Determining the relation between the parents and offspring using SIFT and SURF algorithms

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Abstract: By using the SIFT and SURF algorithms and by further finding the distance between keypoints one can effectively find out whether a offspring is more matched to the father or the mother .There are many conventional methods of finding out the relationship between the family members but at the cost of the hardware part and heavy coding part and still the accuracy would never be 100%. The concept finding the more related parent to the offspring involves SIFT and SURF algorithms where in both are executed differently and different results were generated. Although the concepts were a bit different the whole idea is about finding out the Euclidean distance between the keypoints which are generated at the end of SIFT and SURF algorithms. By using the distance, we can find out using that distance the related one to the query image from the database set. This proposed system would give at least 75 to 80 percentage of accuracy and which could be achieved by any other hardware related system.

Keywords—Keypoints, mapping, Euclidean distance

Introduction

From the moment a child is born there is always a question on "How does he/she look like?" i.e. whether they resemble their father or mother more. Many anthropologists have tried to answer this question for many years. Although their results were 100% accurate the attempts were still made. There were many studies which shows the resemblance between parents and offsprings by using different methods which are usually complex.

In this proposed system, we are solely using software precisely SIFT and SURF. Usually, the SIFT algorithm is mainly used for matching two images and show that they are related. So can we use this for relating humans also? This is precisely the same study which allows SIFT to use human images and find the key points in the images. By using these key points, we will be finding the Euclidean distance between query image and the data base image. Now the required distance is compared with the other distances obtained. So if the distance is less then that particular query image and the data base image are more related.

In this paper, we have also done the study on the families which include twins. So by this we can also show that the distance between the twins key points would be much more less when compared to a father mother or a stranger. Given our proposed method we aim to answer the question from the perspective of a computer:

Do offspring resemble their mother or their father?

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I. RELATED WORKS

There has always been interesting kinship verification. There was a scientist who gave a simple solution to this problem by taking features like distance between facial parts or eye colour and also skin colour for verification. But there was also another scientist who proposed transfer learning between photos of parents one which is younger version and the other which is older version, and an image of a child. As the appearance similarity between parents and kids is large. Finally a method is also presented for this kinship verification using facial components also called as genetic features. But all of these doesnot answer the question we pose.

II. SIFT

SIFT which is also known as "Scale Invariant Feature Transform" is an algorithm which is used for locating local features in images. There are different levels from where this algorithm works. The datsbase which we use in this paper goes through all the levels as per the SIFT.

3.1 Scale space extrema detection:

In this section points of interest were detected which were also called as key points in SIFT keywords. Now the desired image is sent through Gaussian filters, each at different scales and the difference between all the Gaussian filters were taken. Maximum or minimum of the difference of Gaussian's are taken as key points. The mathematical formula for DoG image is given by

$$D(x, y, \sigma) = L(x, y, k_i\sigma) - L(x, y, k_j\sigma) \quad (1)$$

Hence we get the difference of Gaussian's between the scales $k_i\sigma$, $k_j\sigma$. After this keypoints are identified as local minima or maxima of DoG images. Each pixel in DoG images is compared to its eight neighbors and at the same scale and nine neighboring pixels in neighboring scales. If the pixel value is maximum or minimum among all compared pixels it is selected as a candidate key point, so after we get this key points the next step would be keypoint localization.

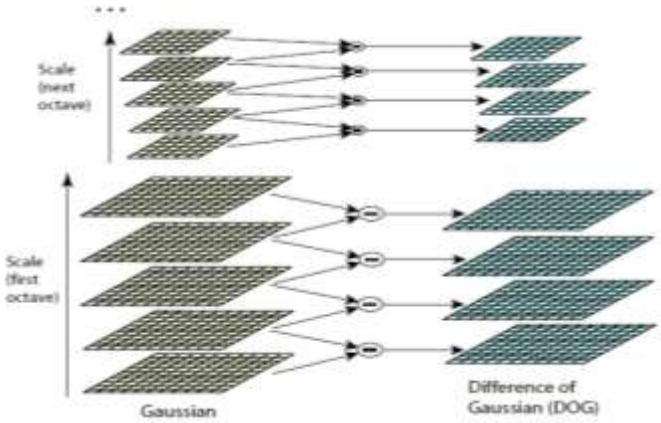

Figure 1: Difference of Gaussians

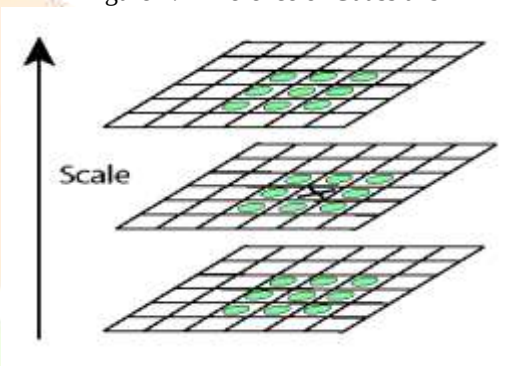

Figure 2 : Comparing the pixel with other pixels

3.2 Keypoint localization:

There are too many keypoints produced in the before step. But these many key points may hamper the efficiency of the system. In order to solve that issue the next step is keypoint localization which rejects the keypoints which have low contrast or keypoints which are on the edges.

3.3 Orientation assignment:

In this stage we get normal amounts of keypoints, these keypoints are assigned one or more orientations based on the local image gradient directions. The main aim of this step is to have invariance to rotation. The magnitude and direction calculations are done for every pixel in the neighboring region around the keypoint. The magnitude and the direction formulae are given as follows

$$m(x,y)= \sqrt{(L(x+1,y)-L(x-1,y))2+(L(x,y+1)-L(x,y-1))2} \quad (2)$$

$$\theta(x,y)= a\tan2\{(L(x,y+1)-L(x,y-1),L(x+1,y)-L(x-1,y)\} \quad (3)$$

Once the histograms are filled the orientation of highest peak points are considered as keypoint.

3.4 Keypoint descriptor:

In this step we get a descriptor vector for each key point. For this histogram with 4*4 pixel neighborhoods with 8 bins each are created. These histograms are calculated from magnitude and orientation values of samples. The descriptor then becomes the vector for all this values of histograms. SIFTY descriptors are invariant to minor affine changes. The distinctiveness SIFT descriptor are tested by measuring against varying number of keypoints in testing data base and the results show that matching accuracy decreases slightly for large databases.

3.5. EUCLIDEAN DISTANCE

Euclidian distance is nothing but the straight line distance between the two points i.e. by using this Euclidian distance in our paper indicates the distance between the keypoints generated in the SIFT algorithm. By measuring the distance between the facial features we are trying to measure the resemblance between the images. Euclidian distance between two keypoints p,q is mathematically calculated as

$$d(p,q) = \sqrt{(p_1 - q_1)2 + (p_2 - q_2)2} \quad (4)$$

III. SURF

This algorithm is superior version of SIFT . Though there are three steps in the process, in this study we have used a particular function to get the desired result. The function which we used is "detectSURFfeatures". This function returns a SURFPoints object, points, containing information about SURF features detected in the 2-D grayscale input image I. The detectSURFFeatures function implements the Speeded-Up Robust Features (SURF) algorithm to find blob features.

By using this function, we can get the SURF keypoints. By using this SURf keypoints we can find the distance between two images or more images. By using this distance, we can relate the who is more related to the child.

V. PROPOSED METHODOLGY AND SOFTWARE

The flow chart of the proposed system is shown in figure 3 . The flowchart consists of a database with nearly seventy five families which consists of images of father, mother and child. Next we have the coding part where the database of the image is selected family wise. For example in family number 1 we take the images of father mother and child an also a stranger. Now we make this images pass through the SIFT algorithm. Therefore every image goes through the above mentioned steps in the SIFT algorithm. After getting the keypoints from the query images we calculate the Euclidian distance between the child image and the father image and between child image and mother image and between the stranger image and the child image. We check the results of the distance that is if the distance is less between the two images then those two images are more similar

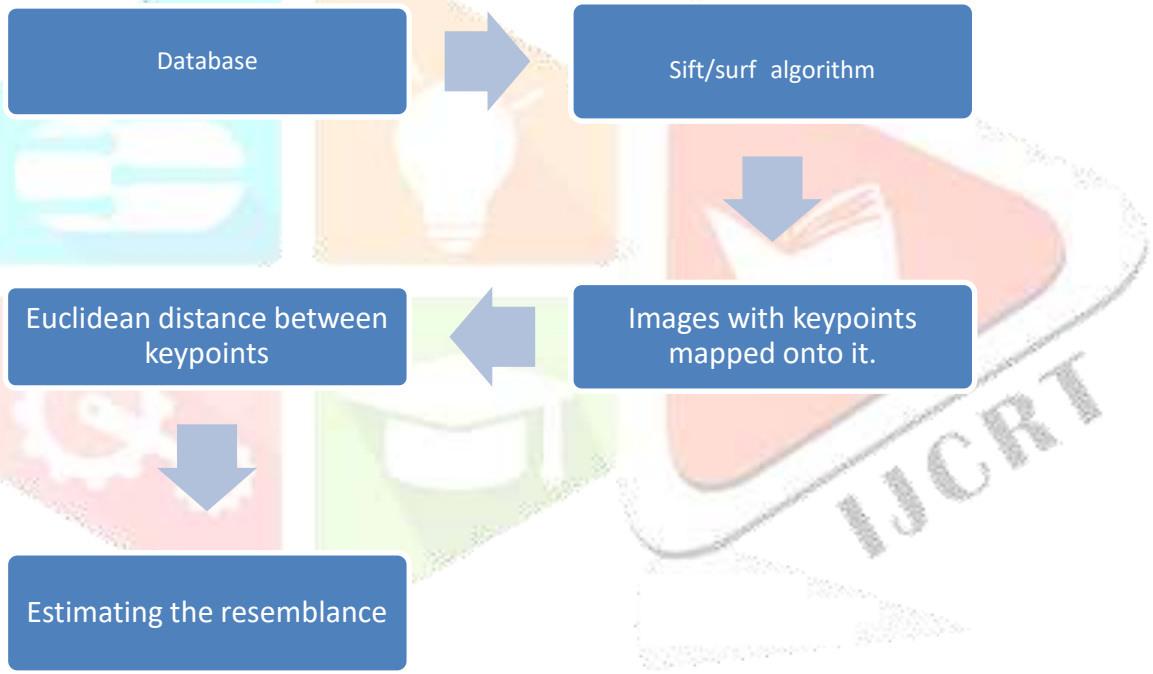

Figure 3: flow chart

VI. RESULTS AND DISCUSSION

The Sift results are computed for seventy families with a father mother and a child. The blue line is higher than other lines as we can see and it depicts the fact that the distance between the stranger and a child is more therefore the resemblance is less.

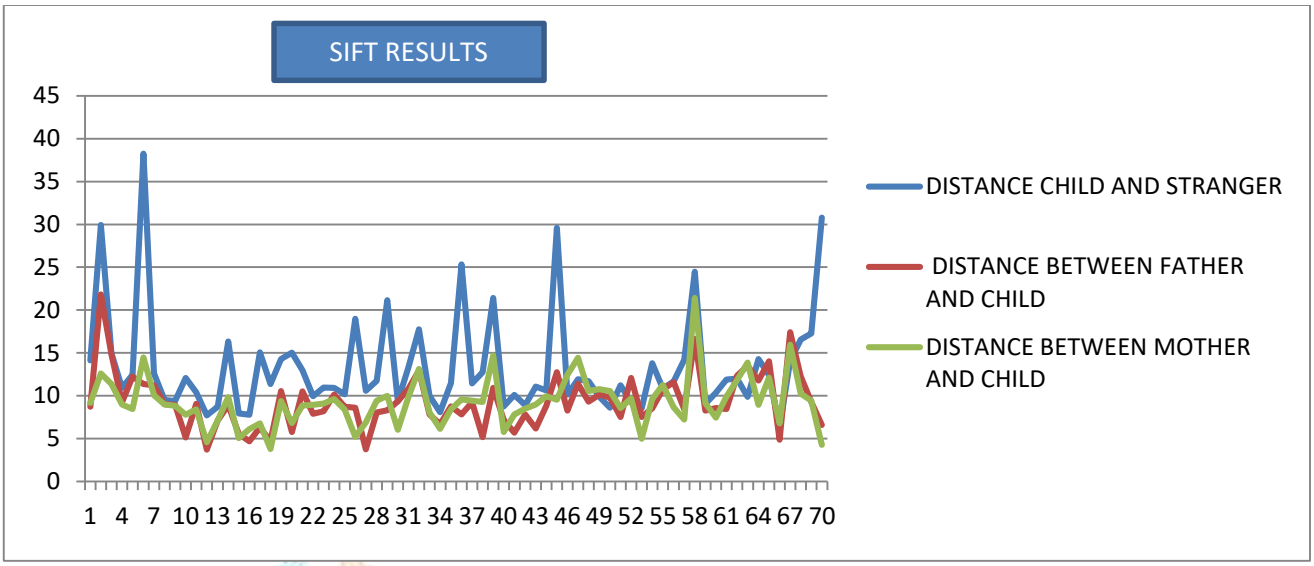

Figure 4

Simulataneously, the same has been computed for SURF. In SURF, we can see some cases where the disatnce between mother and child is high. The accuracy in those cases is not good enough.

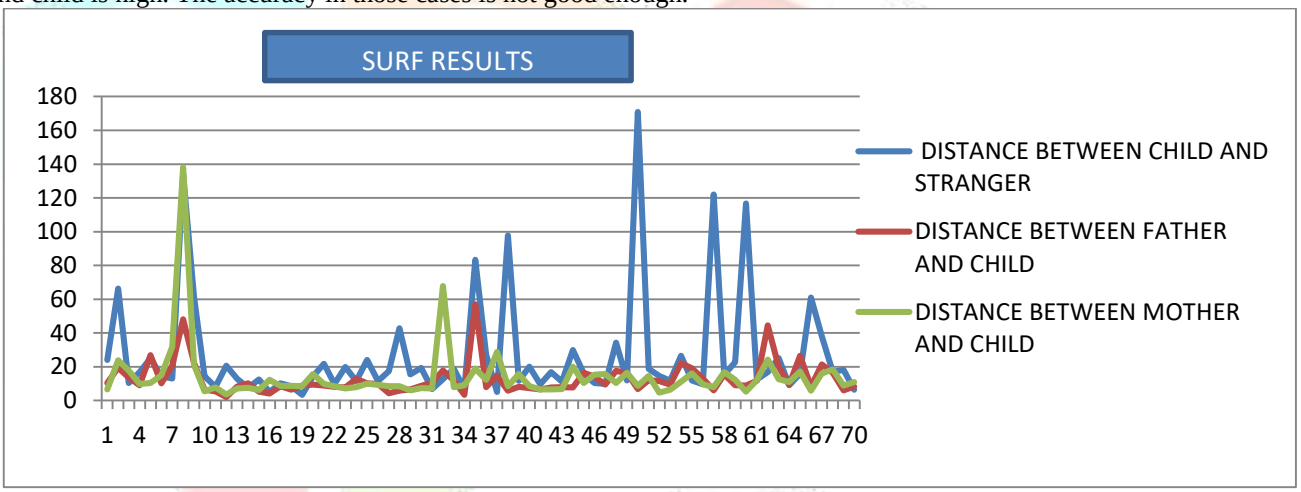

Figure 5

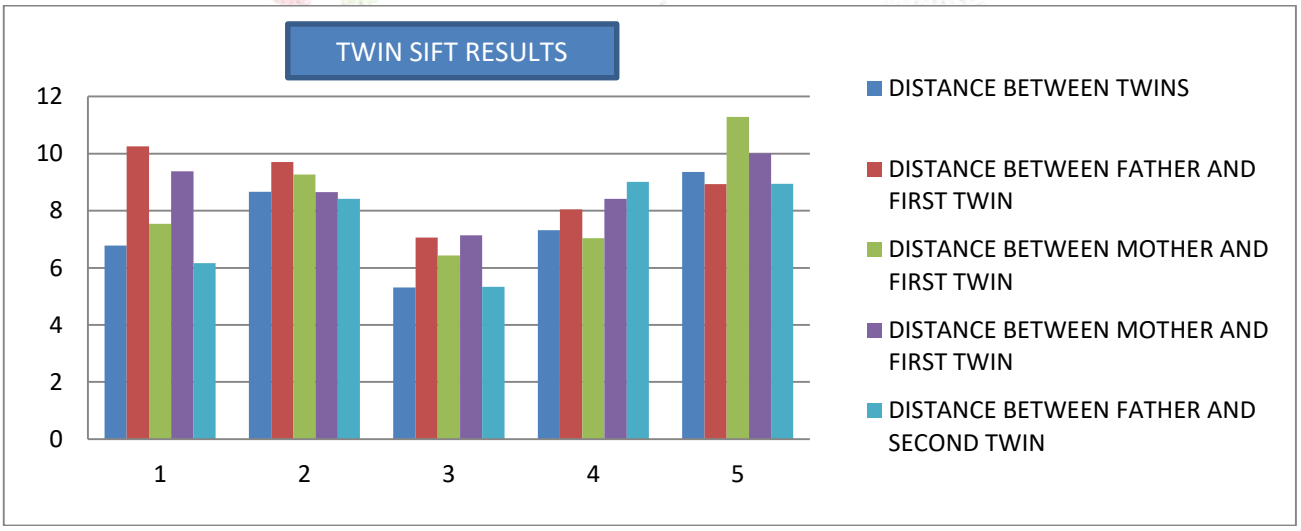

Figure 6

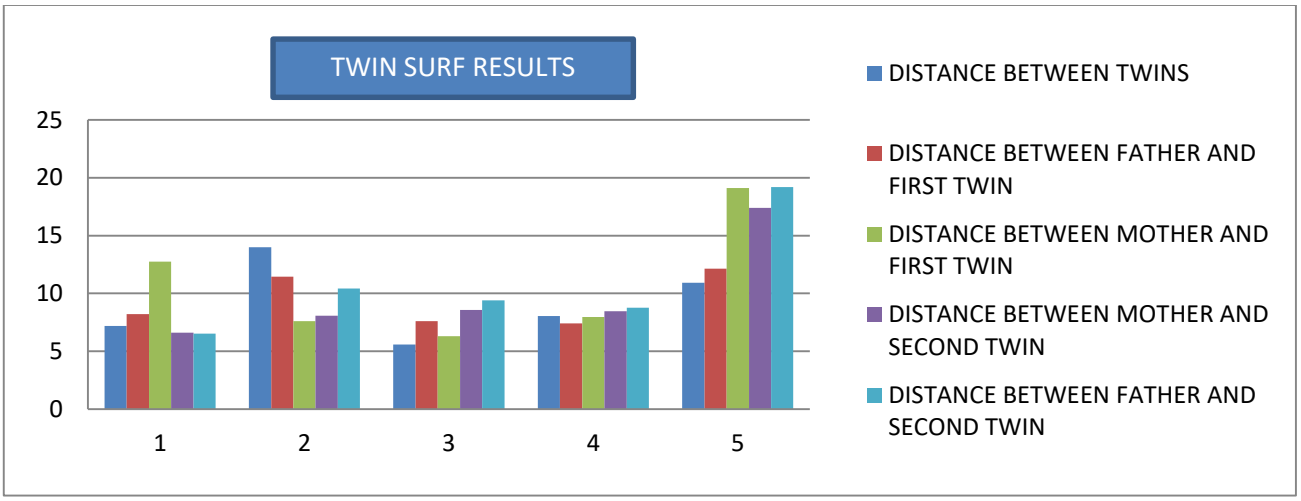

Figure 7

The next two results that we computed are between the twin families. In this, we computed the distance between twins and their respective mother and father. Here, we can see that the distance between the twins is less means they are more similar. The twins we used here are identical twins.

VII.CONCLUSION

From using the Euclidean distance, we can get the results at a satisfactorily level, although this is not 100% accurate. The concept of getting the answer to the question "who does the offspring resemblance to?" without using any hardware device in particular is proposed in this paper. There could also be other sophisticated algorithms which could elevate the results at a higher rate. Anyway, this proposed method could greatly reduce the conventional method of finding the resemblance.

VIII. REFERENCES

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