AnInvestigation into Facial Attributes Prominence in Face Recognition: Using Hybrid Method AHP and TOPSIS Approach

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Abstract : In this manuscript, the researcher has proposed a method to assess the significance of characteristics in face identification by ensuring the assessmentof each criterion which is calculated using pairwise comparisons based on decision-making using AHP – (Analytical Hierarchy Process) from which weights can be accessed in orderto prioritize criteria using those weights which are incorporated into the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution method) so that options can be prioritized. The process of selecting the alternative and the drawback of an algorithm(AHP,TOPSIS) are demonstrated with the help of numerical computations. TOPSIS, one of the (Multi-Criteria Decision-Making) MCDM methods, which was originally developed by Hwang et al., in 1981with further developments by Yoon in 1987 and Hwang, Lai , Liu in 1993. It is a target based approach for finding the alternative that is closest to the optimal solution. Using this method, alternatives are graded based on optimal solution or alternative similarity. Optimal solution is a solution that is the best or idealand tries to approximate it. Basically, for measuring the similarity of an alternative to optimal level and non-optimal, we consider distance of the alternative from optimal and non-optimal solutions. This manuscript explains the usefulness of TOPSIS in decision-making, quantification of data, solving real worldcomplications, besides touching upon ins and outs of TOPSIS.

Keywords:MCDM, TOPSIS, Decision-Making, Rank Reversal, Face recognition,Features saliency, Linguistic description

I.Introduction

Face identification is an aspectof the major part of the essential regularization in recent biometrics. Various attributessuch as non-coercive quality of data collection when compared with iris recognition or finger print, utilizations in forensic science,criminalistics, tracking of missing people, accessibility control, driving license verification including passport, PAN, AADHAR etcare considered., ubiquity of computing machinery plays a primary role over here. Nevertheless,there are enormous challenges to be considered in the domain of human face identification. Recognizing a face is still a trickyissue ;several researches are focusing on solving these types of problems.Even if anyone has have already seen the face to be recognized, he/she will be unable to recall hundreds of facial images and compared with acceptable time[1]. Computers are intensively used in face recognition with efficient procedures. O'Toole et al.,have opined that sophisticated algorithms improve the accuracy of face recognition[2]. Sinha, Pet al., have opined that human brain recognizes faces in a holistic manner[3]. Karczmarek, P et al.,have observed that prominence of human facial features is to be identified and quantified by the human and the algorithms[4]. In this manuscript is indicatedhow the prominent human facial features are determined by a hybrid algorithm which is the combination of AHP which is used to rank the facial attributes combined with TOPSIS for suspecting the individual inputs. The novelty of this approach stems from a rational way of evaluating the most prominent facial features through the use of the analytic hierarchy process (AHP), (Saaty 1980; SaatyandVargas 2012)[5][6][7].

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II. Architecture of the proposed System

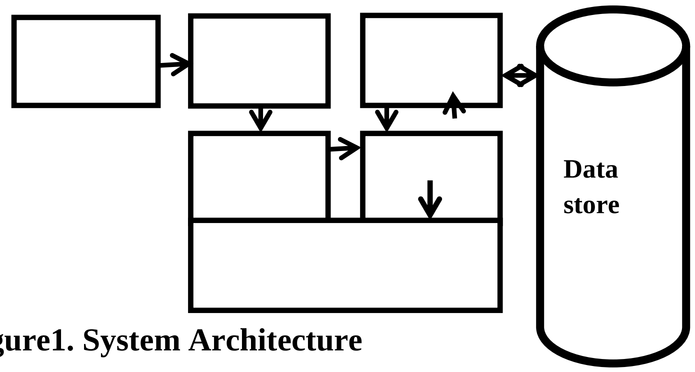

Figure1. System Architecture

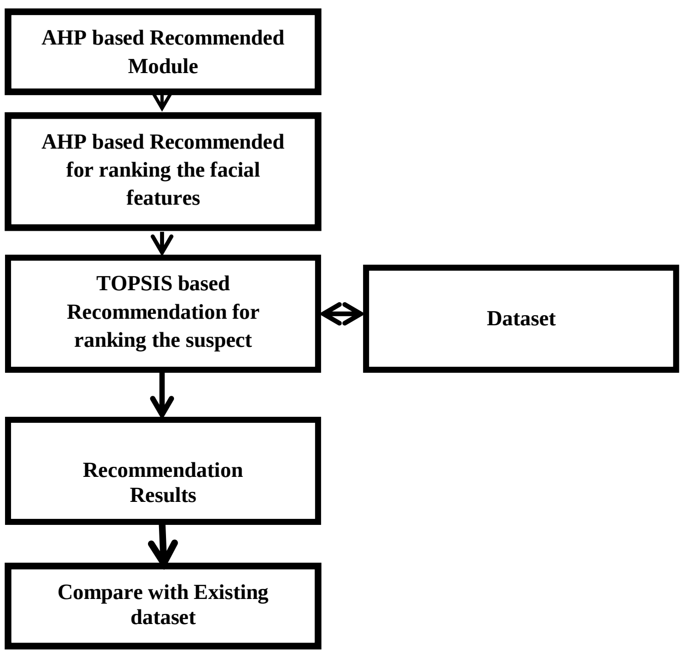

Figure2. Overall Experimental Flow

Numerous methods are used for identifying human faces from human photographs. This manuscript claimshow the human face can be suspected by accepting the attributes of the human facial images. The entire course of face identification can be shown in Figure.1. The initial step is to collect the human facial image from the data set. Facial features(sayLips,Cheek,Eyes, Nose, Skin color, Forehead,mouth,Eyetails,Eyelid, etc are called attributes) are gathered from a researcher point of view, which is prioritized by using pairwise comparisons using the popular methodcalled Analytical Hierarchy Process, one of the MCDM and the suspected individuals are recommended using TOPSIS, which is the another companion of an MCDM scenario. From Figure.2 illustrates the overall experimental flow indicates how the individual faces are suspected through recommendations.

III. Analytical Hierarchy Process:

Of the several MCDM methodologies, the Analytical Hierarchy Process (AHP) was introduced by Professor Thomas.L.Saaty and itis one such method used by several researchers. Here a complex issue is reduced within a structure consisting of objective, sub-criteria,criteria, along with options.This methodology identifies a set of matrices and gives priority by comparing requirements and alternatives together.While it is widely used, several facets of AHP appear to be contentious, in nature. The issue of reverse ranks in general, if an alternative is introduced or removed, has been highlighted [5][6][18][19].

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The practices when using Analytical Hierarchy Process:“Problem Representation”, “Pairwise Comparison”, “Developing Local Priority”, “Verifying Consistency”, “Evaluating the Global Priority”.

Problem Representation:

The researcher frameworks a dilemma within 3 sections: “objective”, “criteria”, “sub-criteria” (if needed), as well as alternatives. This supports to minimize the problem’s complexity.

Pairwise Comparison:

Pairwise comparisons of both tangible and intangible considerations for decisions, are the key components of the AHP method. In Analytical Hierarchy Process the data are obtained by pairwise comparison among alternatives according to an independent parameter. For quantification purposes, verbal statements are translated into numerical numbers according to the fundamental Scale provided by the Saaty scale, as shown in following Table.1:

Table.1[Fundamental Scale of Relative importance according to Saaty (1980)] :

Scale for pairwise Comparisons		
Intensity of Importance	Definition	Explanation
1	Of equal value	Two requirements are of equal value
3	Slightly more Value	Experience slightly favors one requirement over another
5	Essential or Strong value	A requirement is strongly favored and its dominance is demonstrated in practice
7	Very Strong Value	A requirement is very strongly favored and its dominance is demonstrated in practice
9	Extreme value	The evidence favoring one over another is of the highest possible order of affirmation.
2,4,6,8	Intermediate values between two adjacent judgements	When a compromise is needed
Reciprocals	If requirement i has one of the above numbers assigned to it when compared with requirement j, then j has the reciprocal value when compared with i.	

Developing Local Priority:

When comparisons are carried out to assess the relative significance of the parameter, their priority rank order is defined by an Eigenvector approach.

Eigenvector approach:

Increase the comparison matrix pairwise to an appropriate large power.

Sum through rows and normalize to provide an assessment of an Eigenvector.

Stop, if the variable of two successive estimates of an Eigenvector has a very small difference.

The order of rank of the alternatives vis- a-vis each of the parameters is decided by a similar method.

Verifying the Consistency:

The accuracy of the pairwise matrices for comparison is verified with the “formula C.R = C.I/R.I” . Here the Random Index (R.I) and “$C.I = (\lambda_{max} - n) /(n-1)$” table provided by Saaty. λ_{max}represents the maximum Eigenvalue and n the matrices order utilized. When “C.R> 0.1” the comparisons in pairwise are reassessed.

Evaluating Global Priority:

For each alternative, the Global Priority (Final Priority) is calculated by adding the n criteria weight product and the local priority of m, alternatives according to each criterion with Global Priority formula = “$\Sigma\ a_{ij} x\ w_{j}$, for i= 1,2,3………m, j =1,2,3………. n". a_{ij} denotes the i, j^{th} the element of the decision matrix, and w_j indicates the weight of the corresponding criterion.

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Algorithm of an AHP:

1.Represent the problem as a decision hierarchy containing the Goal, Criteria and Alternatives.

2.Construct a pairwise comparison n x n matrix for the n criteria.

3.Determine the dominance of each criterion by making a series of judgements using pairwise comparisons of criteria. This is the judgement matrix.

4. Determine the priority vector.

Saaty's Eigen vector method

Raise the pairwise comparison matrix to a sufficiently large power.

Sum over rows and normalize to get an estimate of the eigenvector.

Stop when there is a very small difference between the components.of two successive estimates of the Eigenvector .

Determine the maximum Eigenvalue (λ_{max}) of the pairwise comparison matrix: Calculate the product of the vector of the total of each column of the judgement matrix

with the corresponding priority vector .

5.Calculate the Consistency Index (C.I) using the formula C.I = (λ_{max} - n) /(n-1).

6.Calculate the Consistency Ratio(C.R) using the formula C.R = C.I/R.I. The Random Index (R.I) value can be taken from following Table.2:

Table.2 (RI values for different values of n, where n is the order of the matrix)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.0	0.0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

7.Check the consistency of the n x n matrix; if the C.R > 0.1, then re-evaluate the

Pairwise comparison , perform Step (2).

8.Construct a set of pairwise comparison matrices for the alternatives with respect to the criterion; consider n criteria and m alternatives , then n number of matrices are constructed of order m x m.

9.Determine the dominance of each alternative by making a series of judgements using pairwise comparisons of two alternatives at a time.

10.Perform Step (4) to determine λ_{max} , Step (5) to determine C.I , Step (6) to determine C.R.

11. Check the consistency of the m x m matrix (alternatives with respect to each criterion); if the C.R > 0.1, then re-evaluate the pairwise comparison, perform Step (9)

12.The Final Priority (Global Priority) for each alternative is determined by summing the product of the criteria weights and the corresponding local priority of an alternative with respect to each criterion, by using the formula

$$\text{Global Priority} = \sum_{j=1}^{n} a_{ij} * w_j \quad , \text{for } i= 1,2,3\ldots\ldots\ldots..m.$$

a_{ij} is the i,jth element of the decision matrix and w_j is the weight of the corresponding criterion

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IV.TOPSIS

TOPSIS is a systemintroduced by Yoon in 1987 along with Hwang[16][17], It was further developed by Lai and Liu in 1993[11]. The above said approach iscloser to the positive optimum and far away from the unfavourable one. If an option is, moreover equivalent to the ideal, it intends a higher rate[16]; this morality is also recommended by Zeleny (1982) along with Hall(1989) and refined by Yoon(1987) and Hwang, Lai and Liu (1993).The above said method specifies m x n matrix, m options and n parameters and assigns priority to the available options. It is easier to use and covers all types of parameters (subjective and objective). It shrinks a complication into a practical manner. The manipulations are straightforward. It is implemented in various fields such asapplied science, technical, and other business arena[12].

TOPSIS method comprises certain steps as given below:

Step (1): Draft the matrix (m x n) for options in relation to parameters,

m-> dozens of options

n -> dozens of parameters

The matrix is given below..

X=		C_1	C_2	-	C_n
	A_1	a_{11}	a_{12}	-	a_{1n}
	A_2	a_{21}	a_{22}	-	a_{2n}
	-	-	-	-	-
	A_m	a_{m1}	a_{m2}	-	a_{mn}

A_i->indicates the options i = 1 ..m,

C_j-> indicates the parameters relating to the options j=1..n,

Step (2): Determine the normalized m x n matrix $R(=r_{ij})$. The normalized value r_{ij} is calculated as

$r_{ij} = x_{ij} / \sqrt{(\Sigma x_{ij}^2)}$ for i=1 ..m, j=1 .. n

Step (3): The estimated normalized value $V_{ij}$is $V_{ij} = W_j r_{ij}$, for i=1 ..m, j=1 .. n where w_j indicates the estimate of the j^{th} parameter

Step (4): Estimate the ideal and negative ideal solutions

$V^+ = \{V_1^+, \ldots, Vn^+\} = \{(\max V_{ij} \mid j \in J), (\min V_{ij} \mid j \in J^1)\}$

$V^- = \{V_1^-, \ldots, Vn^-\} = \{(\min V_{ij} \mid j \in J), (\max V_{ij} \mid j \in J^1)\}$

J ->is a benefit parameter

J^1->is a cost parameter

Step(5): Finding the separation of each choice from the positive ideal solution (D_i^+) is given as

$D_i^+ = \sqrt{(\Sigma(V_{ij} - V_j^+)^2}$, i=1..m, j=1..n.

Likewise, the negative ideal solution $D_i^- = \sqrt{(\Sigma(V_{ij} - V_j^-)^2}$, i=1..m, j=1..n

Step (6): Rank the alternative using the formula $C_i = D_i^- / (D_i^+ + D_i^-)$, i=1….m , $C_i$lies between 0 and 1.

Step (7): Prioritize the choices

V. SALIENCY OF THE FACIAL FEATURES

According to Karczmarek et al., 2017[20], the face description can bedivided into three levels as shown in Figure.3.

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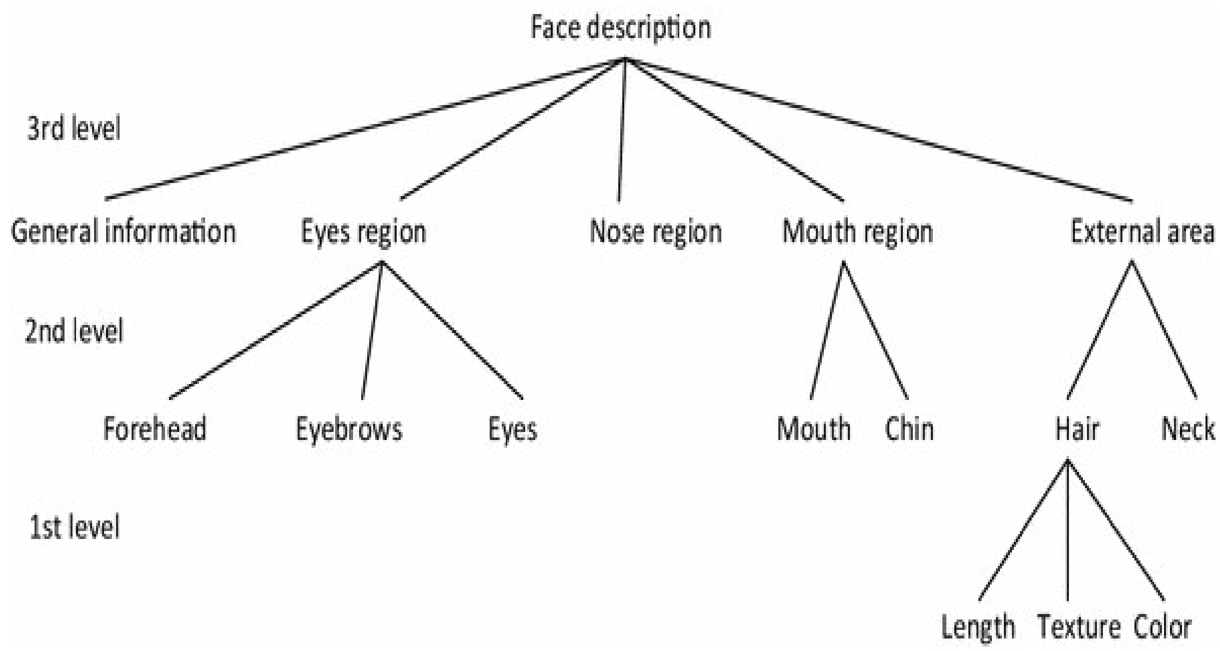

Figure 3.Three-level human face description features

Figure-3 describes the essential partition of the face description . Inhis experiment,the researcher assumesthat the crucialseparation of the face includes uppermostand lower part of the face, nose region,forehead area, the mouth region, the regions of eyes, nose ,mouth, cheeks, chin, hair, eyebrows. The researcher is keenly interested in evaluating the most essential facial features or attributes that are useful in the background of human face identification. The prioritization based on the quantified numbers(weights) is associatedwith thespecificattributesthat may be used in the face recognition utilizations, using a procedure which is based upon the Quantification methods. In this experiment, theprocess of determining the prominence of the face attributes has been proposed. The researcher used the quantification approach to determine the necessity of face attributes. The main objective is to choose the most essential attributes from the given data from the given images. The criterion is very essential in recognizing the proceedingof identification of the face of humans. The individuals are combined into the following other composed features while noticing the overall face, especially the gender and the age of an individual person, ;next segment is the eye region which includes forehead, typically the other region includes human ear and nose along with chin and mouth being represented as the internal human face attributes. Finally, we use pairwise comparisons to derive the priority of the entire attributes by using an AHP. The following Table-3 indicates the exceptional facial features and their attributes from the researcher's opinionwith the most descriptive one which can be obtained from the raw facial images.

Table -2.Selected Facial attributes and their Morphological Factors

Criteria	**Attribute (Sub – Criteria)**	**Morphological Factors**
General Information(C_1)	Shape of the face(C_{11})	Rectangular, oval, pentagonal, triangular , round, ellipsoidal, rhomboidal ,trapezoidal
	Gender(C_{12})	Male, Transgender, Female
	Origin(C_{13})	African, Asian, Spanish , Caucasian, etc.
	Age(C_{14})	Older adult , Young adult, Child, , middle age adult etc
Hair(C_2)	Length(C_{21})	Short, average, long
	Texture(C_{22})	Straight, Wavy ,curly
	Color(C_{23})	Blonde, Light blonde, auburn, dark blonde, auburn,

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		chestnut, gray, turning gray, black
Forehead area (C_3)	Width(C_{31})	High, Average, Low
	Height(C_{32})	Narrow, Wide,Average
	Shape(C_{33})	Inversely trapezoidal , Rectangular, Trapezoidal , Square
	Skin(C_{34})	Smooth, creased, Wrinkled
Eyebrows(C_4)	Length(C_{41})	Short, average, long
	Direction(C_{42})	Horizontal, turned up, turned down
	Distance between the eyebrows(C_{43})	Narrow , Merged, Wide ,Average
	Position(C_{44})	High, Average,Low
	Shape(C_{45})	bushy , Straight , Arched , Wavy, Broken lined
	Thickness(C_{46})	Average ,Wide,, Narrow
	Color(C_{47})	Light, average, dark
Eyes(C_5)	Shape of the lower eyelid(C_{51})	Normal, thickened, saggy
	Distance between eyelids(C_{52})	Narrow, average, wide
	Fissures length(C_{53})	Short, average, long
	Direction of the fissures(C_{54})	Turned down , Horizontal, Turned up
	Inter-eye distance(C_{55})	Narrow, average, wide
	Color(C_{56})	Gray , Blue, Hazel, Green,
Nose(C_6)	Length(C_{61})	Average ,Short, Long
	Width(C_{62})	Wide , Average, Narrow
	Width of the nasal bridge(C_{63})	Wide, Average, Narrow
	Shape of the nasal bridge(C_{64})	Inversely trapezoidal , Rectangular, Trapezoidal,
	Shape of the nasal tip(C_{65})	Tounded, spiked, blunt, angular
	Nostrils(C_{66})	Narrow, average, wide
Ears(C_7)	Protrusion(C_{71})	protruding , average, Flat against head
	Length(C_{72})	Long , Average, Short,
Cheeks(C_8)	Fullness(C_{81})	Sunken, normal, filled

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	Length of the bones(C_{82})	Long , Average, Short
	Width of the bones(C_{83})	Wide ,Narrow, Average,
Mouth (C_9)	Shape of the opening between lips(C_{91})	Wavy, Convex, Straight, Concave
	Fullness(C_{92})	Low, average, high
	Width(C_{93})	Long ,Average, Short
	Width of the philtrum(C_{94})	Wide ,Narrow, average,
Chin(C_{10})	Shape(C_{101})	concave, triangular , angular ,oval, Round
	Size(C_{102})	Big, Small, average

VI. EXPERIMENTAL ANALYSIS

This manuscript demonstrates that face recognition which refers to the process of identifying the face using the facial attributes with their priorities.Dramaticuplift in the claim for face recognitiontechnics in various investigation and industrial areas has led to the development of numeroustechnics, methods fordeploying major application areas such as preventing crimes, unlockingmobiles, smarter advertising, finding missing persons, helping the blind, protecting law enforcement, helping forensic research, identifying social media platforms, diagnosing diseases, identifying VIPS at sporting events, protecting schools from risks, tracking school attendance, encouraging secure transactions, user authentication at ATMS, Control access to sensitive areas, Recognizing drivers etc. In this scenario the researcher needs to find an individual suspect against the main criteria-General Information(C_1), Hair(C_2), Forehead area (C_3), Eyebrows(C_4), Eyes(C_5), Nose(C_6), Ears(C_7), Cheeks(C_8), Mouth (C_9), and Chin(C_{10}) along with sub – criteria mentioned above in Table -3.As stated by Saaty[5][6][18][19], the scale demonstratesa series of numbers, assumed on the researcher's opinion. It is crucial to emphasize that for Saaty impalpable factors general information or forehead area is also eminently significant. Estimate of the similarities occurring in pairs are claimed to measure the intensity by which one individual's image is higher than the another one.

Table - 3

Pairwise comparison for the main criteria

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	Weights
C_1	1	2.00	3.00	3.00	2.00	2.00	3.00	4.00	4.00	4.00	0.20506
C_2	0.50	1	3.00	4.00	3.00	3.00	2.00	4.00	3.00	4.00	0.196502
C_3	0.33	0.33	1	2.00	3.00	3.00	4.00	4.00	3.00	3.00	0.143506
C_4	0.33	0.25	0.50	1	2.00	3.00	4.00	3.00	3.00	4.00	0.115045
C_5	0.50	0.33	0.33	0.50	1	3.00	4.00	3.00	3.00	5.00	0.105364
C_6	0.50	0.33	0.33	0.33	0.33	1	3.00	4.00	2.00	3.00	0.074794
C_7	0.33	0.50	0.25	0.25	0.25	0.33	1	2.00	4.00	2.00	0.055074
C_8	0.25	0.25	0.25	0.33	0.33	0.25	0.50	1	2.00	3.00	0.039997
C_9	0.25	0.33	0.33	0.33	0.33	0.50	0.25	0.50	1	3.00	0.037825
C_{10}	0.25	0.25	0.33	0.25	0.20	0.33	0.50	0.33	0.33	1	0.026833
										Total	1.0000

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λ_{max} = 11.30375, CI = 00.144861 and CR= 00.0972

Table-4

Pairwise comparison matrix for the General Information(C1) Main criterion with the associated sub-criteria(C_{11},C_{12}, C_{13}, C_{14})

	C_{11}	C_{12}	C_{13}	C_{14}	Weights
C_{11}	1	4.00	5.00	7.00	0.597658
C_{12}	0.25	1	2.00	3.00	0.193112
C_{13}	0.20	0.50	1	5.00	0.153368
C_{14}	0.14	0.33	0.20	1	0.055862
				Total	1.0000

λ_{max} = 4.229881, CI = 0.076627 and CR= 0.084258

Table -3 indicates the pairwise comparison for the main criteria and Table-4 represents the pairwise comparison matrix for the general information (C_1) main criterion with the associated sub criteria (C_{11},C_{12}, C_{13}, C_{14}). The rest of the computations are shown in the Appendix. The weights of the sub-criteria are derived as shown in Table -12, Calculated weight of each sub criterian is shown below

Table-14 Calculation of each Sub criterion weight

Criteria	**Feature**	**Weights**		
		Sub	**Main**	**Combined**
General Information(C_1)	Shape of the face(C_{11})	0.597658	0.205060	0.12256
	Gender(C_{12})	0.193112		0.03960
	Origin(C_{13})	0.153368		0.03145
	Age(C_{14})	0.055862		0.01146
Hair(C_2)	Length(C_{21})	0.614395	0.196502	0.12073
	Texture(C_{22})	0.268390		0.05274
	Color(C_{23})	0.117215		0.02303
Forehead area (C_3)	Width(C_{31})	0.588392	0.143506	0.08444
	Height(C_{32})	0.254858		0.03657
	Shape(C_{33})	0.104381		0.01498
	Skin(C_{34})	0.052370		0.00752
Eyebrows(C_4)	Length(C_{41})	0.383187	0.115045	0.04408
	Direction(C_{42})	0.225969		0.02600
	Distance between the eyebrows(C_{43})	0.168550		0.01939
	Position(C_{44})	0.108303		0.01246

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	Shape(C_{45})	0.048675		0.00560
	Thickness(C_{46})	0.035604		0.00410
	Color(C_{47})	0.029711		0.00342
Eyes(C_5)	Shape of the lower eyelid(C_{51})	0.453602	0.105364	0.04779
	Distance between eyelids(C_{52})	0.219808		0.02316
	Fissures length(C_{53})	0.155818		0.01642
	Direction of the fissures(C_{54})	0.095250		0.01004
	Inter-eye distance(C_{55})	0.047524		0.00501
	Color(C_{56})	0.027998		0.00294
Nose(C_6)	Length(C_{61})	0.464416	0.074794	0.03473
	Width(C_{62})	0.219352		0.01641
	Width of the nasal bridge(C_{63})	0.142581		0.01066
	Shape of the nasal bridge(C_{64})	0.093304		0.00698
	Shape of the nasal tip(C_{65})	0.052421		0.00392
	Nostrils(C_{66})	0.027926		0.00209
Ears(C_7)	Protrusion(C_{71})	0.833300	0.055074	0.04589
	Length(C_{72})	0.166700		0.00918
Cheeks(C_8)	Fullness(C_{81})	0.698571	0.039997	0.02794
	Length of the bones(C_{82})	0.237092		0.00948
	Width of the bones(C_{83})	0.064337		0.00257
Mouth (C_9)	Shape of the opening between lips(C_{91})	0.530269	0.037825	0.02006
	Fullness(C_{92})	0.293184		0.01109
	Width(C_{93})	0.118442		0.00448
	Width of the philtrum(C_{94})	0.058104		0.00220
Chin(C_{10})	Shape(C_{101})	0.857143	0.026833	0.02230
	Size(C_{102})	0.142857		0.00383
	Total	4.000000	1.000000	1.00000

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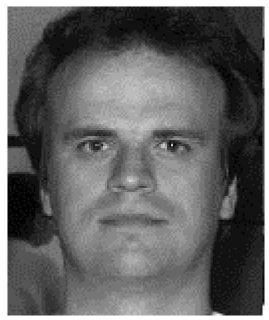
Table-66

Overall result / final matrix

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	Total
P1	**0.57810**	**0.56292**	**0.553481**	**0.58093059**	**0.54589526**	**0.58928406**	**0.395892**	**0.588568**	**0.5943061**	**0.62813128**	**0.5616923**
P2	**0.26412**	**0.25986**	**0.274935**	**0.26152303**	**0.27787403**	**0.24887601**	**0.176287**	**0.266171**	**0.23260551**	**0.21281686**	**0.25752124**
P3	**0.10706**	**0.12501**	**0.125068**	**0.11714180**	**0.12380931**	**0.11227381**	**0.076830**	**0.105602**	**0.1222396**	**0.11155129**	**0.11545754**
P4	**0.05071**	**0.05221**	**0.046518**	**0.04040334**	**0.05242102**	**0.04956544**	**0.034759**	**0.039659**	**0.05084808**	**0.04750057**	**0.04791073**
Main	**0.20506**	**0.196502**	**0.143506**	**0.115045**	**0.105364**	**0.074794**	**0.055074**	**0.039997**	**0.037825**	**0.026833**	

			
Person – 1(P1)	Person – 2(P2)	Person – 3(P3)	Person – 4(P4)

P1>P2>P3>P4

This manuscript demonstrates that the researcher wants to choose a sequence from a set of individual suspects–Person-1(P1),Person-2(P2), Person-3(P3), Person-4(P4)against the criteria General Information(C_1), Hair(C_2),Forehead area (C_3), Eyebrows(C_4), Eyes(C_5), Nose(C_6), Ears(C_7), Cheeks(C_8), Mouth(C_9), and Chin(C_{10}).

Start of TOPSIS method:

Step (1): Construct an m x n matrix for alternative performance with respect to criteria available ; m denotes the number of individual persons (P1,P2, P3, P4) and n denotes the number of criteria (C_1,C_2,C_3,C_4,C_5,C_6,C_7,C_8,C_9,C_{10}). In this step the decision-makers use the linguistic weighting variables to assess the importance of the criteria. They use the linguistic rating variables to evaluate the rating of alternatives with respect to each criterion. The human feelings are converted into numbers inorder to construct a matrix. The linguistic variables are converted into numerical values by using a 10 point scale

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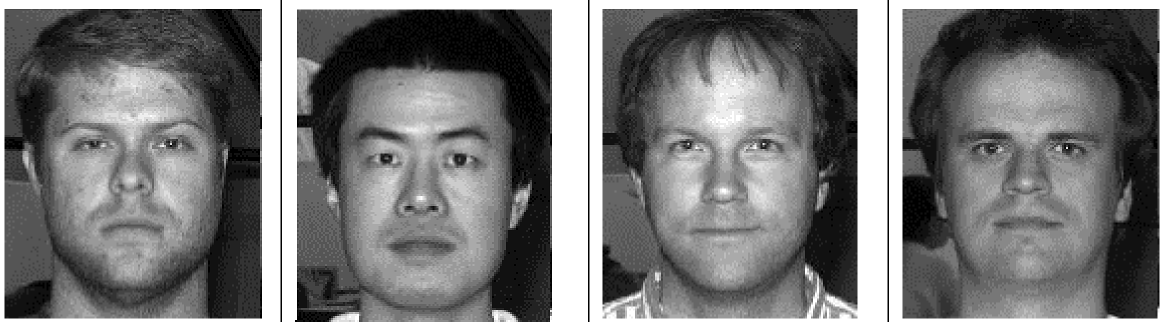
VL	Very Low	0	VP	Very Poor	0	VL	Very Slow	0
L	Low	1	P	Poor	1	L	Slow	1
ML	Medium Low	3	MP	Medium Poor	3	ML	Medium Slow	3
M	Medium	5	F	Fair	5	M	Fair	5
MH	Medium High	7	MG	Medium Good	7	MH	Medium Fast	7
H	High	9	G	Good	9	H	Fast	9
VH	Very High	10	VG	Very Good	10	VH	Very Fast	10

The following table furnishes a list of persons and their corresponding criteria ; the individual images are taken as input for analysis as shown below.Selected images from the Yale Face Dataset, denoted as Person-1(P1),Person-2(P2),Person-3(P3),Person-4(P4) are shown in Figure -4.Table 67 shows various alternatives and their respective criteria.



Person – 1(P1)	Person – 2(P2)	Person – 3(P3)	Person – 4(P4)

Figure – 4. Selected images from the Yale Face Dataset

The structure of the matrix can be expressed as Table.67

	0.12256	0.0396	0.03145	0.01146	0.12073	0.05274	0.02303	0.08444	0.03657	0.01498	0.00752
Alt	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
P1	7	6	6	8	5	7	5	8	5	8	7
P2	8	5	7	7	6	3	6	7	8	7	8
P3	6	7	8	6	7	6	8	6	7	6	6
P4	9	8	9	5	7	5	9	5	9	5	9

	0.04408	0.026	0.01939	0.01246	0.0056	0.0041	0.00342	0.04779	0.02316	0.01642	0.01004
Alt	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
P1	8	8	8	7	8	8	7	7	8	6	8
P2	5	7	7	8	7	7	8	8	7	7	7
P3	6	9	6	7	6	6	6	7	9	8	5

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P4	5	6	5	9	5	9	8	9	6	6	6

	0.0050	0.00294	0.03473	0.01641	0.01066	0.00698	0.00392	0.00209	0.04589	0.00918	0.02794
Alt	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}
P1	7	6	8	7	6	8	5	8	6	7	6
P2	6	7	6	8	7	6	7	6	7	8	7
P3	8	8	7	6	8	9	8	7	8	6	8
P4	9	5	9	9	5	7	6	9	5	9	9

	0.00948	0.00257	0.02006	0.01109	0.00448	0.0022	0.0223	0.00383
Alt	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}
P1	8	6	8	6	6	6	8	6
P2	7	7	7	7	7	7	6	7
P3	6	8	6	8	9	8	7	8
P4	9	5	9	5	8	6	5	5

Step (2): To normalize m x n matrix $R(=r_{ij})$. The normalized value r_{ij} is calculated as $r_{ij} = x_{ij} / \sqrt{(\Sigma x_{ij}^2)}$ for i=1 ..m, j=1 .. n , It is shown in Table 68

Table 68:Normalization matrix

Alt	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
P1	0.461566	0.454859	0.395628	0.606478	0.396526	0.641689	0.3483665	0.6064784	0.337869	0.606478	0.4615663
P2	0.527504	0.379049	0.461566	0.530669	0.475831	0.27501	0.4180398	0.5306686	0.54059	0.530669	0.5275044
P3	0.395628	0.530669	0.527504	0.454859	0.555136	0.550019	0.5573864	0.4548588	0.473016	0.454859	0.3956283
P4	0.593442	0.606478	0.593442	0.379049	0.555136	0.458349	0.6270597	0.379049	0.608164	0.379049	0.5934424

Alt	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
P1	0.653197	0.527504	0.606478	0.44905	0.606478	0.527504	0.479632	0.44905	0.527504	0.441129	0.606478
P2	0.408248	0.461566	0.530669	0.5132	0.530669	0.461566	0.548151	0.5132	0.461566	0.51465	0.530669
P3	0.489898	0.593442	0.454859	0.44905	0.454859	0.395628	0.411113	0.44905	0.593442	0.588172	0.379049
P4	0.408248	0.395628	0.379049	0.57735	0.379049	0.593442	0.548151	0.57735	0.395628	0.441129	0.454859

Alt	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}
P1	0.461566	0.454859	0.527504	0.461566	0.454859	0.527504	0.379049	0.527504	0.454859	0.461566	0.395628
P2	0.395628	0.530669	0.395628	0.527504	0.530669	0.395628	0.530669	0.395628	0.530669	0.527504	0.461566
P3	0.527504	0.606478	0.461566	0.395628	0.606478	0.593442	0.606478	0.461566	0.606478	0.395628	0.527504
P4	0.593442	0.379049	0.593442	0.593442	0.379049	0.461566	0.454859	0.593442	0.379049	0.593442	0.593442

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Alt	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}
P1	0.527504	0.454859	0.527504	0.454859	0.395628	0.441129	0.606478	0.454859
P2	0.461566	0.530669	0.461566	0.530669	0.461566	0.51465	0.454859	0.530669
P3	0.395628	0.606478	0.395628	0.606478	0.593442	0.588172	0.530669	0.606478
P4	0.593442	0.379049	0.593442	0.379049	0.527504	0.441129	0.379049	0.379049

Weighted Normalization Matrix

Alt	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
P1	0.05657	0.018012	0.012443	0.00695	0.047873	0.033843	0.0080229	0.051211	0.012356	0.009085	0.003471
P2	0.064651	0.01501	0.014516	0.006081	0.057447	0.014504	0.0096275	0.0448097	0.019769	0.007949	0.0039668
P3	0.048488	0.021014	0.01659	0.005213	0.067022	0.029008	0.0128366	0.0384083	0.017298	0.006814	0.0029751
P4	0.072732	0.024017	0.018664	0.004344	0.067022	0.024173	0.0144412	0.0320069	0.022241	0.005678	0.0044627

Alt	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
P1	0.028793	0.013715	0.01176	0.005595	0.003396	0.002163	0.00164	0.02146	0.012217	0.007243	0.006089
P2	0.017996	0.012001	0.01029	0.006394	0.002972	0.001892	0.001875	0.024526	0.01069	0.008451	0.005328
P3	0.021595	0.01543	0.00882	0.005595	0.002547	0.001622	0.001406	0.02146	0.013744	0.009658	0.003806
P4	0.017996	0.010286	0.00735	0.007194	0.002123	0.002433	0.001875	0.027592	0.018907	0.007243	0.004567

Alt	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}
P1	0.002312	0.001337	0.01832	0.007574	0.004849	0.003682	0.001486	0.001102	0.020873	0.004237	0.011054
P2	0.001982	0.00156	0.01374	0.008656	0.005657	0.002761	0.00208	0.000827	0.024352	0.004842	0.012896
P3	0.002643	0.001783	0.01603	0.006492	0.006465	0.004142	0.002377	0.000965	0.027831	0.003632	0.014738
P4	0.002973	0.001114	0.02061	0.006492	0.004041	0.003222	0.001783	0.00124	0.017395	0.005448	0.016581

Alt	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}
P1	0.005001	0.001169	0.010582	0.005044	0.001772	0.00097	0.013524	0.001742
P2	0.004376	0.001364	0.009259	0.005885	0.002068	0.001132	0.010143	0.002032
P3	0.003751	0.001559	0.007936	0.006726	0.002659	0.001294	0.011834	0.002323
P4	0.005626	0.000974	0.011904	0.004204	0.002363	0.00097	0.008453	0.001452

Compute the positive and negative ideal solution to the problem,

The Positive ideal solution …

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	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
	0.072732	0.024017	0.018664	0.00695	0.067022	0.033843	0.0144412	0.051211	0.022241	0.009085	0.0044627
	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
	0.028793	0.01543	0.01176	0.007194	0.003396	0.002433	0.001875	0.027592	0.018907	0.009658	0.006089
V^+	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}
	0.002973	0.001783	0.02061	0.072732	0.006465	0.004142	0.002377	0.00124	0.027831	0.005448	0.016581
	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}			
	0.005626	0.001559	0.011904	0.006726	0.002659	0.001294	0.013524	0.002323			

The Negative ideal solution …

	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
	0.048488	0.01501	0.012443	0.004344	0.047873	0.014504	0.0080229	0.0320069	0.012356	0.005678	0.0029751
	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
	0.017996	0.010286	0.00735	0.005595	0.002123	0.001622	0.001406	0.02146	0.01069	0.007243	0.003806
V^-	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}
	0.001982	0.001114	0.01374	0.006492	0.004041	0.002761	0.001486	0.000827	0.017395	0.003632	0.011054
	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}			
	0.003751	0.000974	0.007936	0.004204	0.001772	0.00097	0.008453	0.001452			

Find the separation assessment, m – nearest distance. The separation of each substitute from the feasible perfect answer to a problem(D_i^+) is specified in Table 69 , $D_i^+ = \sqrt{(\Sigma(V_{ij} - V_j^+)^2}$, i=1..m, j=1..n

Alternatives	**$D_i^+ = \sqrt{(\Sigma(V_{ij} - V_j^+)^2}$**	**$D_i^- = \sqrt{(\Sigma(V_{ij} - V_j^-)^2}$**	**$C_i = D_i^- / (D_i^+ + D_i^-)$**	**Rank**
P1	**0.072651**	**0.032627**	**0.309911**	**II**
P2	**0.071529**	**0.026149**	**0.267705**	**IV**
P3	**0.073468**	**0.030575**	**0.29387**	**III**
P4	**0.072045**	**0.038989**	**0.351143**	**I**

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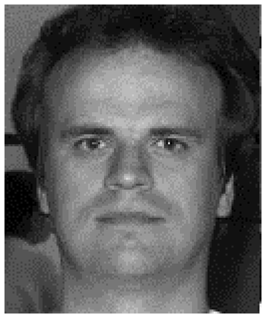
P4>P1>P3>P2

			
Person – 4(P4)	Person – 1(P1)	Person – 3(P3)	Person – 2(P2)

When the new individual suspectP5 is added which is almost identical to P1, the latest substitute P5 is added which is almost identical to P1, then as a result of the decision matrix substituteswith regard to Criteria specified in the table given below.

The structure of the matrix can be expressed as

Table 70

	0.12256	0.0396	0.03145	0.01146	0.12073	0.05274	0.02303	0.08444	0.03657	0.01498	0.00752
Alt	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
P1	7	6	6	8	5	7	5	8	5	8	7
P2	8	5	7	7	6	3	6	7	8	7	8
P3	6	7	8	6	7	6	8	6	7	6	6
P4	9	8	9	5	7	5	9	5	9	5	9
P5	7	6	6	8	5	7	5	8	5	8	7

	0.04408	0.026	0.01939	0.01246	0.0056	0.0041	0.00342	0.04779	0.02316	0.01642	0.01004
Alt	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
P1	8	8	8	7	8	8	7	7	8	6	8
P2	5	7	7	8	7	7	8	8	7	7	7
P3	6	9	6	7	6	6	6	7	9	8	5
P4	5	6	5	9	5	9	8	9	6	6	6
P5	8	8	8	7	8	8	7	7	8	6	8

	0.00501	0.00294	0.03473	0.01641	0.01066	0.00698	0.00392	0.00209	0.04589	0.00918	0.02794
Alt	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}

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P1	7	6	8	7	6	8	5	8	6	7	6
P2	6	7	6	8	7	6	7	6	7	8	7
P3	8	8	7	6	8	9	8	7	8	6	8
P4	9	5	9	9	5	7	6	9	5	9	9
P5	7	6	8	7	6	8	5	8	6	7	6

	0.00948	0.00257	0.02006	0.01109	0.00448	0.0022	0.0223	0.00383
Alt	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}
P1	8	6	8	6	6	6	8	6
P2	7	7	7	7	7	7	6	7
P3	6	8	6	8	9	8	7	8
P4	9	5	9	5	8	6	5	5
P5	8	6	8	6	6	6	8	6

Step (2): To normalize m x n matrix $R(=r_{ij})$. The normalized value r_{ij} is calculated as $r_{ij} = x_{ij} / \sqrt{(\Sigma x_{ij}^2)}$ for i=1 ..m, j=1 .. n , It is shown in Table 71

Table.71: Normalization matrix

Alt	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
P1	0.419079	0.414039	0.367884	0.518563	0.368605	0.540062	0.3289758	0.518563	0.320092	0.518563	0.419079
P2	0.478947	0.345033	0.429198	0.453743	0.442326	0.231455	0.394771	0.4537426	0.512148	0.453743	0.4789475
P3	0.359211	0.483046	0.490511	0.388922	0.516047	0.46291	0.5263614	0.3889222	0.448129	0.388922	0.3592106
P4	0.538816	0.552052	0.551825	0.324102	0.516047	0.385758	0.5921565	0.3241019	0.576166	0.324102	0.5388159
P5	0.419079	0.414039	0.367884	0.518563	0.368605	0.540062	0.3289758	0.518563	0.320092	0.518563	0.419079

Alt	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
P1	0.546869	0.466569	0.518563	0.409644	0.518563	0.466569	0.432461	0.409644	0.466569	0.403604	0.518563
P2	0.341793	0.408248	0.453743	0.468165	0.453743	0.408248	0.494242	0.468165	0.408248	0.470871	0.453743
P3	0.410152	0.524891	0.388922	0.409644	0.388922	0.349927	0.370681	0.409644	0.524891	0.538138	0.324102
P4	0.341793	0.349927	0.324102	0.526685	0.324102	0.524891	0.494242	0.526685	0.349927	0.403604	0.388922
P5	0.546869	0.466569	0.518563	0.409644	0.518563	0.466569	0.432461	0.409644	0.466569	0.403604	0.518563

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Alt	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}
P1	0.419079	0.414039	0.466569	0.419079	0.414039	0.466569	0.354441	0.466569	0.414039	0.419079	0.367884
P2	0.359211	0.483046	0.349927	0.478947	0.483046	0.349927	0.496217	0.349927	0.483046	0.478947	0.429198
P3	0.478947	0.552052	0.408248	0.359211	0.552052	0.524891	0.567105	0.408248	0.552052	0.359211	0.490511
P4	0.538816	0.345033	0.524891	0.538816	0.345033	0.408248	0.425329	0.524891	0.345033	0.538816	0.551825
P5	0.419079	0.414039	0.466569	0.419079	0.414039	0.466569	0.354441	0.466569	0.414039	0.419079	0.367884

Alt	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}
P1	0.466569	0.414039	0.466569	0.414039	0.367884	0.403604	0.518563	0.414039
P2	0.408248	0.483046	0.408248	0.483046	0.429198	0.470871	0.388922	0.483046
P3	0.349927	0.552052	0.349927	0.552052	0.551825	0.538138	0.453743	0.552052
P4	0.524891	0.345033	0.524891	0.345033	0.490511	0.403604	0.324102	0.345033
P5	0.466569	0.414039	0.466569	0.414039	0.367884	0.403604	0.518563	0.414039

Weighted Normalization Matrix

Alt	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
P1	0.051362	0.016396	0.01157	0.005943	0.044502	0.028483	0.0075763	0.0437875	0.011706	0.007768	0.0031515
P2	0.0587	0.013663	0.013498	0.0052	0.053402	0.012207	0.0090916	0.038314	0.018729	0.006797	0.0036017
P3	0.044025	0.019129	0.015427	0.004457	0.062302	0.024414	0.0121221	0.0328406	0.016388	0.005826	0.0027013
P4	0.066037	0.021861	0.017355	0.003714	0.062302	0.020345	0.0136374	0.0273672	0.02107	0.004855	0.0040519
P5	0.051362	0.016396	0.01157	0.005943	0.044502	0.028483	0.0075763	0.0437875	0.011706	0.007768	0.0031515

Alt	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
P1	0.024106	0.012131	0.010055	0.005104	0.002904	0.001913	0.001479	0.019577	0.010806	0.006627	0.005206
P2	0.015066	0.010614	0.008798	0.005833	0.002541	0.001674	0.00169	0.022374	0.009455	0.007732	0.004556
P3	0.018079	0.013647	0.007541	0.005104	0.002178	0.001435	0.001268	0.019577	0.012156	0.008836	0.003254
P4	0.015066	0.009098	0.006284	0.006562	0.001815	0.002152	0.00169	0.02517	0.016723	0.006627	0.003905
P5	0.024106	0.012131	0.010055	0.005104	0.002904	0.001913	0.001479	0.019577	0.010806	0.006627	0.005206

Alt	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}
P1	0.0021	0.001217	0.016204	0.006877	0.004414	0.003257	0.001389	0.000975	0.019	0.003847	0.010279
P2	0.0018	0.00142	0.012153	0.00786	0.005149	0.002442	0.001945	0.000731	0.022167	0.004397	0.011992
P3	0.0024	0.001623	0.014178	0.005895	0.005885	0.003664	0.002223	0.000853	0.025334	0.003298	0.013705
P4	0.002699	0.001014	0.018229	0.005895	0.003678	0.00285	0.001667	0.001097	0.015834	0.004946	0.015418

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P5	0.0021	0.001217	0.016204	0.006877	0.004414	0.003257	0.001389	0.000975	0.019	0.003847	0.010279

Alt	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}
P1	0.004423	0.001064	0.009359	0.004592	0.001648	0.000888	0.011564	0.001586
P2	0.00387	0.001241	0.008189	0.005357	0.001923	0.001036	0.008673	0.00185
P3	0.003317	0.001419	0.00702	0.006122	0.002472	0.001184	0.010118	0.002114
P4	0.004976	0.000887	0.010529	0.003826	0.002197	0.000888	0.007227	0.001321
P5	0.004423	0.001064	0.009359	0.004592	0.001648	0.000888	0.011564	0.001586

Compute the positive and negative ideal solution to the problem,

The Positive ideal solution …

V^+	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
	0.066037	0.021861	0.017355	0.005943	0.062302	0.028483	0.0136374	0.0437875	0.02107	0.007768	0.0040519
	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
	0.024106	0.013647	0.010055	0.006562	0.002904	0.002152	0.00169	0.02517	0.016723	0.008836	0.005206
	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}
	0.002699	0.001623	0.018229	0.00786	0.005885	0.003664	0.002223	0.001097	0.025334	0.004946	0.015418
	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}			
	0.004976	0.001419	0.010529	0.006122	0.002472	0.001184	0.011564	0.002114			

The Negative ideal solution …

V^-	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}	C_{34}
	0.044025	0.013663	0.01157	0.003714	0.044502	0.012207	0.0075763	0.0273672	0.011706	0.004855	0.0027013
	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	C_{51}	C_{52}	C_{53}	C_{54}
	0.015066	0.009098	0.006284	0.005104	0.001815	0.001435	0.001268	0.019577	0.009455	0.006627	0.003254
	C_{55}	C_{56}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	C_{71}	C_{72}	C_{81}
	0.0018	0.001014	0.012153	0.005895	0.003678	0.002442	0.001389	0.000731	0.015834	0.003298	0.010279
	C_{82}	C_{83}	C_{91}	C_{92}	C_{93}	C_{94}	C_{101}	C_{102}			
	0.003317	0.000887	0.00702	0.003826	0.001648	0.000888	0.007227	0.001321			

Find the separation assessment, m – nearest distance. The separation of each substitute from the feasible perfect answer to a problem(D_i^+) is specified in Table 72 , $D_i^+ =\sqrt{}(\Sigma(V_{ij}- V_j^+)^2$, i=1..m, j=1..n

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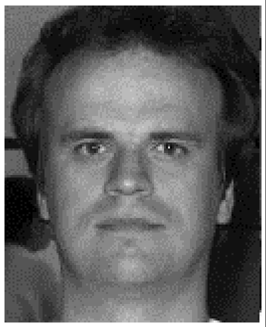
Alternatives	**$D_i^+ = \sqrt{(\Sigma(V_{ij}- V_j^+)^2}$**	**$D_i^- = \sqrt{(\Sigma(V_{ij}- V_j^-)^2}$**	**$C_i=D_i^-/(D_i^+ + D_i^-)$**	**Rank**
P1	0.029632	0.027875	0.484722	**III**
P2	0.027779	0.023549	0.458793	**IV**
P3	0.028448	0.027523	0.491734	**II**
P4	0.024478	0.03556	0.592294	**I**
P5	0.029632	0.027875	0.484722	**III**

P4>P3>P1=P5>P2

				
Person – 4(P4)	Person – 3(P3)	Person – 1(P1)	Person – 5(P5)	Person – 2(P2)

VII. Conclusion

In this manuscript,we proposed a framework of estimation of facial attributes during the process of face recognition through rational and systematic way done by humans. Thistechnique is based on the practical exposure depending on the capability of an individual.The AHP is a rational way to derive the weights of essential attributes utilized by human in characterizing the human faces. The different level hierarchy has been established along with an assessment of an individual done in a pragmatic manner. The quantitativeassessments are used to establish the enumerated experimental outcomes. AHP is the most powerful MCDM techniqueused for the evaluation of criteria and TOPSIS is used in the determination of priorities of suspected individuals while obtaining the weights of the criteria.In thisillustration discussed above four individual suspects are examined; the preference becomes P4>P1>P3>P2for an initial observation. But a same suspected individual A which is renamed as E is added with an existing image data set the preference becomes P4>P3>P1 = P5>P2. This manuscript clearly specifies that change in the preference exists when an existing person is again included with an existing suspected individuals in the image data set. In this scenario the researcher quantified his own feelings when using the above said two approaches AHP and TOPSIS. Though researchers like Hand et al., opine that individual feelings cannot quantify[21],In practice using AHP and TOPSIS many researchers have quantified individual feelings. In spite of certain limitations the approach is highly appreciable one.In this manuscript the focus is on deriving a new framework for enhancing effectiveness of making decisions due to hybridization (AHP combined with TOPSIS) but there is no such advantage of insisting the hybridization of the two MCDM approaches.

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Appendices

Table-5
Pairwise comparison matrix for the Hair(C_2) Main criterion with the associated sub-criteria(C_{21},C_{22}, C_{23})

	C_{21}	C_{22}	C_{23}	Weights
C_{21}	1	3.00	4.00	0.614395
C_{22}	0.33	1	3.00	0.26839
C_{23}	0.25	0.33	1	0.117215
			Total	1.0000

λ_{max} = 3.073536 , CI = 0.03677 and CR= 0.0634

Table-6
Pairwise comparison matrix for the Forehead area (C_3) Main criterion with the associated sub-criteria(C_{31},C_{32}, C_{33}, C_{34})

	C_{31}	C_{32}	C_{33}	C_{34}	Weights
C_{31}	1	4.00	5.00	7.00	0.588392
C_{32}	0.25	1	4.00	5.00	0.254858
C_{33}	0.20	0.25	1	3.00	0.104381
C_{34}	0.14	0.20	0.33	1	0.052370
Total					1.0000

λ_{max} = 4.242715, CI = 0.080905 and CR= 0.08989

Table-7
Pairwise comparison matrix for the Eyebrows (C_4) Main criterion with the associated sub-criteria(C_{41},C_{42}, C_{43}, C_{44},C_{45} ,C_{46} ,C_{47})

	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	Weights
C_{41}	1	3.00	4.00	5.00	6.00	5.00	8.00	0.383187
C_{42}	0.33	1	3.00	3.00	5.00	6.00	4.00	0.225969
C_{43}	0.25	0.33	1	3.00	6.00	5.00	6.00	0.16855
C_{44}	0.20	0.33	0.33	1	4.00	6.00	4.00	0.108303
C_{45}	0.17	0.20	0.17	0.25	1	3.00	2.00	0.048675
C_{46}	0.20	0.17	0.20	0.17	0.33	1	2.00	0.035604
C_{47}	0.12	0.25	0.17	0.25	0.50	0.50	1	0.029711
							Total	1.0000

λ_{max} = 7.789 , CI = 0.1315 and CR= 0.09962

Table-8
Pairwise comparison matrix for the Eyes (C_5) Main criterion with the associated sub-criteria(C_{51}, C_{52}, C_{53}, C_{54},C_{55} , C_{56})

	C_{51}	C_{52}	C_{53}	C_{54}	C_{55}	C_{56}	Weights
C_{51}	1	3.00	5.00	6.00	6.00	9.00	0.453602
C_{52}	0.33	1	3.00	2.00	6.00	5.00	0.219808
C_{53}	0.20	0.33	1	4.00	4.00	5.00	0.155818
C_{54}	0.17	0.50	0.25	1	3.00	6.00	0.095250
C_{55}	0.17	0.17	0.25	0.33	1	3.00	0.047524
C_{56}	0.11	0.20	0.20	0.17	0.33	1	0.027998
						Total	1.00000

λ_{max} = 6.615707 , CI = 0.12314 and CR= 0.0993

Table-10
Pairwise comparison matrix for the Ears (C_7) Main criterion with the associated sub-criteria(C_{71}, C_{72})

	C_{71}	C_{72}	Weights
C_{71}	1	5.00	0.8333
C_{72}	0.20	1	0.1667
		Total	1.000

λ_{max} = 2.000 , CI = 0.00 and CR = 0.00

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Table-9
Pairwise comparison matrix for the Nose (C_6) Main criterion with the associated sub-criteria(C_{61}, C_{62}, C_{63}, C_{64}, C_{65}, C_{66})

	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	Weights
C_{61}	1	3.00	5.00	7.00	6.00	9.00	0.464416
C_{62}	0.33	1	3.00	2.00	6.00	5.00	0.219352
C_{63}	0.20	0.33	1	3.00	4.00	5.00	0.142581
C_{64}	0.14	0.50	0.33	1	3.00	5.00	0.093304
C_{65}	0.17	0.17	0.25	0.33	1	4.00	0.052421
C_{66}	0.11	0.20	0.20	0.20	0.25	1	0.027926
						Total	1.00000

λ_{max} =6.577101, CI = 0.1154202 and CR= 0.093080

Table-11
Pairwise comparison matrix for the Cheeks (C_8) Main criterion with the associated sub-criteria (C_{81}, C_{82}, C_{83})

	C_{81}	C_{82}	C_{83}	Weights
C_{81}	1	4.00	8.00	0.698571
C_{82}	0.25	1	5.00	0.237092
C_{83}	0.12	0.20	1	0.064337
			Total	1.000

λ_{max} = 3.094 , CI =0.047 and CR = 0.081

Table-12
Pairwise comparison matrix for the Mouth (C_9) Main criterion with the associated sub-criteria(C_{91}, C_{92}, C_{93}, C_{94})

	C_{91}	C_{92}	C_{93}	C_{94}	Weights
C_{91}	1	3.00	4.00	6.00	0.530269
C_{92}	0.33	1	4.00	5.00	0.293184
C_{93}	0.25	0.25	1	3.00	0.118442
C_{94}	0.17	0.20	0.33	1	0.058104
				Total	1.0000

λ_{max} = 4.210 , CI = 0.07 and CR= 0.077

Table-13
Pairwise comparison matrix for the Chin(C_{10}) Main criterion with the associated sub-criteria(C_{101}, C_{102})

	C_{101}	C_{102}	Weights
C_{101}	1	6.00	0.857143
C_{102}	0.17	1	0.142857
		Total	1.000

λ_{max} =2.000 , CI = 0.0 and CR = 0.0

Table-15
Pairwise comparison matrix for the shape of the face(C_{11}) sub-criterion of the General Information(C_1)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	6.00	8.00	0.60680
P2	0.25	1	4.00	6.00	0.25210
P3	0.17	0.25	1	3.00	0.09460
P4	0.12	0.17	0.33	1	0.04650
				Total	1.0000

λ_{max} = 4.21058, CI = 0.07019 and CR= 0.07798

Table-16
Pairwise comparison matrix for the gender(C_{12}) sub-criterion of the General Information(C_1)main

Table-17
Pairwise comparison matrix for the origin(C_{13}) sub-criterion of the General Information(C_1)main criterion

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criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	4.00	6.00	0.532305
P2	0.33	1	4.00	4.00	0.283872
P3	0.25	0.25	1	3.00	0.121556
P4	0.17	0.25	0.33	1	0.062268
				Total	1.0000

λ_{max} =4.215223, CI =0.071741 and CR=0.07971

	P1	P2	P3	P4	Weights
P1	1	3.00	3.00	8.00	0.519241
P2	0.33	1	4.00	5.00	0.295966
P3	0.33	0.25	1	4.00	0.136091
P4	0.12	0.20	0.25	1	0.048702
				Total	1.0000

λ_{max} =4.246736, CI =0.08225 and CR= 0.0914

Table-18
Pairwise comparison matrix for the age(C_{14}) sub-criterion of the General Information(C_1)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	5.00	7.00	0.591018
P2	0.25	1	4.00	3.00	0.237020
P3	0.20	0.25	1	3.00	0.110637
P4	0.14	0.33	0.33	1	0.061324
				Total	1.0000

λ_{max} =4.26656, CI =0.0889 and CR= 0.0988

Table-19
Total priorities of the General Information(C_1) main criterion

	C_{11}	C_{12}	C_{13}	C_{14}	Weights
P1	0.60680	0.532305	0.519241	0.591018	0.57810
P2	0.25210	0.283872	0.295966	0.237020	0.26412
P3	0.09460	0.121556	0.136091	0.110637	0.10706
P4	0.04650	0.062268	0.048702	0.061324	0.05071
Main	0.597658	0.193112	0.153368	0.055862	

Table-20
Pairwise comparison matrix for the Length (C_{21}) sub-criterion of the Hair(C_2)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	5.00	7.00	0.552533
P2	0.33	1	4.00	4.00	0.271826
P3	0.20	0.25	1	4.00	0.121313
P4	0.14	0.25	0.25	1	0.054328
				Total	1.0000

λ_{max} = 4.262069 , CI =0.08736 and CR= 0.09706

Table-21
Pairwise comparison matrix for the Texture (C_{22}) sub-criterion of the Hair(C_2)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	4.00	7.00	0.573457
P2	0.25	1	3.00	5.00	0.244247
P3	0.25	0.33	1	4.00	0.131764
P4	0.14	0.20	0.25	1	0.050532
				Total	1.0000

λ_{max} = 4.239711, CI =0.07990and CR= 0.08878

Table-22
Pairwise comparison matrix for the Colour (C_{23}) sub-criterion of the Hair(C_2)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	5.00	8.00	0.593269
P2	0.25	1	3.00	5.00	0.232858
P3	0.20	0.33	1	5.00	0.128965
P4	0.12	0.20	0.20	1	0.044909
				Total	1.0000

λ_{max} = 4.262618, CI =0.08754 and CR= 0.0973

Table-23
Total priorities of the Hair(C_2) main criterion

	C_{21}	C_{22}	C_{23}	Weights
P1	0.552533	0.573457	0.593269	0.56292
P2	0.271826	0.244247	0.232858	0.25986
P3	0.121313	0.131764	0.128965	0.12501
P4	0.054328	0.050532	0.044909	0.05221
Main	0.614395	0.26839	0.117215	

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Table-24
Pairwise comparison matrix for the Width (C_{31}) sub-criterion of the Forehead area(C_3)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	5.00	8.00	0.551772
P2	0.33	1	4.00	6.00	0.283872
P3	0.20	0.25	1	5.00	0.121334
P4	4	0.12	0.17	0.20	0.043023
				Total	1.0000

λ_{max} = 4.266844, CI =0.088948 and CR= 0.098831

Table-25
Pairwise comparison matrix for the Height (C_{32}) sub-criterion of the Forehead area(C_3)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	4.00	7.00	0.534701
P2	0.33	1	4.00	4.00	0.280771
P3	0.25	0.25	1	4.00	0.129679
P4	0.14	0.25	0.25	1	0.054848
				Total	1.0000

λ_{max} = 4.263568, CI =0.087856 and CR= 0.097617

Table-26
Pairwise comparison matrix for the Shape (C_{33}) sub-criterion of the Forehead area(C_3)main criterion

	P1	P2	P3	P4	Weights
P1	1	5.00	4.00	9.00	0.612457
P2	0.20	1	3.00	5.00	0.219723
P3	0.25	0.33	1	4.00	0.123823
P4	0.11	0.20	0.25	1	0.043996
				Total	1.0000

λ_{max} =4.24911,CI =0.083036 and CR= 0.092262

Table-27
Pairwise comparison matrix for the Skin (C_{34}) sub-criterion of the Forehead area(C_3)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	4.00	8.00	0.546514
P2	0.33	1	3.00	4.00	0.256159
P3	0.25	0.33	1	5.00	0.147064
P4	0.12	0.25	0.20	1	0.050264
				Total	1.0000

λ_{max} =4.218363, CI =0.0727876 and CR= 0.080875

Table-28
Total priorities of the Forehead area(C_3) main criterion

	C_{31}	C_{32}	C_{33}	C_{34}	Weights
P1	0.551772	0.534701	0.612457	0.546514	0.553481
P2	0.283872	0.280771	0.219723	0.256159	0.274935
P3	0.121334	0.129679	0.123823	0.147064	0.125068
P4	0.043023	0.054848	0.043996	0.050264	0.046518
Main	0.588392	0.254858	0.104381	0.052370	

Table-29
Pairwise comparison matrix for the Length (C_{41}) sub-criterion of the Eyebrows(C_4)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	5.00	9.00	0.596523
P2	0.25	1	3.00	7.00	0.242922
P3	0.20	0.33	1	5.00	0.121805
P4	0.11	0.14	0.20	1	0.03875
				Total	1.0000

λ_{max} = 4.234634, CI = 0.078211 and CR= 0.086901

Table-30
Pairwise comparison matrix for the Direction (C_{42}) sub-criterion of the Eyebrows(C_4)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	4.00	9.00	0.544229
P2	0.33	1	4.00	7.00	0.296232

Table-31
Pairwise comparison matrix for the Distance between the eyebrows (C_{43}) sub-criterion of the Eyebrows(C_4)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	6.00	9.00	0.569046
P2	0.33	1	4.00	8.00	0.284935

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P3	0.25	0.25	1	4.00	0.118027
P4	0.11	0.14	0.25	1	0.041511
				Total	1.0000

λ_{max} =4.186962 , CI =0.062321 and CR=0.069245

P3	0.17	0.25	1	5.00	0.108777
P4	0.11	0.12	0.20	1	0.037242
				Total	1.0000

λ_{max} =4.238254, CI =0.079418and CR= 0.0882422

Table-32
Pairwise comparison matrix for the Position(C_{44}) sub-criterion of the Eyebrows(C_4)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	5.00	8.00	0.596127
P2	0.25	1	3.00	6.00	0.240818
P3	0.20	0.33	1	4.00	0.118133
P4	0.12	0.17	0.25	1	0.044922
				Total	1.0000

λ_{max} = 4.209651, CI = 0.069883 and CR= 0.077648

Table-33
Pairwise comparison matrix for the Shape(C_{45}) sub-criterion of the Eyebrows(C_4)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	5.00	7.00	0.588226
P2	0.25	1	3.00	6.00	0.244153
P3	0.20	0.33	1	4.00	0.119975
P4	0.14	0.17	0.25	1	0.047646
				Total	1.0000

λ_{max} = 4.247203, CI = 0.082401 and CR= 0.091557

Table-34
Pairwise comparison matrix for the Thickness(C_{46}) sub-criterion of the Eyebrows(C_4)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	6.00	9.00	0.611492
P2	0.25	1	3.00	8.00	0.243823
P3	0.17	0.33	1	4.00	0.105737
P4	0.11	0.12	0.25	1	0.038948
				Total	1.0000

λ_{max} =4.205749, CI =0.068583 and CR= 0.0762033

Table-35
Pairwise comparison matrix for the Color(C_{47}) sub-criterion of the Eyebrows(C_4)main criterion

	P1	P2	P3	P4	Weights
P1	1	5.00	5.00	8.00	0.622441
P2	0.20	1	3.00	7.00	0.229777
P3	0.20	0.33	1	3.00	0.103137
P4	0.12	0.14	0.33	1	0.044645
				Total	1.0000

λ_{max} =4.248166, CI =0.082722and CR= 0.0919133

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Table-36
Total priorities of the Eyebrows(C_4) main criterion

	C_{41}	C_{42}	C_{43}	C_{44}	C_{45}	C_{46}	C_{47}	Weights
P1	0.596523	0.544229	0.569046	0.596127	0.588226	0.611492	0.622441	0.58093059
P2	0.242922	0.296232	0.284935	0.240818	0.244153	0.243823	0.229777	0.26152303
P3	0.121805	0.118027	0.108777	0.118133	0.119975	0.105737	0.103137	0.11714180
P4	0.03875	0.041511	0.037242	0.044922	0.047646	0.038948	0.044645	0.04040334
Main	0.383187	0.225969	0.16855	0.108303	0.048675	0.035604	0.029711	

Table-37
Pairwise comparison matrix for the Shape of the lower eyelid(C_{51}) sub-criterion of the Eyes(C_5)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	4.00	5.00	0.519167
P2	0.33	1	4.00	5.00	0.297705
P3	0.25	0.25	1	3.00	0.120534
P4	0.20	0.20	0.33	1	0.062594
				Total	1.0000

λ_{max} =4.251936, CI =0.089398 and CR= 0.0933096

Table-38
Pairwise comparison matrix for the Distance between eyelids (C_{52}) sub-criterion of the Eyes(C_5)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	5.00	8.00	0.598293
P2	0.25	1	3.00	5.00	0.233614
P3	0.20	0.33	1	4.00	0.120748
P4	0.12	0.20	0.25	1	0.047344
				Total	1.0000

λ_{max} =4.204092, CI =0.068031 and CR= 0.0755896

Table-39
Pairwise comparison matrix for the Fissures length(C_{53}) sub-criterion of the Eyes(C_5)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	4.00	9.00	0.545533
P2	0.33	1	3.00	6.00	0.26831
P3	0.25	0.33	1	6.00	0.145781
P4	0.11	0.17	0.17	1	0.040375
				Total	1.0000

λ_{max} =4.210579 , CI =0.070193 and CR= 0.0779922

Table-40
Pairwise comparison matrix for the Direction of the fissures(C_{54}) sub-criterion of the Eyes(C_5)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	4.00	9.00	0.53665
P2	0.33	1	5.00	7.00	0.31234
P3	0.25	0.20	1	4.00	0.110437
P4	0.11	0.14	0.25	1	0.040573
				Total	1.0000

λ_{max} =4.249789, CI =0.083263 and CR= 0.092514

Table-42
Pairwise comparison matrix for the Color(C_{56}) sub-criterion of the Eyes(C_5)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	5.00	9.00	0.593514
P2	0.25	1	4.00	7.00	0.261101
P3	0.20	0.25	1	4.00	0.105538
P4	0.11	0.14	0.25	1	0.039847
				Total	1.0000

λ_{max} = 4.253167, CI = 0.084389 and

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Table-41
Pairwise comparison matrix for the Inter eye distance(C_{55}) sub-criterion of the Eyes(C_5)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	4.00	8.00	0.550322
P2	0.33	1	3.00	5.00	0.265466
P3	0.25	0.33	1	4.00	0.134757
P4	0.12	0.20	0.25	1	0.049455
				Total	1.0000

λ_{max} =4.145518, CI =0.048506and CR= 0.0538955

CR=0.093766

Table-43
Total priorities of the Eyes(C_5) main criterion

	C_{51}	C_{52}	C_{53}	C_{54}	C_{55}	C_{56}	Weights
P1	0.519167	0.598293	0.545533	0.53665	0.550322	0.593514	0.54589526
P2	0.297705	0.233614	0.26831	0.31234	0.265466	0.261101	0.27787403
P3	0.120534	0.120748	0.145781	0.110437	0.134757	0.105538	0.12380931
P4	0.062594	0.047344	0.040375	0.040573	0.049455	0.039847	0.05242102
Main	0.453602	0.219808	0.155818	0.095250	0.047524	0.027998	

Table-44
Pairwise comparison matrix for the Length(C_{61}) sub-criterion of the Nose(C_6)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	5.00	7.00	0.564963
P2	0.33	1	3.00	5.00	0.262229
P3	0.20	0.33	1	3.00	0.117523
P4	0.14	0.20	0.33	1	0.055284
				Total	1.0000

λ_{max} =4.117188, CI =0.039063 and CR= 0.043403

Table-45
Pairwise comparison matrix for the Width(C_{62}) sub-criterion of the Nose(C_6)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	6.00	9.00	0.608675
P2	0.25	1	4.00	6.00	0.248474
P3	0.17	0.25	1	4.00	0.101436
P4	0.11	0.17	0.25	1	0.041414
				Total	1.0000

λ_{max} =4.245261, CI =0.081754 and CR= 0.09084

Table-46
Pairwise comparison matrix for the Width of the nasal bridge(C_{63}) sub-criterion of the Nose(C_6)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	5.00	8.00	0.565588
P2	0.33	1	3.00	4.00	0.247473
P3	0.20	0.33	1	5.00	0.137364
P4	0.12	0.25	0.20	1	0.049575
				Total	1.0000

λ_{max} =4.228285, CI =0.076095 and CR=

Table-47
Pairwise comparison matrix for the Shape of the nasal bridge(C_{64}) sub-criterion of the Nose(C_6)main criterion

	P1	P2	P3	P4	Weights
P1	1	5.00	8.00	9.00	0.666656
P2	0.20	1	3.00	5.00	0.198234
P3	0.12	0.33	1	3.00	0.089863
P4	0.11	0.20	0.33	1	0.045247
				Total	1.0000

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0.08455

λ_{max} =4.175284, CI =0.058428 and CR= 0.06492

Table-48
Pairwise comparison matrix for the Shape of the nasal tip(C_{65}) sub-criterion of the Nose(C_6)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	8.00	9.00	0.63017
P2	0.25	1	4.00	6.00	0.236777
P3	0.12	0.25	1	4.00	0.092347
P4	0.11	0.17	0.25	1	0.040706
				Total	1.0000

λ_{max} =4.256756, CI =0.085585 and CR= 0.09509

Table-49
Pairwise comparison matrix for the Nostrils(C_{66}) sub-criterion of the Nose(C_6)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	8.00	7.00	0.627165
P2	0.25	1	3.00	6.0	0.229046
P3	0.12	0.33	1	3.00	0.094287
P4	0.14	0.17	0.33	1	0.049502
				Total	1.0000

λ_{max} =4.216106, CI =0.072035 and CR= 0.080039

Table-50
Total priorities of the Nose(C_6) main criterion

	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}	C_{66}	Weights
P1	0.564963	0.608675	0.565588	0.666656	0.63017	0.627165	0.58928406
P2	0.262229	0.248474	0.247473	0.198234	0.236777	0.229046	0.24887601
P3	0.117523	0.101436	0.137364	0.089863	0.092347	0.094287	0.11227381
P4	0.055284	0.041414	0.049575	0.045247	0.040706	0.049502	0.04956544
Main	0.464416	0.219352	0.142581	0.093304	0.052421	0.027926	

Table-51
Pairwise comparison matrix for the Protrusion (C_{71}) sub-criterion of the Ears(C_7)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	8.00	6.00	0.621407
P2	0.25	1	3.00	5.00	0.224424
P3	0.12	0.33	1	3.00	0.098396
P4	0.17	0.20	0.33	1	0.055773
				Total	1.0000

λ_{max} = 4.249957, CI =0.083319and CR= 0.092577

Table-52
Pairwise comparison matrix for the Length(C_{72}) sub-criterion of the Ears(C_7)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	7.00	7.00	0.609893
P2	0.25	1	4.00	6.00	0.249818
P3	0.14	0.25	1	3.00	0.091287
P4	0.14	0.17	0.33	1	0.049002
				Total	1.0000

λ_{max} = 4.248707, CI =0.082902 and CR= 0.0921137

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Table-53
Total priorities of the Ears(C_7) main criterion

	C_{71}	C_{72}	Weights
P1	0.564963	0.608675	0.395892
P2	0.262229	0.248474	0.176287
P3	0.117523	0.101436	0.076830
P4	0.055284	0.041414	0.034759
Main	0.464416	0.219352	

Table-54
Pairwise comparison matrix for the Fullness(C_{81}) sub-criterion of the Cheeks(C_8)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	5.00	9.00	0.593514
P2	0.25	1	4.00	7.00	0.261101
P3	0.20	0.25	1	4.00	0.105538
P4	0.11	0.14	0.25	1	0.039847
				Total	1.0000

λ_{max} = 4.253167, CI =0.0842389 and CR=0.093766

Table-55
Pairwise comparison matrix for the Length of the bones(C_{82}) sub-criterion of the Cheeks(C_8)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	6.00	9.00	0.569046
P2	0.33	1	4.00	8.00	0.284935
P3	0.17	0.25	1	5.00	0.108777
P4	0.11	0.12	0.20	1	0.037242
				Total	1.0000

λ_{max} = 4.238254, CI =0.079418 and CR= 0.088242

Table-56
Pairwise comparison matrix for the Width of the bones (C_{83}) sub-criterion of the Cheeks(C_8)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	6.00	8.00	0.606800
P2	0.25	1	4.00	6.00	0.252065
P3	0.17	0.25	1	3.00	0.094603
P4	0.12	0.17	0.33	1	0.046532
				Total	1.0000

λ_{max} = 4.21058 , CI =0.070193 and CR= 0.07799

Table-57
Total priorities of the Cheeks(C_8) main criterion

	C_{81}	C_{82}	C_{83}	Weights
P1	0.593514	0.569046	0.606800	0.588568
P2	0.261101	0.284935	0.252065	0.266171
P3	0.105538	0.108777	0.094603	0.105602
P4	0.039847	0.037242	0.046532	0.039659
Main	0.698571	0.237092	0.064337	

Table-58
Pairwise comparison matrix for the Shape of the opening between lips(C_{91}) sub-criterion of the Mouth(C_9)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	4.00	8.00	0.581322
P2	0.25	1	3.00	5.00	0.241059
P3	0.25	0.33	1	4.00	0.129845
P4	0.12	0.20	0.25	1	0.047774
				Total	1.0000

λ_{max} =4.209656, CI =0.06989 and CR= 0.077650

Table-59
Pairwise comparison matrix for the Fullness(C_{92}) sub-criterion of the Mouth(C_9)main criterion

	P1	P2	P3	P4	Weights
P1	1	5.00	5.00	7.00	0.619418
P2	0.20	1	3.00	5.00	0.219497
P3	0.20	0.33	1	3.00	0.109015

Table-60
Pairwise comparison matrix for the Width(C_{93}) sub-criterion of the Mouth(C_9)main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	6.00	7.00	0.606537
P2	0.25	1	3.00	4.00	0.221627
P3	0.17	0.33	1	4.00	0.118955

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P4	0.14	0.20	0.33	1	0.052071
				Total	1.0000
λ_{max} =4.240322, CI =0.08011and CR= 0.089008					

P4	0.14	0.25	0.25	1	0.052881
				Total	1.0000
λ_{max} =4.248708, CI =0.082903and CR= 0.092114					

Table-61
Pairwise comparison matrix for the Width of the philtrum(C_{94}) sub-criterion of the Mouth(C_9)main criterion

	P1	P2	P3	P4	Weights
P1	1	3.00	5.00	6.00	0.561169
P2	0.33	1	3.00	3.00	0.243984
P3	0.20	0.33	1	3.00	0.126258
P4	0.17	0.33	0.33	1	0.068589
				Total	1.0000
λ_{max} =4.162648, CI =0.054216 and CR= 0.06024					

Table-62
Total priorities of the Mouth(C_9) main criterion

	C_{91}	C_{92}	C_{93}	C_{94}	Weights
P1	0.581322	0.619418	0.606537	0.561169	0.5943061
P2	0.241059	0.219497	0.221627	0.243984	0.23260551
P3	0.129845	0.109015	0.118955	0.126258	0.1222396
P4	0.047774	0.052071	0.052881	0.068589	0.05084808
Main	0.530269	0.293184	0.118442	0.058104	

Table-63
Pairwise comparison matrix for the Shape(C_{101}) sub-criterion of the Chin(C_{10})main criterion

	P1	P2	P3	P4	Weights
P1	1	4.00	6.00	9.00	0.621362
P2	0.25	1	3.00	4.00	0.216313
P3	0.17	0.33	1	4.00	0.114740
P4	0.11	0.25	0.25	1	0.047585
				Total	1.0000
λ_{max} = 4.18966, CI =0.06322 and CR= 0.070244					

Table-64
Pairwise comparison matrix for the Size(C_{102}) sub-criterion of the Chin(C_{10})main criterion

	P1	P2	P3	P4	Weights
P1	1	6.00	7.00	8.00	0.668747
P2	0.17	1	3.00	5.00	0.191840
P3	0.14	0.33	1	3.00	0.092419
P4	0.12	0.20	0.33	1	0.046994
				Total	1.0000
λ_{max} = 4.250838, CI =0.083613 and CR= 0.092903					

Table - 65
Total priorities of the Chin(C_{10}) main criterion

	C_{101}	C_{102}	Weights
P1	0.621362	0.668747	0.62813128
P2	0.216313	0.191840	0.21281686
P3	0.114740	0.092419	0.11155129
P4	0.047585	0.046994	0.04750057
Main	0.857143	0.142857	

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