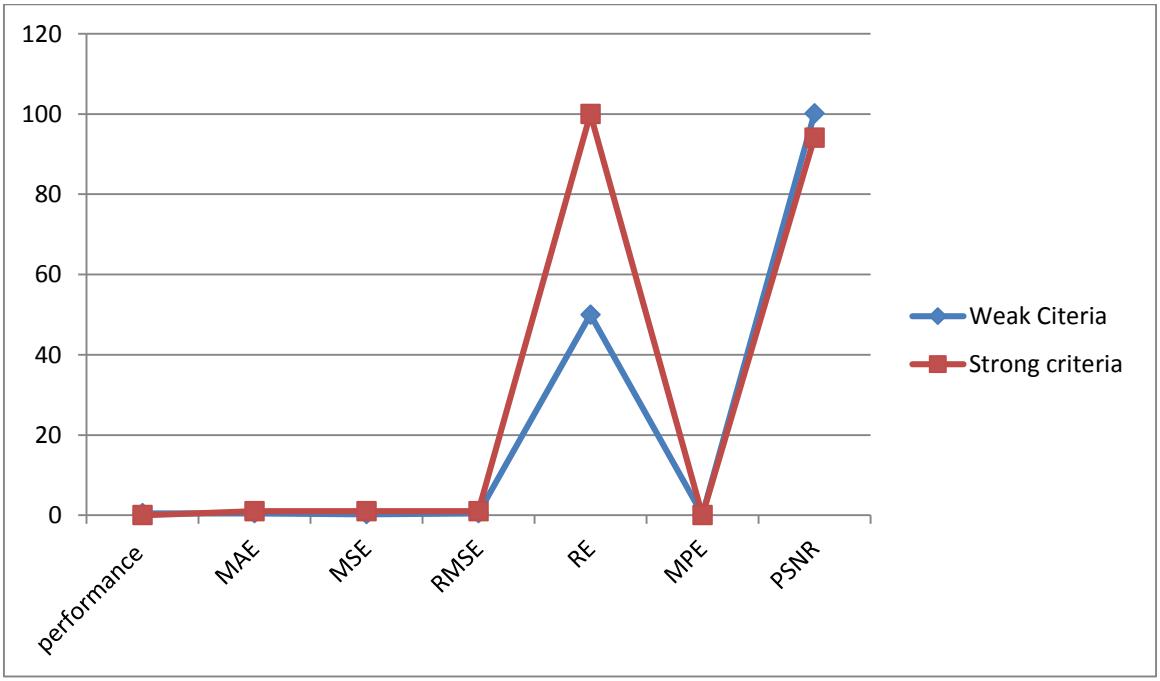

Figure 2: Curve for Weak and Strong Criteria

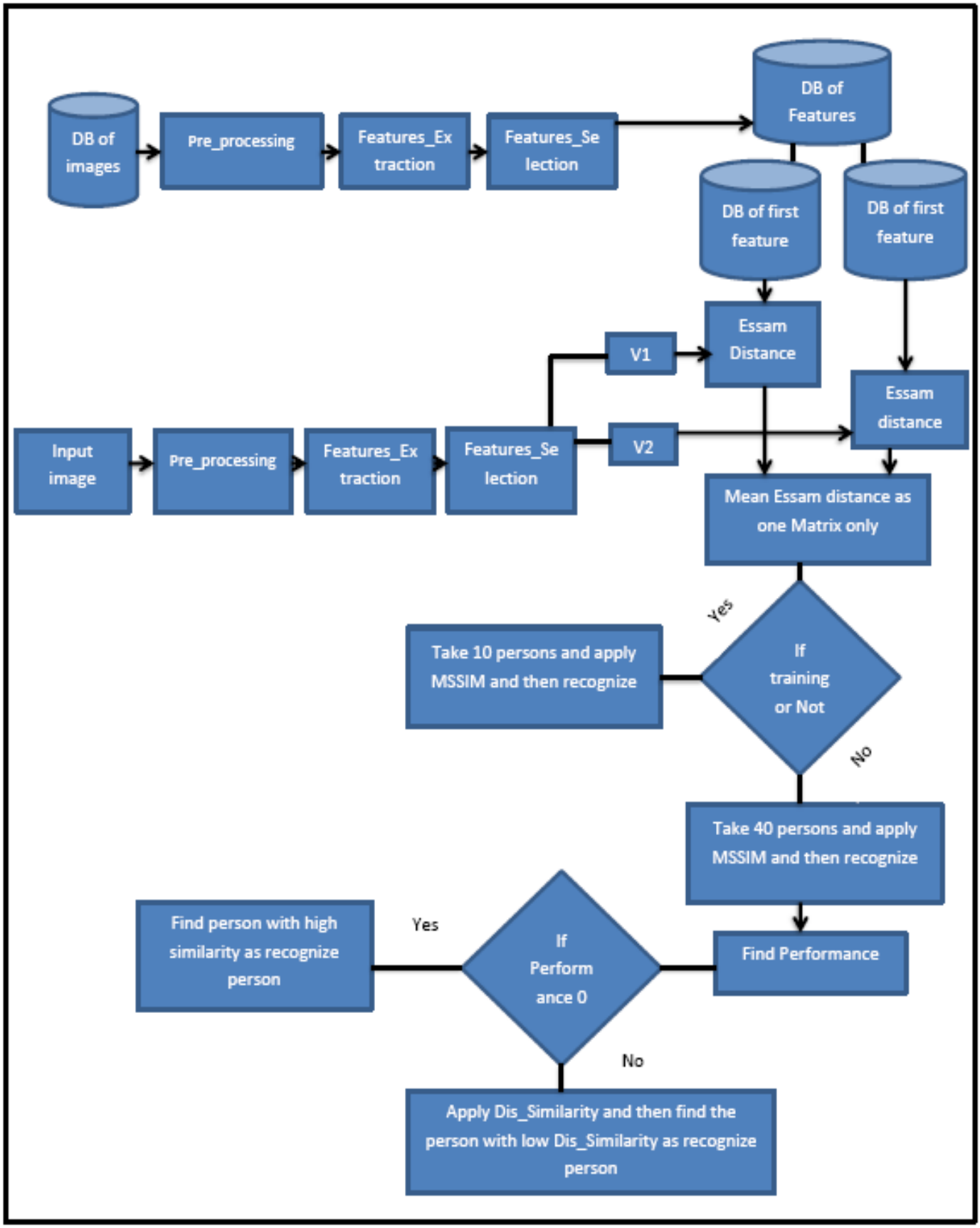

Figure 3: Whole Diagram OF NLS

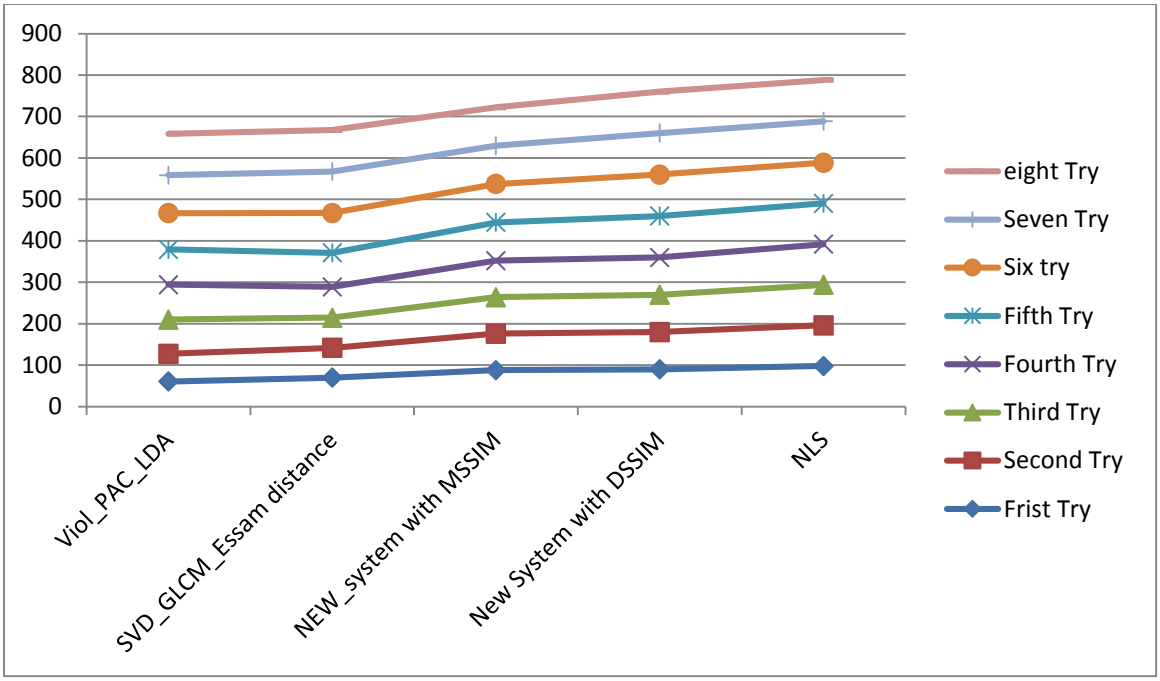

Figure 4: NLS with another system in eight try

CONCLUSION

NLS system is suitable for FEI d ORL database and I build this new system to deals with flexible database this mean I can add more peoples to ORL or Sub FEI and then find recognize people. NLS depends on two previous systems that I also built them, to become NLS. Finally NLS can mix with another method to become anew Large system but in modified form.

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