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Cephalometric Analysis of Skull for Biometrics

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Abstract— There is a need of strong biometric system that resolve the issues related to those who use illegal way to break the system, those with change in psychological and behavioural characteristics and specially to those disable people (people with no limbs, bad retina, facial changes, etc.). The Cephalometric analysis is a strong tool based on image processing of human skull that can be used mathematically for strong biometrics.

Keywords— Biometrics, Cephalometric, Cephalometric analysis, Skull analysis, X-ray, Unique biometrics, Craniofacial scan.

INTRODUCTION

Now days, it is getting very important to establish an identity to an individual. Biometric analysis refers to the use of distinctive physiological (e.g., iris, fingerprints, palm print, face, retina) and behavioral (e.g., signature, gait) characteristics, called biometric identifiers (Or simply biometrics) for automatically recognition of individuals.

Biometrics system is superior to any other authentication system like traditional password based systems. But such systems are weak and disposed to numbers of attacks like stored template attack which is the most common attack among them. Applications of biometrics are identification of criminals, access control to facilities and security, access to banks & power plants, identity authentication in police investigation, airport security, and passports or licenses, forensic department and medical databases. Also biometric finds its applications in several high security areas providing security to biometric template is of utmost importance.

From years there has been a lot of improvement performed on development of systems based on fingerprint, face, iris, voice etc. But some of the issues related to its use by the disabled persons are also exist [1].

So, the Cephalometric analysis is performed on human skull. Its Parameters measurement is based on a set of feature point's landmarks. The tracing identifies specific skeletal and dental landmarks. Our system is able to make linear and angular measurements of the skull. It helps in recognition of any individual.

From many years human skull has been used by forensic to identify the individual face. Researchers have tried to map the relation between the skeletal landmarks of human face and the different components of biometrics.

These experiments serve advantage for analyzing and predicting the features from different orthodontics treatments. The radio-graphical Cephalometric analysis is based on study of human skull using image processing used mathematically for orthodontics treatment planning.

PROPOSED SYSTEM

The Cephalometric based biometric system composed of two parts the enrolment and the identification block. The cephalometric system capable of capturing the data in the form of x-ray image, using the electronic/digital Cephalometric machine, then processing the x-ray image, its features extraction, and storing those features in the form of templates. Later collecting the data on real time then extraction of features and matching it with the templates.

The system takes few key features from the facial x-ray image and compare it with the real time x-ray, if the 80% of the features matched with the templates, the identity is accepted because there can be changes in the facial bones and structure as per age of person and due to accidents, else the comparison is rejected.

The main function is performed by the feature extractor and the comparison block. The comparator makes use for the past tends to automatically identify the individual using the x-ray. The proposed system is shown in figure 1. The biometric sensor is a cephelogram machine used by the orthodontics that takes the X-ray of human skull mostly for the dental studies and it stores the extracted features in the form of cephelograms.

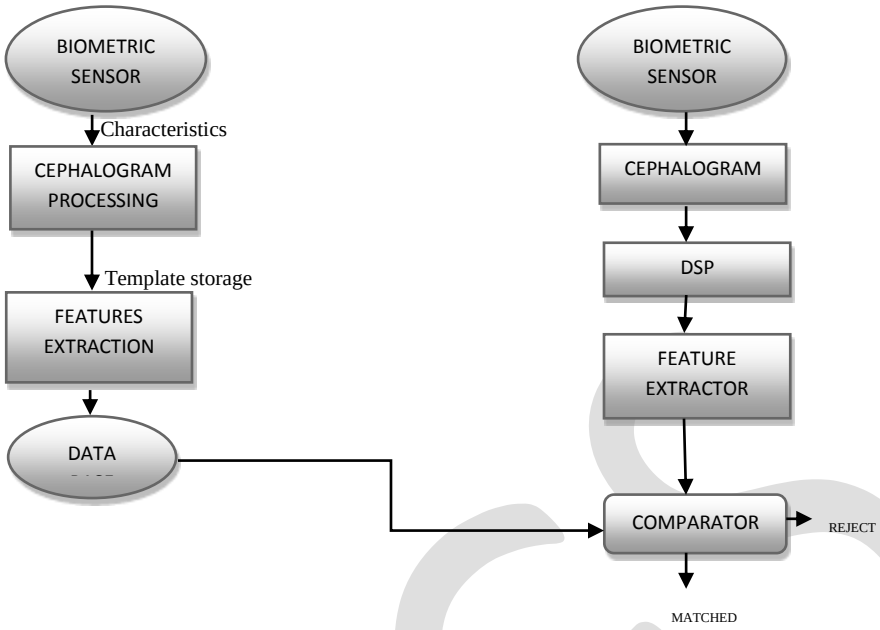

Fig 1: Block diagram of Cephalometric System

Enrolment Block

Block diagram of an enrolment block is shown in Fig.2. The physical characteristic of human skull is sensed and then converted into digital form by biometric sensors. It is then processed by the Cephalogramic software, to check if the characteristics are fed properly or not. The Feature extractor block reduces the size and save the storage by extracting the main features of the x-ray image. And finally it gets stored in the form of template in the *Data Base of system*

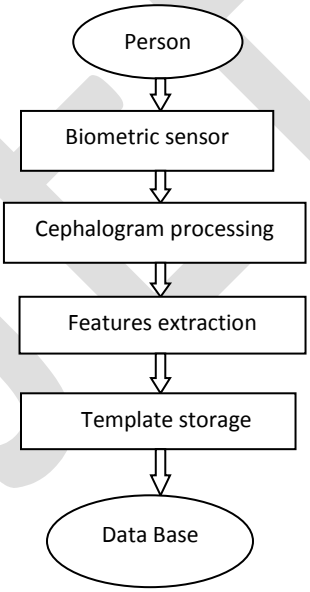

Fig 2: Block diagram of Enrolment block

Identification Block

The block diagram of Identification/Verification Module is shown in Fig.3. It is responsible to identify/verify the claim of an individual. The physical characteristics are converted into a digital form. Then digital form of characteristics is entered into the feature extractor unit to produce the same form as that of template.

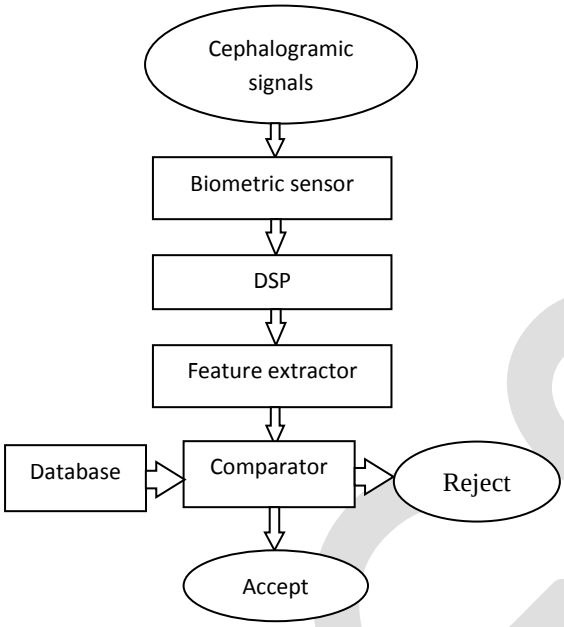

Fig 3: Block diagram of Identification block

The resulting representation is entered into a comparator. The comparison state compares the template with template already in the data base. It calculates the match score that whether the match scores is within the given threshold or not. It determines the acceptance or rejection of the identity of the person. X-ray image is used to define the Landmarks, head structure that had to be identified.
The main function is performed by the feature extractor and the comparison block. The comparator makes use for the past tends to automatically identify the individual using the x-ray.

RESULTS

In this section, experimental analysis and results for the proposed cephalometric based Biometrics system are presented. Three different images are considered. In fig. 4, the x-ray of same person is compared, one is fetched from the database and the second one is taken real-time. More than 80% of features matched, and showed success.

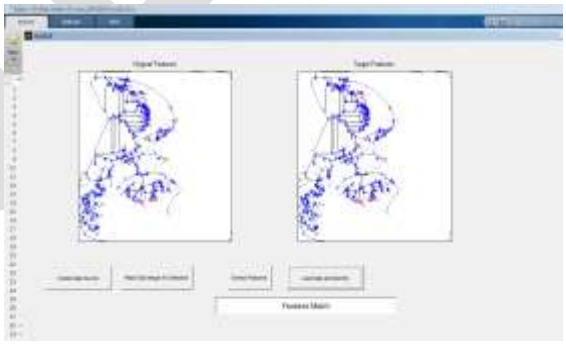

Fig 4: Matched result, using cephalometric scheme

In fig.5, the comparison is done between the database based Cephalogram and the real-time based features, the results failed as the features matched are less than 80%. The system first acquire the claimed identity's features from the templates stored in the database and the extract the feature of person on real-time using the identity block and then compare the features.

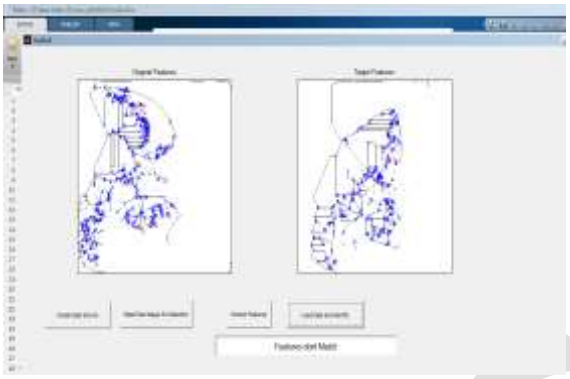

Fig 5: Result unmatched, for different skull

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CONCLUSION

In this paper, a new strong and reliable biometric system is proposed. Its main feature is that the system takes human skull's x-ray as input, extract its features and then compare it with the real time x-ray image. If the image matches by 80%, the system accept it else it shows the wrong identity.
In the future, the problem of the growth of bones at different ages can be solved and may be further studied.

REFERENCES:

[1] "Issues Of Biometrics For Disabled", Dr Pamela, Dr H.M. Rai, Dr Mohit Rai, Dr Rekha Thakral, Er.Priyanka, Journal Of Applied Engineering Research, Issn 0973-4562 Vol.7 No.11, 2012.

[2] "Matching 3d Face Scans Using Interest Point And Local Histogram Descriptors", Stefano Berretti , Naoufel Werghi, Albertodel Bimbo, Pietro Pala, Department Of Information Engineering, University Of Firenze, Italy, Khalifa University Of Science Technology & Research , Abu Dhabi, United Arab Emirates, 2013.

[3] "3d Template Matching For Pose Invariant Face Recognition Using 3d Facial Model Built With Iso-Luminance Line Based Stereo Vision", S. Lao, Y. Sumi, M. Kawade, And F. Tomita ,International Conference On Pattern Recognition (Icpr 2000), Pages Ii:911.916, 2000.

[4] "Security Of Biometric Systems", Milan Adámek*, Miroslav Matýsek, Petr Neumann, Daaam, 2014.

[5] "Face Recognition With Biometric Encryption For Privacy-Enhancing Self-Exclusion", Haiping Lu, Karl Martin, Francis Bui, K. N. Plataniotis, Dimitris Hatzinakos, The Edward S. Rogers Sr. Department Of Electrical And Computer Engineering,University Of Toronto, M5s 3g4, Canada, 2012.

[6] "Reeb Graph For Automatic 3d Cephalometry" Mestiri Makram , Hamrouni Kamel , Enit/Electrical/Image Processing Enit Elnasr 2, 2037, Tunisia, 2012.

[7] "3d Skull Recognition Using 3d Matching Technique",Hamdan.O.Alanazi, B.B Zaidan, A.A Zaidan, Journal Of Computing, Volume 2, Issue 1, January 2010.

[8] "An Approach For Efficient Detection Of Cephalometric Landmarks", Thuong Le-Tien, Hieu Pham-Chi, Procedia Computer Science 37 , 2014 .

[9] "Face Recognition From Lower Jaw Or Mandible Of A Human", Sourav Ganguly Et Al. / International Journal On Computer Science And Engineering (Ijcse),2013.

[10] "Motion Invariant Palm-Print Texture Based Biometric Security" Rohit Kumar* , Ratnesh P. Keshri, C.Malathy, Annapoorani Panaiyappan.K, Procedia Computer Science 2 (2010)

[11] " A Survey Of Emerging Biometric Modalities", Sushil Chauhana, A.S. Arorab, Amit Kaula,*, Procedia Computer Science 2 ,2010.

[12] " Automatic age estimation based on facial aging patterns." Xin Geng, Zhi-Hua Zhou, and Kate SmithMiles. IEEE Transactions on Pattern Analysis and Machine Intelligence, , 29(12): 2234-2240, 2007.