ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 4, Issue – 4, August - 2021, Page No. : 167 - 170

Application of Image Processing Techniques for improving the quality of Dental X-Ray

[1]Sovamayee, HiTech Dental College and Hospital, Bhubaneswar, Odisha, India

[1]Debasmita Das, HiTech Dental College and Hospital, Bhubaneswar, Odisha, India

[2]Raghunath Dey, IIIT Bhubaneswar, Odisha, India

[2]Rakesh Chandra Balabantaray, IIIT Bhubaneswar, Odisha, India

Corresponding Author: Rakesh Chandra Balabantaray, IIIT Bhubaneswar, Odisha, India

Citation of this Article: Sovamayee, Debasmita Das, Raghunath Dey, Rakesh Chandra Balabantaray, "Application of Image Processing Techniques for improving the quality of Dental X-Ray", IJDSIR- August - 2021, Vol. – 4, Issue - 4, P. No. 167 – 170.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Classification of dental caries is important for the diagnosis as well as treatment of the dental disease, which is affecting a very large population throughout the world. It will also create opportunity for conducting through study and investigations about the nature of the dental diseases. Classification of dental diseases is decided on the basis of certain criteria, such as based on whether the lesion is within the enamel, dentin or whether it touches the pulp. Dental caries are, clearly visible in the x-ray changes and it can be detected from the caries lesion present in the radiographs. In this paper we propose to demonstrate how image processing techniques will help check the x-ray and examine the extent to which the caries lesion is present.

Keywords: Radiographs, Dental X-rays

Introduction

Dental X-rays are the images of the teeth that are used by Dentist to evaluate the oral health. Dental X-rays exposed patients to relatively low radiation doses. It is one of the common radiological procedures that are frequently performed in dental clinics for oral examination. Clear radiographs of teeth and jaws decrease the risk of faulty treatment planning. The X-ray spectrum always increases the horizon by increasing the knowledge of radiation by dentist [1-4], thereby increasing their ability to normal and pathological conditions. Hence it is important to have a good knowledge on the dental x-ray radiation dose in the interpretation of the x-ray for treatment planning. The radiation doses used or transferred to an auxiliary dentist are responsible for the quality of x-ray obtained [5,6]. The person should ensure that they are properly trained and legally satisfied when assigned to the job [5, 6].To protect patients and the staff from radiation over exposure, dental indications and procedures must be understood. Each patient should get minimum level of x-ray radiation.

The production of diagnostic quality radiographs depends on various factors such as proper film positioning,

appropriate X-ray exposure and correct film processing techniques. An error in any of these factors will result in less than optimal or non-diagnostic radiographic image [8]. Thus the purpose is to provide a diagnostic quality image through segmentation which could help the dentist to identify many conditions that may otherwise remain undetected. In [9] segmentation and contour extraction are applied to extract features for automatic identification of dental radiographs. In [7] an automated morphological filtering wavelet based approach for tooth segmentation in dental X-ray images is proposed. In the boundary-based image-segmentation approach, several post- procedures, such as edge tracking, gap filling, smoothing, or thinning, should be performed on these detected edge points [10]. Obviously, all these post-procedures are very time-consuming and not so easy. This paper presents a novel method to detect objects of dental radiographs automatically based on edge detection, skew correction and region of interest (ROI) finding.

Pro-processing

The dataset consisting of x-ray images and are quite noisy. That is why a set of preprocessing steps are adopted to enhance the quality of the image. At the very beginning noises present in the image are eliminated by applying a media blur filter technique. At the second phase of preprocessing edge of the object is determined. This edge image of the samples will help to find the angle of the skewness possessed by any tooth at the time of taking their x-ray. After the angle of the tooth determined, the skewness is removed by rotating to that same angle in opposite direction with the edge images as well as original x-ray teeth images. After correcting the skewness of the teeth x-ray images, then the next task is to find the proper Region of Interest (ROI). So that the spatial position of the teeth as well as wire in original x-ray samples can be find out properly.

Median Blurs Filtering

Images become less clear and distinct as they are blurred. The Median Filter is frequently used to reduce noise in images or signals. Because of its nature to maintain edges in certain cases, the median filter is widely employed in digital image processing.

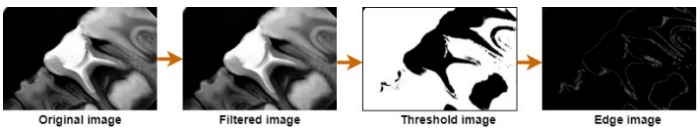
img = MedianBlur(img,order).....(1)

In this case, order refers to the window's dimension, on which the median blur effect would be applied. In all cases, the value of the order should be odd for easy calculation of the centre or midpoint.

Edge Detection

Edges are characterized by rapid fluctuations in pixel intensity near the image's edges. Edge recognition requires such changes in the surrounding pixels. Due to its versatility and persistence, Canny Edge Detection is one of the most often used methods for identifying edges. For extracting edges from an image, the algorithm uses a four-stage technique.

- Reducing noises
- Image Intensity Gradient Calculation
- Removing a malicious edge
- Historization thresholding

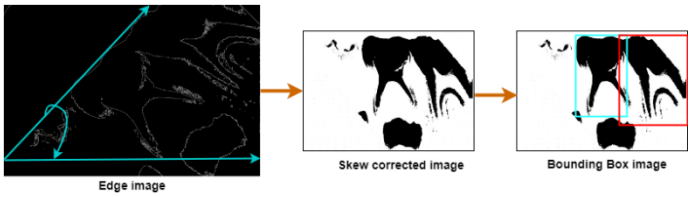


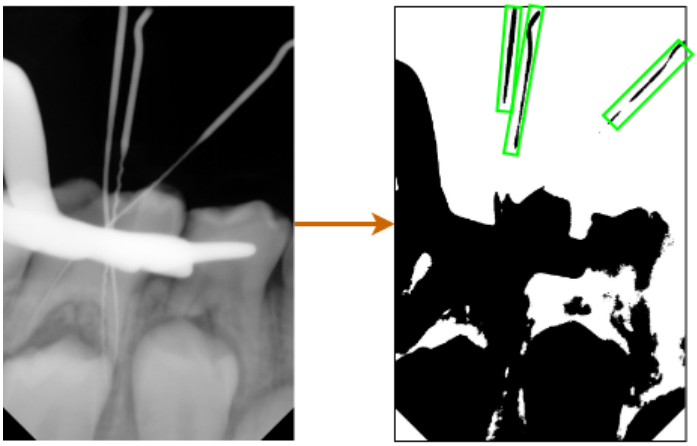
Skew Correction

Unavoidable distortion occurs in the received x-ray images during scanning. One of the first jobs performed on papers scanned into digital format is skew detection. This phase aligns a picture before processing it since object segmentation and identification algorithms require properly aligned images.

ROI Finding

The spatial location of the required object is located by a bounding box. The x and y coordinates in the upper-left corner and the x and y coordinates in the lower-right corner determine the rectangular shape of the bounding box. It can be represented by using the coordinates of the bounding box with the corresponding width and height. Here, a minimum rectangular shape has been used to find the closed area to cover all the possible regions. To determine the position of the teeth, the width or height of the bounding box, one of the values is set between 60 and 100. Similarly, for finding the region of interest for the wire, the value of width is chosen as a minimum of ten and a maximum of 20, whereas the height remains the same as in the case of teeth. If wires are present in an image, they must always be at the top of the image. As a result, the wire search is always done on the upper half of the images.

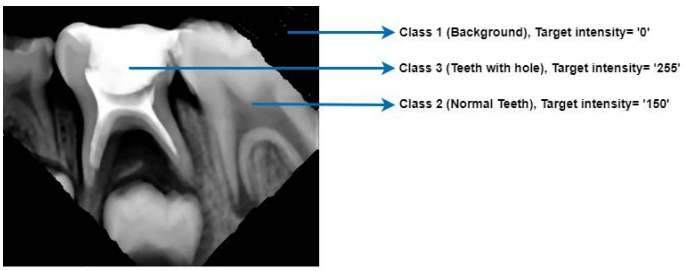




Proposed Approach

Here a four-class classification technique based on the intensity values present in the x-ray images is suggested. The dataset chosen over here is having various noises, which may lead to an improper classification. That is why, before providing the images into the classification technique, these are being passed through several preprocessing steps. After the completion of the suggested preprocessing functionalities, then these are supplied for the classification based on the intensity ranges occupied by each pixel of the image.

The approach is intensity-based classification. It solely depends upon the gray level intensity value present at a particular coordinate of the image matrix. If the gray level value lies between 0 to 100, then the model converts it into 0 in the pixel of the target image. In the same way, when the grey level value of the x-ray image lies between 100 and 180, then the model transforms it into a fixed value of 150. Lastly, when the grey level value lies between 180 and 255, then the model converts it into the fixed value of 255. So this will become white.



Results and Discussion

The model is designed to predict the labels present on an x-ray image of teeth. In total, there are 89 samples present in the dataset. Out of which, only 50 samples are chosen randomly, those which have four classes. The significance of the three classes is shown in Fig. (Background, hole in teeth, and normal teeth). The fourth class is the wire, which is optional and always present at the top portion of the samples. All the samples do not have wires. The performance with respect to the classification of the four classes is shown in Table 1. The suggested approach was

able to achieve 194 correct labels in total out of 205 labels. This becomes an overall accuracy of 94.64%.

Samples	Count	Correctly classified	Misclassified
Back ground	50	50	0
Normal teeth	70	65	5
Teeth with hole	40	40	0
Teeth with wire	45	39	6
Total	205	194	11

Conclusion

The experimental study proposed a new approach for independent, identical dental noise distribution and reduced image data redundancy using image processing techniques. The role of the proposal approach helps in the diagnostic of the content. It also helps in the radiological use of imaging technology which showed the overall appearance of the image with its diagnostic content and small and low contrast details (noise variation). This has caused the edges to be identified near the initial storage output and the other artifacts were on the border. This paper concludes that this work is an attempt to understand the issue which supports a new approach for viewing and filtering panoramic images as a combination of (unwanted) background information, diagnostic data and information about noise.

References

1. Lin PL, Lai YH, Huang PW. An effective classification and numbering system for dental bitewing radiographs using teeth region and contour information. Pattern Recognition; 43:1380–1392 (2010)
2. Jain AK, Chen H. Matching of dental X-ray images for human identification. Pattern Recognition; 37:1519– 1532 (2004).
3. Banumathi A, Vijayakumari B, Raju S. Performance analysis of various techniques applied in human identification using dental X-rays. J Med Syst; 31:210-218 (2007).
4. Said EH, Diaa EM, Nassar GF, et al. Teeth segmentation in digitized dental X-ray films using mathematical morphology. Transactions Information Forensics Security; 1:178–189 (2006).
5. Nomir O, Abdel-Mottaleb M. Fusion of matching algorithms for human identification using dental X-ray radiographs. IEEE Transactions on Information Forensics and Security; 3:223-233 (2008).
6. Nomir O, Abdel-Mottaleb M. Human identification from dental X-ray images based on the shape and appearance of the teeth. IEEE Transactions Information Forensics Security; 2:188-197(2007).
7. Nomir, O., Abdel-Mottaleb, M.: A system for human identification from X-ray dental radiographs. Pattern Recognition 38, 1295–1305 (2005)
8. Razmus, T.F., Williamson, G.F.: Current oral and maxillofacial imaging, 1st edn. W.B. Saunders Company (1996)
9. Nomir, O., Abdel-Mottaleb, M.: Hierarchical contour matching for dental X-ray radiographs. Pattern Recognition 41, 130–138 (2008)
10. Pal, N.R., Pal, S.K.: A review on image segmentation techniques. Pattern Recognition 26(9), 1277–1294 (1993)