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Study and Analysis of Edge Detection Techniques for Segmentation using Dental Radiograph

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Abstract

Dental Biometric is mainly used in Forensic Science. Segmentation plays a vital role in the interpretation of Dental Radiograph that is useful in identification of an individual, bite mark analysis and in mass disasters. In this paper, we have an overview of a different discontinuities and Edge Detection Techniques. We have also done a comparative study of the edge detectors. In this Study, the first step we have done is pre-processing on animage. In the second step, we enhance the image by using Low Pass Filter and in the last step we applied different Edge Detectors on the image.

Keywords:PM,AM, ADIS, CAPMI, WINID, HVS

I.Introduction

Biometric is the branch of science that establishes the identity of an individual based on the physiological or behavioural attributes of a person.In physiological biometric a person is identified on the basis of a unique characteristics of bodyorgans likefingerprint,iris, handprint, dental record etc.

Forensic odontology is a branch of dentistry that pertains to the teeth. The applications involved in it are related to the individual,mass disasters and bite mark analysis. The ultimate aim of forensic odontology is to identify the person when other means of identification like fingerprint,DNA, voice, iris are not available. The purpose of electing the dental biometric for review is that the teeth can withstand decomposition, heat degradation, water immersion and desiccation.[1] Dentalfeatures are manifested in root and crown morphology. Teeth size, spacing,sinus patterns and characteristics of dental work are few dental features of specific importance in identification. [2]

II.Literature Survey

Forensic identification may takes place prior to death and is referred to as Ante Mortem. The identificationsthat carried after the death are called as Post Mortem identification.[2] Dental records are considered to be best records for PM identification in severe circumstances encountered in mass disasters or when identification is carried out more than couple of weeks PM.

As per the survey,some major disasters of World Trade Centre attack in 2001,killed 2,819 people. Swiss Air Flight 111crash in 1998off the coast of Nova Scotta killed 229 people,Dental biometric have beenmost effective and reliable means of identifying victims of such mass disasters. A ranking of matching scores are generated based on the distance between the AM and PM tooth shape. The matching of dental X-ray is carried out under ADIS. The ADIS provides automated search and matching capabilities for digitised X-ray.

There are several computer aided PM identification systems. CAPMI and WINID are most famous among these systems.[3, 4]

III. Segmentation

In the identification system,segmentation is the most important and crucial task for the interpretation of an image. Segmentation accuracy determines eventual success or failure of computerised analysis. Segmentation is the process that subdivides an image into its constituent regions or objects that have similar features according to a set of predefined criteria of features.The subdivision carried out depends on the

problem being solved;itmeans segmentation should be stopped when the ROI has been isolated.[5]Following are the features
on which the segmentation is to be carried out on the basis of intensity, histogram, mean, variance, energy, texture.
Most commonly the segmentation algorithm for monochrome images can be carried out on the basis of intensity; it has two basic properties;
Discontinuity:In this type,the image is partitioned on abrupt changes in intensity. The most common way to look for discontinuities is to runa mask through the image. Point, Line and Edge detection are the three types of discontinuities in an image.
Similarity: In this type,the image is partitioned into regions that are similar and are according to the set of predefined criteria.Thresholding, Region growing, and Region splitting are types of Similarities.

IV. Types of Discontinuities

A. Point detection

Theisolated point whose grey value is significantly different from its background can be detected by Mask operation. The isolated point has been detected at the location onwhich the mask is centred. The filter which is used to detect a point is a high pass spatial filter as Laplacian. The filter
detects a point whose grey level is significantly different from its background

B.Line detection: Hough proposed an algorithm for detecting lines in images.The line detection operator consists of a convolution kernel tuned to detect the presence of lines of a particular width; at a particular orientation angle.The masks can extract lines that are one pixel thick and running in a particular direction. The lines will be detected in horizontal or vertical direction and $+45^0$ and -45^0
directions.

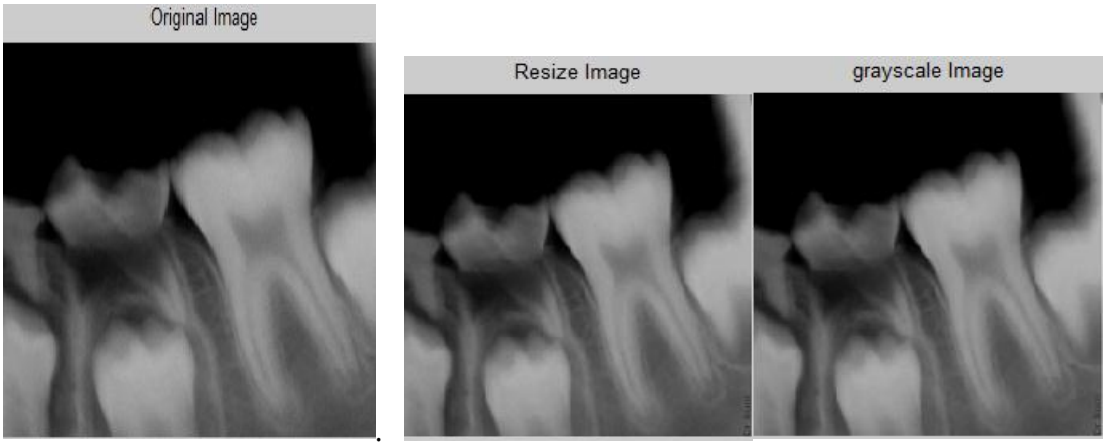
C.Edge Detection

Edge is a basic feature of an image. Edge detection refers to the process of identifying and locating sharp discontinuities in an image. Such discontinuities are detected by first and second order derivatives. The various types of edges are shown in Fig,1.

Convex Roof Edge Concave Roof Edge Concave Ramp Edge

Step Edge Bar Edge

Fig.1 Types of Edges



(a) Original Image (b) Resize Image (c) Grey scale Image

Fig.2 Pre-processing of an Image

1)Robert Edge Detection:Robert Edge detection is the oldest edge detector. In Robert cross algorithm, the horizontal and vertical edges bring out individually and they put together for resulting edge detection. It is based on the first derivatives and difference between two adjacent pixels.

2) Zero Crossing: This detector is based on the same concept of LOG method. It uses second orderderivatives having fixed characteristics in all directions and sensitive to noise.

3) Laplacian of Gaussian :In this detector, first we have to use smoothing function , it filters the image with Gaussian function and blur it with reducing noise and then computes the Laplacian based on second order derivatives which yields double edge image, then edges consists of zero crossing between the double edges.

4) Prewitt Edge Detector:It is based on the first order derivative .The parameters of this function are similar to Sobel parameters. It is simple edge
detector compare to other but the results are somewhat noisy.

5) Sobel Edge Detector:This technique is similar to Robert's edge detector. It computes the gradient by using the discrete differences between rows and
columns of 3x3 neighbourhoods which provides the smoothening of image. Sobel edge detection can be implemented by filtering of an image.

6) Canny Edge Detector:Canny edge detector was invented in 1986 and is the most powerful edge
detector to detect an edge. The problem with this edge detection approach is that,a low threshold produces false edge and high threshold mixes important edges.
Following is the method of the use of Canny.

1] Smoothening the image using Gaussian filter with specified standard deviation.2] The local gradient and edge direction are computed at each
Point.

3] The edge point determined, give rise to ridges,ridge pixelsthen threshold.

4] Finally the algorithm performs edge linking.[6]

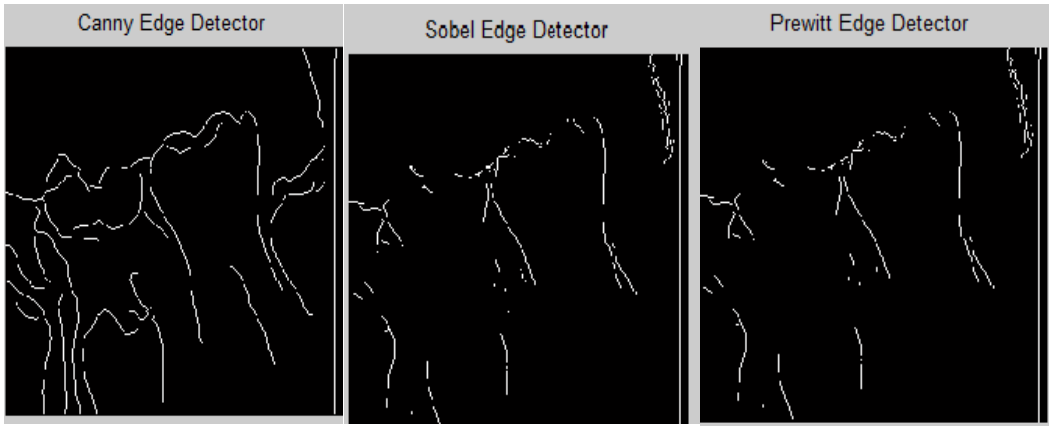
For the good result of segmentation, some steps of pre-processing have to be performed on the image.

Though the Dental Radiographs seems to be a monochrome image; these are colour images.In the first step,we convert the original colour image into greyscale, before that the image requires to be resizing. Fig. 2(a) shows the Original Image, (b) shows the Resized Image and (c) shows grey scale Image.
In the second stage we filter the grey scale image by Gaussian Low pass filter to remove the noise.Fig.3 shows the Filtering Image.Sobel Edge Detector,
Prewitt Edge Detector , Canny Edge Detector
Edge Detectors areapplied on the same image and results are compared.

Fig. 3 Filtering Image

V. Comparison of Edge Detection Methods for Dental Radiograph

The goal of segmentation in this paper is to evaluate edge detection results produced by Sobel, Canny and Prewitt edge detectors. HVS is the most common method for evaluating the effectiveness of a segmentation method. The application of three edge detectors on the Dental Radiograph is shown in the Fig.3. Canny, Sobel and Prewitt Edge detectors are shown in Fig.4 (a), (b) and (c) respectively.



b) Canny Edge Detector (c) Sobel Edge Detector a) Prewitt Edge Detector

Fig.4 Different edge detectors

VI. Conclusion

This paper intends to present an overview of Edge Detection Techniques and comparative study of Edge Detectors on the dental Radiographs and application of Edge Detectors Prewitt, Canny and Sobel. The results are accessed by the HVS system and comparative analysis shows that the Canny Edge Detector shows the good results than other two Edge Detectors, but the result may vary according with the set of images.

References

1] "An Effective Shape Extraction Algorithm for Dental Radiographs using Contour Information"

1B.Vijayakumari, 2Dr. G.Ulaganathan, 3Dr.

[A.Banumathi1,3Thiagarajar college of Engineering,Maduai, Tamilnadu, India2 CSI Dental college, Madurai, Tamilnadu, India

[2]"Towards an Automated Dental Identification System" (ADIS) GamalFahmy, DiaaNassar*, Eyad Haj-Said*, Hong Chen**, OmaimaNomir***, Jindan Zhou***, Robert Howell*, Hany H. Ammar*, Mohamed Abdel-Mottaleb*** and Anil K. Jain** * West Virginia University, ** Michigan State University, *** University of Journal of Advanced Research in Computer Science and Software engineering Research Paper Available online at: www.ijarcsse.com*

[3] United States Army Institute of Dental Research Walter Reed Army Medical Center ,"Computer Assisted Post Mortem Identification via Dental other Characteristics"- USAIDR Information Bulletin. Vol. 5 No.1 Autumn 1990

[4] Dr.Jim McGivney etal.WinIDsoftware(www.winid.com)

[5]"A study of Edge Detection Techniques for Segmentation Computing Approach"S.Lakshmi,Jeppiar Engineering CollegeChennai,India,Dr.V.Sankaranarayanan Crescent EngineeringCollegeChennai,India.

[3] Dental X-Ray Image Analysis by Using Image Processing Techniques 1M.V.Bramhananda eddy, 2Varadala.Sridhar, 3M.Nagendra 1Associate professor ,CSE ,SVIST, 1Madana Palle,Chittor,india 2, Assistantprofessor,ECE,VJIT, Aziz nagar,Hyderabad,india 3 Associate professor, ECE, VBIT, Kadapa,india varadalasri@gmail.com

[4] "Image Processing Techniques used for Dental X-RayImageAnalysys", Ştefan OPREA1, Costin MARINESCU 2, IoanLiţă, Daniel AlexandruVişan, Ion BogdanCioc.Electronics, Communications and Computers Department, University of PitestiStr. Târgul din Vale, Nr.1, Piteşti, ROMANIAEmail: stoprea@upit.ro2Lecturer & Clinical Instructor, D.D.SDivision of Restorative DentistryUCLA School of Dentistry10833 Le Conte Avenue, Box 951668Los Angeles, CA 90095-1668E-mail. cmarinescu@dent.ucla.eduwww.smartooth.com

[5] "Dental Radiographs SegmentationBased on Tooth Anatomy", Vo Phong–DinhComputer Sciences DepartmentHo Chi Minh University of Natural Sciences 227 Nguyen Van CStreet, Ho Chi Minh City, Vietnamvdphong@fit.hcmuns.edu.vnLeBac–HoaiComputer Sciences DepartmentHo Chi Minh University of Natural Sciences227 Nguyen Van Cu Street, Ho Chi Minh City, Vietnamlhbac@fit.hcmuns.edu.vn

[6]"Segmentation and FeatureExtraction of PanoramicDental X-Ray Images",Pedro H. M. Lira, National Laboratory for Scientific Computing, BrazilGilson A. Giraldi, National Laboratory for Scientific Computing, BrazilLuiz A. P. Neves, Federal University of Parana, BrazilJournal of Engineering Research and Studies E-ISSN0976-7916JERS/Vol.III/ Issue I/January-March, 2012/26-29

[7] "DENTAL BIOMETRICS USED IN FORENSIC SCIENCE"Shubhangi Jadhav1, Revati Shriram2Address for Correspondence1 Dept. of Instrumentation and Control, D Y Patil College of Engineering, Pimpri, Pune, INDIA2 Cummins College of Engineering for Women, Karvenagar, Pune, Maharashtra, INDIA

[8] "MULTI RESOLUTION DENTAL IMAGE REGISTRATION BASED ON GENETIC LGORITHM", MythiliOgiralaThesis submitted to theCollege of Engineering and Mineral Resourcesat West Virginia Universityin partial fulfillment of the requirementsfor the degree ofMaster of ScienceinElectricalEngineeringDr. HanyAmmar, Ph.D., ChairDr.Xin Li, Ph.D.Dr. GamalFahmy, Ph.D.Lane Department of Computer Science and Electrical EngineeringMorgantown, West Virginia2005

[9] "Exhaustive Matching of Dental X-rays forHuman Forensic Identification", MajaOmanovic and Jeff J. OrchardDavid R. Cheriton School of Computer Science, University of Waterloo,200 University Avenue West, Waterloo, Ontario, N2L 3G1. Canada.

[10] "Exhaustive Matching of Dental X-rays forHuman Forensic Identification" Majamanovic and Jeff J. OrchardDavid R. Cheriton School of Computer

Science, University of Waterloo,200 University Avenue West, Waterloo, Ontario, N2L 3G1. Canada.

[11]IOSR Journal of Engineering (IOSRJEN) ISSN: 2250-3021 Volume 2, Issue 6 (June 2012), PP 11-15 www.iosrjen.org ISSN: 2250-3021 www.iosrjen.org 11 | P a g e
Determination of Unique feature set from Dental Image Graphs as Bio-Metric Information using Image Processing Techniques Shrikanth Sharma1, Monika Aggarwal2 1(ECE Deptt. BGPC, Sa

[12] Towards an Automated Dental Identification System (ADIS)
GamalFahmy, DiaaNassar*, Eyad Haj-Said*, Hong Chen**, OmaimaNomir***, Jindan Zhou***, Robert Howell*, Hany H. Ammar*, Mohamed Abdel-Mottaleb*** and Anil K. Jain** * West Virginia University, ** Michigan State University, *** University of Miami,(Sangrur, India) 2(ECE Deptt., BGIET, Sangrur, India)*

[13] Matching of dental X-ray images for human identi'cation.
Anil K. Jain, Hong Chen Department of Computer Science & Engineering, Michigan State University, 3115 Engineering Building, East Lansing MI 48824, USA Received 23 May 2003; received in revised form 24 Oct.2003*