A Comparative Study of photometric and Semantic based Face Recognition Analysis Techniques

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Abstract: Image processing is a dynamic field and face recognition techniques are computer applications which mechanically verify the shape of an object from the source file. By comparing the selected facial features from the source file stored in a database we will get some resemblances. Different techniques are used in facial matching but this research is comparative study of geometric or photometric technique, which is statistical approach that purifies an image into values and comparing the values with source file to eliminate variances. Second approach is semantic based approach. This technique is dynamic which uses 3-D sensors to take the information about the shape of a object. This information is then used to identify characteristic features on the surface of a face, such as the shape of the eye, nose, and chin etc. semantic based approach is for better than photometric because its results are mainly used in biological sciences, Aerospace and nuclear sciences which gives the best results as compared to the other techniques. [Journal of American Science 2010;6(10):400-404]. (ISSN: 1545-1003).

Keywords: semantic based model, 3D level, photometry

1. Introduction: Digital Image processing is multi dimensional field. One of its domains is facial recognition system which is computer-based safety systems which are able to automatically, sense and recognize human faces. These systems depend on a recognition algorithm, such as eigenface or the hidden Markov model [1]. The basic step for a facial recognition system is to identify a human face and extract it from the rest of the scene.

Secondly, the system measures points on the face, such as the space between the eyes, the shape of the cheekbones and other apparent features. These points are then compared to the points computed from a database of snaps in order to find a match. These systems are partial and based on the different angles of the face measured and the other constraints like darkness or lightening also has impact on its conditions.

Latest methodology is recently in progress to establish semantic based approach (SB Models) of an object based on digital snaps to measure more data for evaluation. However, this technology is essentially at risk to error, given that, the computer extracts the information (verbal information of face object like nose, chin, forehead, hair etc) and match these features to target one. Compare the characteristic of source and target file and make the difference between these two objects. It is observed that human eye can perceive in different way but computer can measure the difference accurate and precise way [2,3].

2. Material and Methods: Some facial recognition algorithms recognize faces by extracting the facial characteristics, from an image of the subject's face. For example, an algorithm may examine the relative location, size, shape of the eyes, nose, cheekbones, and mouth. These features are then used to search for other images with matching features. Other algorithms control a face images and then compress the face data, only saving the data in the image that is useful for face recognition [4]. A search image is then compared with the face data. Basic feature of face matching is the template matching techniques applied to a set of prominent facial features, providing a sort of compressed face representation. Popular recognition algorithms include principal component Analysis which eigenface, Linear Discriminate Analysis, Elastic Bunch Graph Matching fisher face, the Hidden Markov model, and the neuronal motivated dynamic link matching.

2.2 Photometric Approach: Two techniques have been discussed. The photometric and the semantic - based approaches. The photometric approach relies on the input images in the presence of light and the geometric location of different angles. The photometric transformation is implemented on the source image, does not take into account photometric changes, i.e. changes in the pixel. These changes occur for example when lighting change between the

acquisitions of the two images are used incorporating a photometric [5].

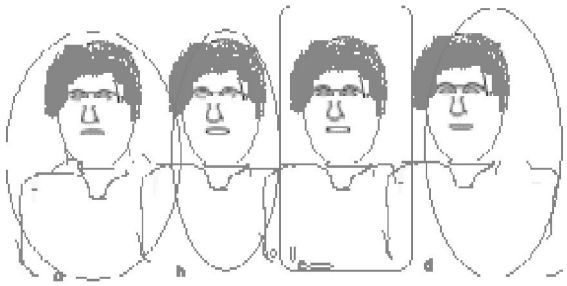


Figure 1

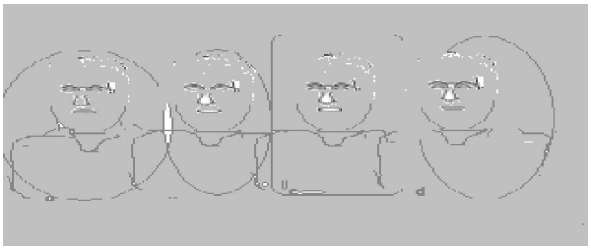


Figure 2

2.1 Photometric based Modeling

The purpose of photometric approach is to reduce the variation between the face in the real world surroundings and this model directly at the 3D level, and can be seen as a substitute and stylish technique to other 2D view (based techniques). Motivated by the reconstruction possibility of an arbitrary illuminated view, in the present study by applying photometric, vertical and angular measurements of men faces taken and compared with each other is the measurement of the properties of light, the study of light, especially color and the geometry of image.

2.3 Human eye detection:

The human eye is not uniformly responsive to all wavelengths of visible light. Photometry attempts are done by considering the wavelength of light with a factor that represents how responsive the eye is at that wavelength [7]. The consistent model of the eye's response to light as a function of wavelength is given by the shine function. Note that the eye has unusual responses as a function of wavelength when it is adapted to light conditions (photopic) and dark conditions (scotopic). Photometry is typically based on the eye's photopic response, and so photometric measurements may not accurately indicate the perceived brightness of sources in faint lighting conditions where colors are not visible in the darkness. The height of object in eye is measured by given formula:

15/100=h/17

H=2.25mm

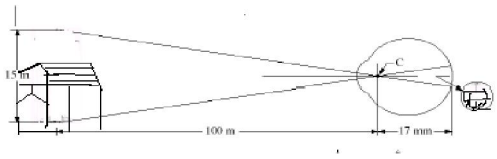


Figure 3

In photometric quantities every wavelength is weighted according to how sensitive the human eye is to it, while radiometric amount use unweighted complete power [10]. For example, the eye reacts much more powerfully to green light as compared to red, so a green light will have greater luminous flux than a red light with the same radiant flux. Radiant energy outside the visible range does not contribute to photometric quantities and color always exist between 0 and 1 range Composition as a Color function of x(red) and y (green) and z (blue). It is observed that in this approach image mostly depends upon the light and give better result in light as compared to darkness

Red X=X/X+Y+Z 0------1

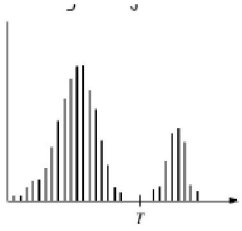
Green Y=Y/X+Y+Z 0------1

Blue Z /X+Y+Z 0------1

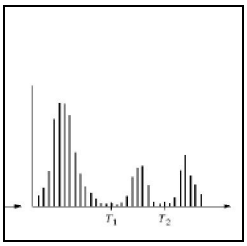
Z (blue) = 1- (x+y)

Green Pt: G (62% R (25%) and B (13%)

2.4 Threshold based Methods



a) image with dark background and a light objects



b) image with dark background and two light objects

Fig. 4 Image with dark background

2.5 Semantic Based facial Technique

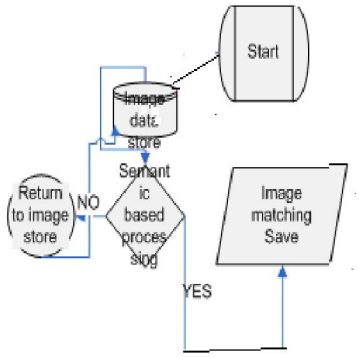


Figure 5: Semantic based Facial Model

We suggest a semantic face matching technique for managing user face image on the bases of his/her features. It is also called feature based facial recognition technique. Facial image depends upon semantic face attributes like, skin color, nose, eyes, hair these features are organized as a semantic face model and compared these features to the source image. It is observed that human eye can not detect the image difference accurately so for obtaining best result computer is involved. when we have to extract the particular image in database then we will give the query to system " image with black skin face color and small eyes" then it will generate the result particular to that one[6].

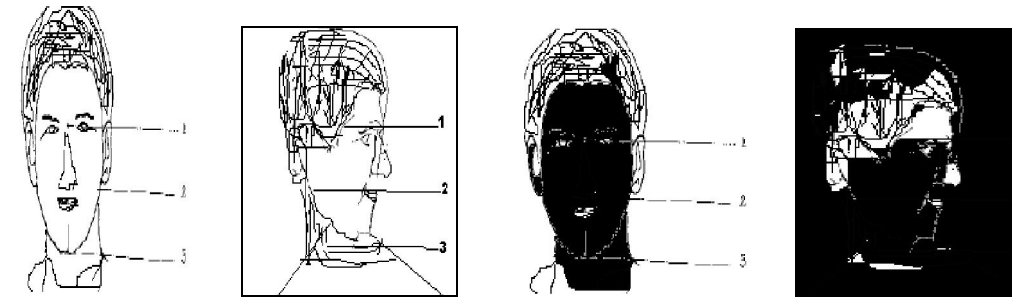
2.6 Semantic Based facial Model:

In semantic based model different images are stored in the database. From this repository different images data has been extracted on bases of semantic like skin color, eyebrow, forehead, nose lips etc.The extracted data from the database match the master file which is already stored in the data store [9]. There is decision time for system. If yes then save it and show the result otherwise return back to the database and finds the new image.

3. Results and Discussions:

3.1 Comparison between Photometric & Semantic based Techniques:

There are different face recognition techniques which are used in image processing but in this research we have comparison between photometric called static facial approach and the semantic based facial called dynamic approach. We have taken four images and the apply the both techniques on these images. Different results show that these techniques have their own characteristics [8]. It is not easy to say which one is better but on different scenarios it shows the importance of different technique. When we undergo the face recognition in light then photometry shows the best result but in darkness it is vice versa. When we matching the facial image on semantic based then it will give best result for large amount of data images but not 100% accurate. In this research we have assigned a specific weight for semantic features like nose hair, skin color and photometric based view also consider then given figures (a, b, c, d).



a **b** **c** **d**

Fig. 6

Consider the given formula calculate the values in semantic table1

f= features of the image

i=total number of features which are under observation i=1, 2, 3……n

We will used the formula to count the average values of the given features

$$\sum_{i=1}^{n} fi / n$$

3.2 Semantic based face features

Table 1

Face features	Semantic based face features			
Face color	Black=5	White=4	Reddish=3	Fair=4
Nose	Long=4.5	Wide=4	Small=3	Big=3.5
Lips	Thin=4	Thick=3.5	Small=3	Big=4
Eyes Color	Dark Brown=5	Light Brown=4	Black=3	Brown=3.5
Hair	Dark Black=4.5	Dark Brown=4	White=3.5	Curly=3

Average value of Semantic based face feature (Face color) =5+4+3+4/4=4

3.3 Photometric based Face Analysis Technique

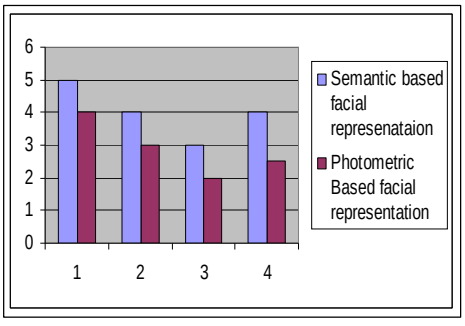
Table 2

Face Measurement	**Face Detection Measurement**			
Normal front face detection in light	Excellent=5	V.Good=4	Good=3	Fair=2.5
Side view face detection in light	V.Good=4.5	Good=3.5	Satisfactory=3	Fair=2.5
Normal front face detection darkness	V.Good= 4	Good= 3	Satisfactory=2.5	Fair=2
Side view face detection in darkness	V.Good =3	Good =2.5	Satisfactory=2	Fair=1.75

Average value of Normal front face detection in darkness =4+3+2.5+2/4=2.875

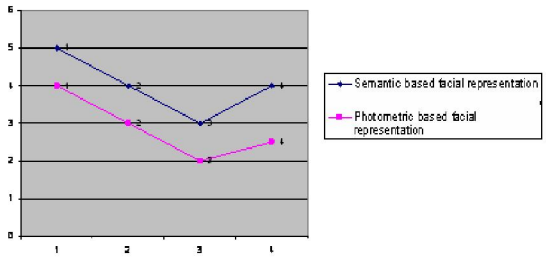
3.4 Statistical Analysis:

We compared the semantic based (Average value of Semantic based face feature e-g Face color) and photometric based (Normal front face detection in darkness) techniques and the result shows that semantic based technique is better as compared to photometric based technique

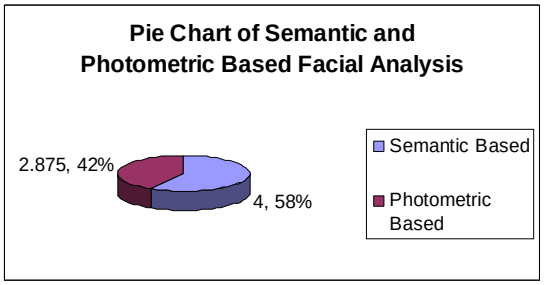


3.5 Statistical Analysis:

We compared the semantic based and Photometric based techniques in line graph and the result shows that semantic based technique is better as compared to Photometric based technique.



3.6 Statistical Analysis:
We compared the semantic based and photometric based techniques in Pie chart and the result shows that semantic based technique is better as compared to photometric based technique.



4. Conclusion:
In this study, we compared the semantic based facial with photometric based technique. By comparing these two techniques, it is showed that semantic based facial technique is better for performance point of view as compared to photometric based technique. The results showed that the semantic based facial technique has better performance in this research and the benchmark technique.

5. Future Work
This research focus on the semantic based facial technique and defined a comparison between semantic based facial and photometric based technique and derived a comparative best performance for these calculated results. For future Extension, this area requires the improvement in the semantic based implementation technique, like searching algorithms, Best search technique, Greedy Algorithm and specific image detection. on the bases of face model and geometry of the face image.

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