PROPOSED MATHEMATICAL MODEL FOR FACE RECOGNIZATION OF A HUMAN FROM LOWER JAW OR MANDIBLE

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ABSTRACT:

Identify a human by his face is a very easy job for a human but it is most difficult job for a machine. These papers presenting some approaches for recognize a human face from skull. Then a totally new conception is introduced here to recognize a person by the help of the lower jaw or mandible of that person. Then a mathematical model is proposed here. This proposed mathematical model, is developed for the first time, in the field of image processing. This proposed mathematical model will try to find out the solution of the problem.

1. INTRODUCTION:

Human face is a very interesting thing. It always attract artists, poets and of course scientists. It is a part of bio-metrics verification also. The main motive of bio-metrics verification is to identify a person uniquely by his unique biological traits or features. But the question arise here "why we try to identify a person?" one of the answer is to recognize that person that`s mean "who is this person?" and another answer is "security". Answer may be different but a question arise here "how?". Several researchers define several types of answer. Some of the researchers try to solve this problem with the help of human skull. In this paper those techniques are describe. After that a completely new technique is introduced.
Now a day the electronic access control, internet banking, banking transaction security, ATM, information security, parole ID and others needs a unique identification of the accessing user. The solution for this security is a strong password. But the problem is that the hackers, crackers can easily manage to break any password. In this situation another identification of the user is needed and that identification will contain a unique biological property which will not be copied by any one.

By those unique biological features the computer system may be able to identify a particularly a person uniquely.

2. RELATED WORK:

Hamdan.O.Alanazi, B.B Zaidan, A.A Zaidan, published a paper on "3D skull recognition using 3D matching technique"[1], where they proposed a technique to recognize a person with the picture of the skull of this person. Here they used a 3D detection technique for recognizing the skull.
In their research project they choose a 3D square for matching. In the second stage they choose a 3D human skull. They choose three different points in the skull and then try to calculate the number of matching pixel. By this process they try to locate a particular human or a particular person.

Shihab A Hameed, B. B. Zaidan, A.A. Zaidan, A.W Naji and Omar Farooq published a paper named "Novel simulation Framework of three-dimensional Skull bio-metric Measurement" [2], where they showed how a 3D image of a person can be recognized using simulated system.
In their research project they choose a 3D skull for matching. For this simulation they use Canfield Imaging Systems. This system provide a environment where the researchers can simulate a 3D skull for visualize, analyze and measure different property of that particular skull. In their research they took a 3D skull and match it with another 3D skull. If both skull match then those skulls actually same skull.

Zane Krisjane, Ilga Urtane, Gaida Krumina, Anvita Bieza, Katrina Zepa, Irena RoGovska published a paper named "Condylar and mandibular morphological criteria in the 2D and 3D MSCT imaging for patients with class II division I subdivision malocclusion"[3] where they try to develop an algorithm valid for the quantification of morphological structure and skeletal landmarks of

the condyle, processus condylaris and mandible in patient with class II division I subdivision malocclusion.
In their research they use 2D MSCT and 3D MSCT (Multislice Computed Tomography) imaging system. By the help of this system they measure different type of distance of mandible.

3. ACTUAL PROBLEM:

In this paper a well known problem is defined. Till now the researchers try to identify a person from the digital picture of that person. That picture may be 2D(two dimensional) or 3D(three dimensional). Some researchers try to use the picture of the skull of human for recognition of a person. In this paper a particular portion of the skull is selected that is lower jaw or mandible to identify a person.

4. CONTRIBUTION:

Identification of human face is a problem to a machine. A human being can easily identify a person but a machine cannot identify a person. Many researchers develop many methods to identify or recognize a person by a machine. Some of the researchers choose human face for this purpose. Some of the researchers choose human skull for recognition purpose. Here we choose a certain portion of human skull called lower jaw or mandible. The shape of the lower jaw or mandible is different for each human. So if we can calculate the shape of the mandible of a person then we can easily identify or recognize that person.

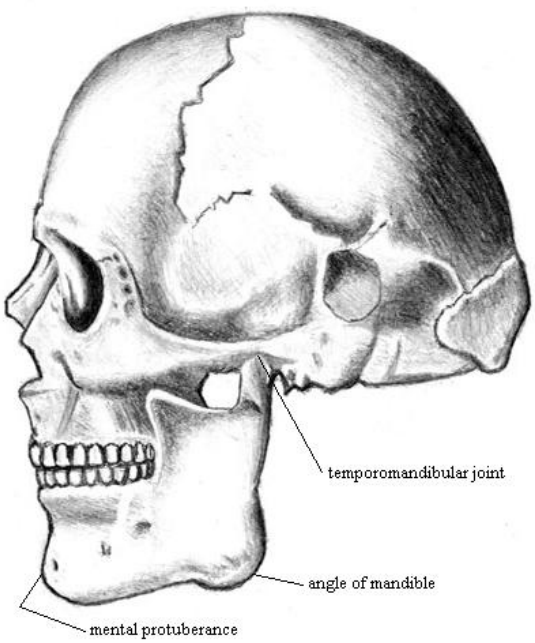

Figure-1 (left view)

From fig 1 we can easily see a point called mental protuberance. This point is actually representing the middle point of the mandible. This point is most projected point of the mandible. Here we have to notice one thing that is the point mental protuberance is only one point in the mandible. That's mean if we consider the front picture of human mandible or if we consider the right side picture of human mandible or if we consider the left side picture of human mandible (fig 1) then we will get only one point.
From the figure 1 we can see a joint called temporomandibular joint. This temporomandibular joint is situated in the left side and the right side of the mandible. By this joint the mandible is joining with the skull. That joining portion of the mandible is called head of mandible. We can see also a joint called temporomandibular joint and a head of mandible in the right side of a human skull also. Here we have to notice one thing that the number of temporomandibular joint is two and the number of head of the mandible is two. One head of mandible and temporomandibular joint is situated in the left side of the skull and another head of mandible and a temporomandibular joint is situated in the right side of the same skull of human. From figure 1b we can easily see a point called angle of mandible. Here the mandible makes a curve. This point is situated in the left side and right side of the mandible. From figure 1 we can see also a point called angle of mandible. Here we have to notice one thing that is the number of the point, angle of mandible, is two. One angle of mandible is situated in the left side of the skull and another angle of mandible is situated in the right side of the same human skull. Now we try to propose a mathematical model. This model will help to identify a human lower jaw or mandible uniquely[4].

5. PROPOSED METHOD:

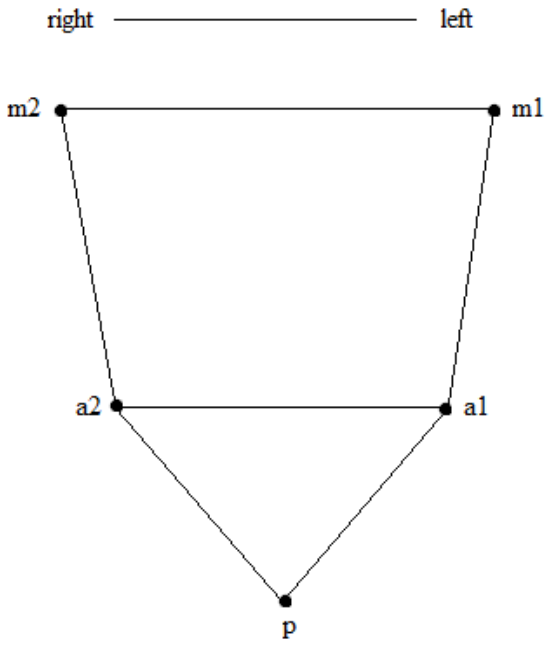

Figure-2
Form figure-2 we can see points m1, m2, a1, a2, p. They are representing as follows:
m1 = head of temporomandibular joint of left side.
m2 = head of temporomandibular joint of right side.
a1 = angle of mandible of left side.
a2 = angle of mandible of right side.
p = mental protuberance.
Now consider that those points m1, m2, a1, a2, p are situated in three dimensional plane.
We know that The distance between two points is the length of the path connecting them. The shortest path distance is a straight line. In a 3 dimensional plane, the distance between points (X_1, Y_1, Z_1) and (X_2, Y_2, Z_2) is given by:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

d = the distance between points (X_1, Y_1, Z_1) and (X_2, Y_2, Z_2).

To calculate the distance between 2 points, (X_1, Y_1, Z_1) and (X_2, Y_2, Z_2)
For example, (5,6,2) and (-7,11,-13), we plug our values into the distance formula:

$$d = \sqrt{(-7-5)^2 + (11-6)^2 + (-13-2)^2}$$

combining terms inside parentheses we get:

$$d = \sqrt{(-12)^2 + (5)^2 + (-15)^2}$$

squaring terms we get,

$$d = \sqrt{144 + 25 + 225}$$

adding the 3 results,

$$d = \sqrt{394}$$

finally,

d = 19.849433

Now,

If we consider the 3 dimensional coordination of "m1" is (X_1, Y_1, Z_1) and "m2" is (X_2, Y_2, Z_2) then we can easily say that "d" will represent the distance between the points "m1" and "m2".

If we apply the same rule for each two point then we will easily measure the distances between them.

By this process we will get the distances between the points m1 and m2, a1 and a2, a1 and m1, a2 and m2, a1 and p, a2 and p.

We may represent it as following:

l1 = distances between the points m1 and m2
l2 = distances between the points a1 and a2
l3 = distances between the points a1 and m1
l4 = distances between the points a2 and m2
l5 = distances between the points a1 and p
l6 = distances between the points a2 and p
where l1, l2, l3, l4, l5, l6 are representing the distances.

We store the value of l1, l2, l3, l4, l5, l6 in system. When we get another value of l1, l2, l3, l4, l5, l6 then we will compare those values. If the values are same then we can say the structure is same. It will imply that the person is same.

5. RESULT:

The program run for eleven skull images and it give hundred percent accurate results. The result is displayed in the figure-3.

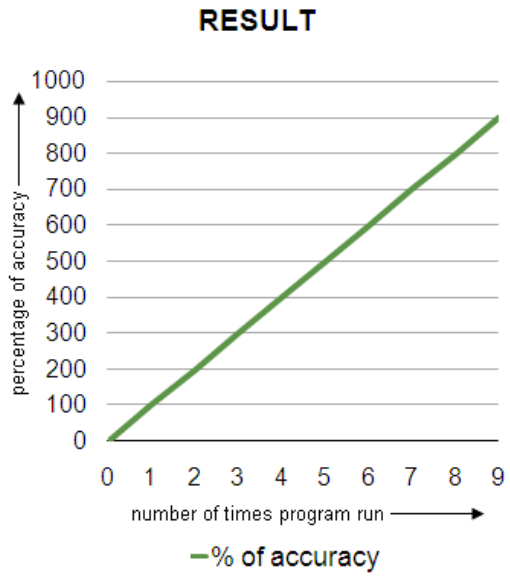

Figure-3 result displayed in graph

6. CONCLUSION:

This system is developed first time. So we will try to make this system more sophisticated.

7. REFERENCES

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