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# Dental Biometric Identification for Missing Teeth

Ms. Pranoti Rajput
PG student, Department of electronics and telecommunication,
Late G. N. Sapkal College of engineering,
Anjaneri, Nasik, India
*pranotirajput@gmail.com*

Mrs. K. J. Mahajan
Asst. Prof., Department of electronics and telecommunication,
Late G. N. Sapkal College of engineering,
Anjaneri, Nasik, India

***Abstract*—**The identification of person using biometrics is the emerging field for security. The one of the emerging field is dental biometrics. Mostly dental biometric is used in forensic science to identify the human whos body get decayed. It utilized the observation by dental radiographs for human identification. The human dental observation contain tooth contour, distance between adjacent teeth and shape of dental work such as crowns, bridges and fillings. Proposed work includes different techniques to identify the person using dental biometrics. Dental biometrics needs Ante mortem (AM) and Postmortem (PM). Proposed method consists of three main processing stages: (i) feature extraction, (ii) creation of a dental code and (iii) matching.

***Keywords-*** *Biometrics, Dental Radiograph, HMM, Missing teeth detection, SVM, Teeth Matching, Teeth contour*

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## I. INTRODUCTION

Teeth are the toughest part of our body. The decay of tooth is rarely possible in case of accident, crime, burial etc. The dental patterns are the most important feature for person identification. If the records of the human teeth are stored, then we can identify the person by matching characteristics [1]. Therefore dental biometrics provides the information about the person even though soft tissue of the body dosen't gives any information.

The field of biometrics has received much attention in the last years because it is a motivating alternative to traditional substantiation systems like passwords. Fingered print based person identification systems are available in the offices, school and colleges. Under severe circumstances, e.g. encountered in mass disasters, conservative biometric characteristics, such as fingerprints, may not be able to be used account of their low resistance. In such cases, tooth features are measured for person identification. The objective of forensic deontology (forensic dentistry) is it to identify individuals based on their dental characteristics. To achieve this aim, dental biometrics automatically analyze dental radiographs through comparing unlabeled post-mortem (PM) radiographs, acquired after death, with labeled ante-mortem (AM) radiographs, acquired before death, and stored in a database.

Forensic dental biometrics used to identify unrevealed victims. Automatic forensic identification utilizes dental radiographs. Biometrics can be classified in two category based on characteristic like behavioral and physical. Physical biometric represents iris, fingerprint, face gratitude etc. Behavioral biometric represent voice, bearing, signature and all behavioral traits of individual. Estimate of biometrics features requires characteristics such as universality, uniqueness, durability, concert, collectability and adequacy.

## II. DENTAL IDENTIFICATION SYSTEM

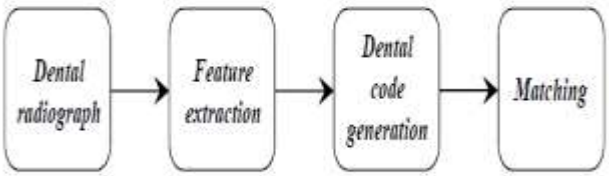


Fig.1: Basic Flow of System.

The components of Dental identification system are:
1) Dental Radiograph
2) Radiograph preprocessing and segmentation
3) Contour extraction
4) Atlas registration

The dental radiographs with a missing tooth is one of the search issues addressed earlier. Consequently, this research work exploits radiographic images and photographic images with missing tooth, dental work such as crown mineralization and filling etc. This research will explain about the skeleton based measures in addition with the contour-based approach both for the dental radiographs and photographs.

The necessity of the system is because Dental trial have been extensively used in identifying the sufferers of massive disasters, such as the 9/11 bombing and the Asian tsunami. Dental Biometric issues, dental radiographs to identify victims in situations (e.g., fire victims) where conservative biometric features, i.e., face, fingerprint, and iris, are not available.

Dental photograph is a symbolic examination of tooth structure and its appearance; it gives the virtual position of the neighboring teeth and shapes of dental work. It can be taken by any digital camera by stretching upper an inferior lip as shown in fig. 2.

Fig. 2**:** Dental photograph

This paper work is organized as four sections. The proposed approach is as shown in Fig.3. The contour tracing using SBGFRLS method is the first step of the proposed algorithm. In the second section, shape extraction is done by a skeleton. The third section is shape matching of the contours traced. Observing shape matching using skeleton is the fourth section.

The remaining paper is constituted as follows. Related study is done in Section II. Section III describes the architecture of the proposed system and working of the proposed system with the implementation details is explained in Section IV and Section V concludes the paper with a Conclusion.

## III. LITERATURE SURVEY

**C. Savior et. Al [2]** proposed a system based on Radiographic evaluation of teeth subjected to high temperature. It is observed from result that the composite filling were remain after 600$^o$ C (1112$^o$ F), The amalgam fillings were in place maintaining the shape till 1000 $^0$C (1832 $^0$F) and the endodontic treatments were recognizable till 1100 C (2012 $^0$F).

**Elsa Auerkari [3]** proposed the recent trends in Dental Forensics. They reviewed new developments, particularly in biochemical forensic tools and methods that can be applied for dental samples.

**M. Petju et. al. [4]** proposed a person identification system. For experimental purpose they uses dental record of 3750 dead bodies and 3547 missing persons from Thai Tsunami Victim Identification (TTVI) database. The identification rate of the system is higher.

**Anil K. Jain et. al. [5]** Proposed a system based on radiograph images. They used a hybrid contour extraction method, in which poor quality images were tested for addressing the problem of fuzzy tooth contour. Probabilistic model is used to describe the tooth pixels distribution and background pixels in an image. After the tooth contours are extracted, they used a transformation to align the contours to correct the imaging geometric variations, and a matching distance is generated. The final decision is obtained with respect to the matching distances.

The method is fails if the images are blurred or if there is a substantial change in the imaging angle between the AM and PM images that causes changes in the shapes of the teeth, or if some teeth have been extracted.

**A. Banumathi et. al. [6]** Proposed a system based on radiograph an image which uses three step viz. Radiograph segmentation, pixel classification and contour matching. Their result shows hit rate of 0.7 is achieved by the Morphological contour detectors.

**Vijay kumari Pushparaj et. al. [7]** Proposed a system based on dental radiographs by calculating the Mahalanobis distance measure as a means of matching dental records. Their result shows the outputs obtained preserve all the edges of the image and it seems better than the morphological operations.

**Vijaykumari Pushparaj et. al [8]** present the system based on mathematical morphology and homomorphic filter. In proposed system, person is identifying based on the distance metrics. The output results show that the edges of the images were preserve.

**Eyad Haj Said et. al. [9]** presents the morphological approach on Dental X-rays film. For segmentation approach they present contrast stretching transformation.

**Omaima Nomir et. al. [10]** proposed teeth shape and appearance based system for person identification. The feature vector of the force field energy function is used along with Fourier descriptors of the contour of the teeth. Their results on a FBI's Criminal Justice Information Service (CJIS) database of 162 ante mortem images shows that their method is effective in identifying individuals based on dental radiographs and their computation complexity of the algorithm is of the order of O ($N^2$).

## IV. PROPOSED SYSTEM

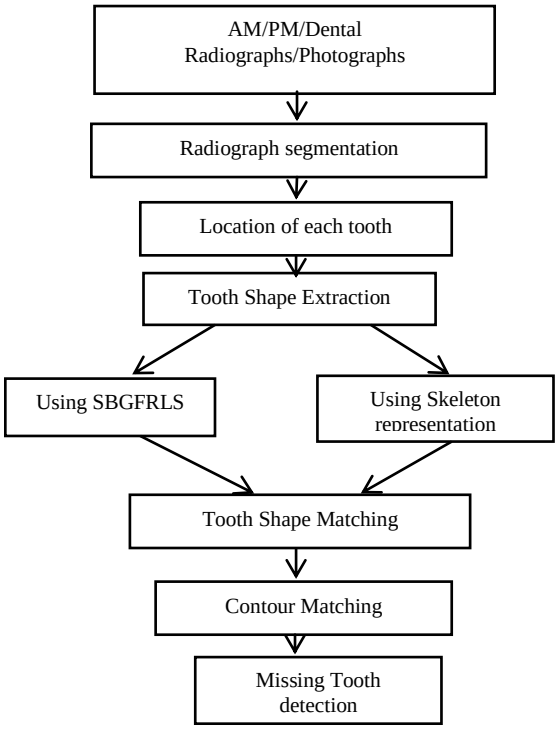


Fig.3. Flow chart of propose system

Results show that in addition to its capability of handling bitewing and per apical dental radiographic views, our approach exhibits the lowest failure rate among all approaches studied.

### *A.Radiograph Segmentation/Location Extraction*

Dental radiograph initially converted into gray scale image. Region of interest (ROI) are decided on radiograph. After this,

gray image converted into binary image. Canny edge algorithm is used for segmentation of image. Boundary of each tooth is been extracted to detect location of each tooth.

### A. *Tooth Shape Extraction*

To extract the shape of the Tooth, SBGFRLS method is used. It is based on region based SPF function. This function efficiently detects the contour at pathetic edge. The main advantage of this method is, it detect the internal and external shape of the tooth.

In skeleton based matching, the set of skeletal nodes are compute and connect them into graph. The graph is then verify with other following object. In proposed method, following characters were consider for skeleton matching

a) Centroid,
b) Distance of the skeleton end point from the origin
c) length of the skeleton
d) Angle of skeleton end point with deference to the reference point.

### B. *Contour Matching*

There are too much time span between ante mortem and post mortem image. So there is small amount of changes can possible in presentation angle. Therefore there may be chance of mismatch of the person identification. To minimize the false alarm there is a necessity of rigid transformation to ante mortal and post mortem image. After rigid transformation, find out the matching distance between ante mortal and post mortal images.

### C. *Missing Tooth Detection*

HMM is the best method to detect out the missing teeth. In proposed method, the continuous and discrete observation defines the state of teeth. If the state is discontinuing means missing teeth are found else discontinue observation gives the information of continuous teeth.

The dental images are classified using well known support vector machine. Support vector machine classify the images using hyperplane. Hyperplane is the boundary which separate the classes.

## V. CONCLUSION

Developing an automated dental identification system is a demanding challenge at present. In this paper a novel shape matching algorithm using skeleton is proposed for dental images. Another novel focus of this paper is usage of dental photographs if there is unavailability of dental radiographs. It is an attempt to provide an aid for forensic law enforcement with the help of photographic images also. The contour tracing is implemented using a level set method named SBGFRLS method. This contour tracing algorithm holds good even for bitewing images with dental works. Since matching with contour alone may not produce convincing results, an additional information using skeleton is worn in this paper. The experimental results clearly show that the algorithm which is adapted to radiographic images is suited for photographic images also with fewer computations. The accuracy and overall measures are higher for skeleton than contour, while considering the whole image, either maxilla or mandible separately for matching.

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