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Early Identification of Dental Caries from IOPA Images

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ABSTRACT

The dental images are significantly analyzed to evaluate and upgrade the medical images for relevant investigation. The dental cavity is that the commonest disease discovered from the first stage. For early identification of cavity is that the best prevention from decay or cancer if it's transmitted to the basis of the teeth. During this paper, a model is proposed to assist the dentist to detect the cavity from radiographic images. The model tries to beat the issue that arises in edge extraction during the basis canal treatment. The proposed algorithm introduced by the pre-processing stage, which make use of the grayscale version and contrast enhancement of the x-ray image. It takes on the concept of masking for detecting a cavity and contours the cavity. The model provides the image with cavity identification because the output for simple visualization.

Keywords— Digital x-ray image; Interproximal cavity; Grayscaleimage;Masking; Contour

INTRODUCTION

The teeth are the foremost important appearance thing that somebody will notice about you. It influences on some factors like speech development and making different sounds, maintaining the shape of the jaw, help in food digestion, build confidence. From many sorts of research, it has been observed that there is 60 to 90 percent of youngsters fall in dental disease due to bacterial infections during a very developed country. Around 90 percent of the people regardless of their age are having difficulty in dental problems which mainly includes cavity. the reason behind cavity includes bacterial infections and acid deposited on the surface of the enamel to erode the hard tissues of the teeth. The dental cavity is categorized into differing types reckoning on their location includes pit and fissure caries, smooth surface caries, interproximal caries, root caries, etc. Dental radiography is utilized to help dentists for detecting caries. A dentist sometimes is disconcerted to choose an appropriate technique for the treatment. because of some issues like inequality in illumination and mixed-orientation, the radio- graphed images are pre-processed to bolster the affected area. By using image processing techniques, caries are dearly. because of this different capturing methodology, the resulting radiograph images ha6321ve several issues like illumination inequalities and varied orientations. due to this fact, these images require preprocessing for enhancing the affected areas and surroundings. cavity finally ends up in caries. the foremost issue in detecting caries at an earlier stage is to forestall them from increasing so as that they are visiting not reach the premise and affect the other tooth. By using the concept of image processing techniques, it should be determined the presence of caries. during this paper, a model is proposed to identify the interproximal cavity. The interproximal cavity is nothing it is a cavity in between the teeth. The proposed model is preceded by an image pre-processing technique and adopts the concept of masking to identify the interproximal cavity.
This paper is organized within the subsequent manner, the introduction part is followed by recent works on the dental image in section II. Section III describes the workflow diagram of the proposed MCD model. The experimental results are discussed in section IV. Finally, the conclusion of this paper is described in section V.

RECENT WORKS ON DENTAL IMAGE

Nowadays image processing techniques are used to medical imaging areas for detecting diseases. Some researchers have adopted basic image processing techniques with algorithms to detect a cavity in dental medical images. Table 1 gives a brief description of the previous works on dental images.

TABLE 1. List of some previous works on dental image

Adoptedtechniques	Purpose	Sourceimage	Reference
Imagesegmentationtechnique basedon probabilisticdataassociation filter	Extraction ofcavitycontour	Ultrasoundimages ofgallbladder	[8]
Top hat bottomhattransformation,sharpening ofimage,morphologyoperation	Todetectcaries	Dentalradiographimages	[7]
Regions withconvolutionneural network(RCNN), neuralnetworkmodel	Teeth detectionto identify aperson,detection ofmissingteeth	Dentalperiapicalfilms	[10]
Used basic imageprocessingtechnique (gray tobinary to extractthe region ofinterest)	Diagnosis ofdentalcavities	Radio-graphicdentalimages	[6]
K-meansclustering methodand thresholdmethod based onhistogram	Identificationand estimationof the depth ofcaries	CT ofdentalimage	[5]

II. METHODS AND DESIGN

Our technology uses digital pictures of the tooth surface as input to determine the presence and extent of caries. To be identified These photos are first extracted and then processed. characteristics to recognise carious areas on the tooth's surface, after which using classification techniques to determine which the carious region is represented by pixels in the digital picture (s).

Caries on the tooth's surface are identified quantitatively using extraction procedures. The surface of the tooth serves as the system's input. Dentists employ a variety of visual indicators to identify early-stage demineralization. Cavitation, texture and roughness, and discolouration are all symptoms of caries. And opacification of the tooth's surface[9]. These images are very appealing. Using feature extraction, cues are quantitatively expressed process. For each pixel, a feature vector is constructed. Within the segmented tooth region of the adjoining pixel.

III. PROPOSED MASKED BASED CAVITY DETECTION

The grayscale image consists of intensity values ranges from zero to 255. this sort of image is especially consisting of AN equal portion of red, green, blue levels. The planned MCD model contains of 2 stages. within the initial image pre- process stage, the x-ray image is born-again into grayscale image. The distinction of the image is often outlined because the distinction in luminousness and brightness of all objects gift within the image. So, the grayscale image is then increased against this to check the teeth and cavity conspicuously. The second stage is that the planned algorithmic program within which a mask construct is employed. The mask of image process is employed to target a neighbourhood of interest. To notice a cavity within the image, a mask of lower and better threshold price is outlined. A lower price of threshold of zero and better price of threshold of ten has been assumed. Then the mask with these threshold values is crossed over the image to seek out the cavity. If the cavity is gift, then it'll be shown within the image because the detected cavity. Then, the detected cavity is contoured within the image to create it simple visualization in keeping with the dentist's perception. The Fig. one illustrates the steps of planned model with a short description of every step.

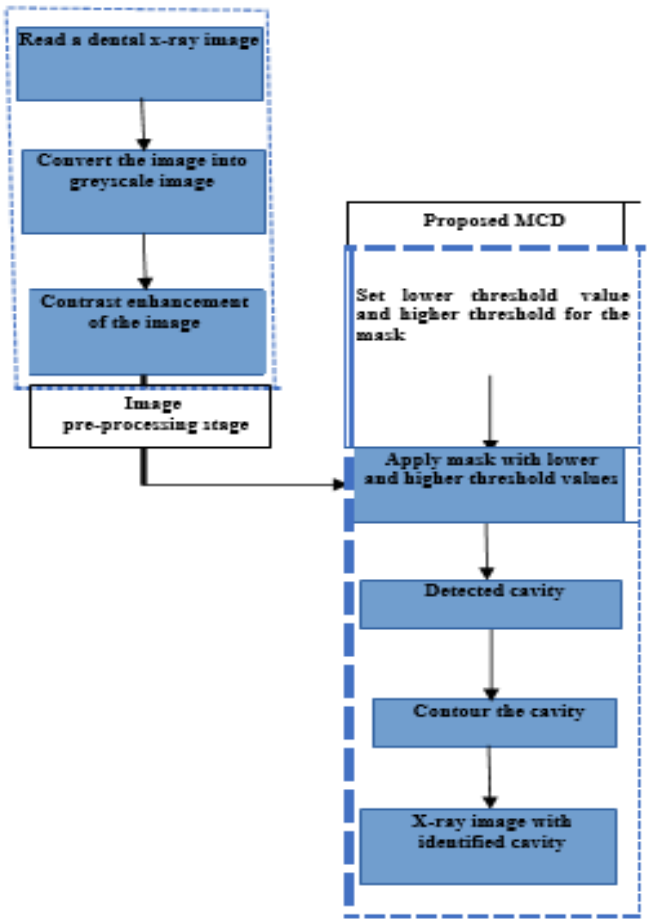

Figure 1: Workflow diagram of proposed mask-based cavity detection (MCD) model

The proposed model is followed by two stages such as image pre-processing and the mask-based algorithm for cavity detection. This model has been implemented by using MATLAB 2017R.

Input: Any dental x-ray image

Output: x-ray image with identified cavity with boundary

Step 1. Read the dental x-ray image into grayscale format

Step2.Find outthecontrastofthatimage.

Step 3. Choose lower threshold value (0) and upper threshold value 10 for the mask of the image.

Step 4. Mask is applied to the x-ray image to detect the cavity.

Step 5. If the cavity is present, then contour the cavity in theimageforidentification.

Step 6. Exit

IV. EXPERIMENTAL RESULTS

A dental x-ray is taken and shown in Fig. 2. The image isundergonetothepre-processing stagetoproducethegrayscale image in Fig. 3 and the grayscale image is enhanced bycontrast, which is shown in Fig. 4. The mask is applied to thepre-processed image to detect the cavity.An interproximalcavity has been detected and shown in Fig. 5. Then finally,contour the cavityfor easevisualization and is shown in Fig.6.

Figure 2: contoured cavity image

Figure 3: Binary mask of the image

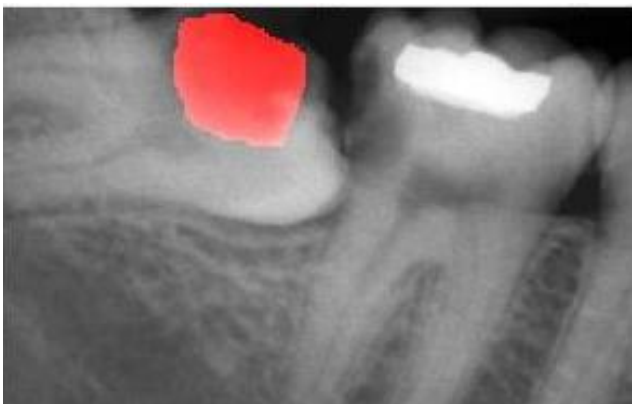

Figure 4: New image with mask burned into image and cavity detected

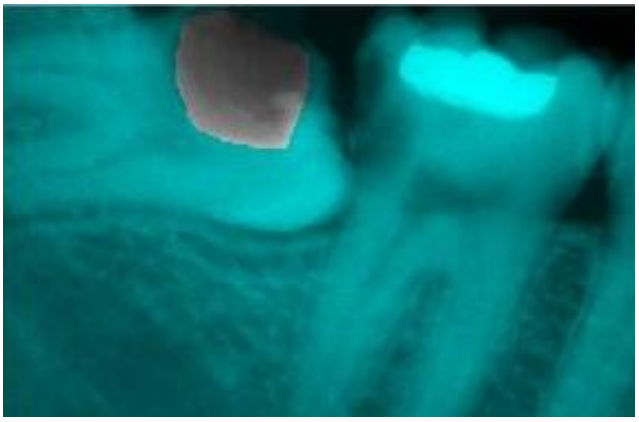

Figure 5:Cavity Outside Region

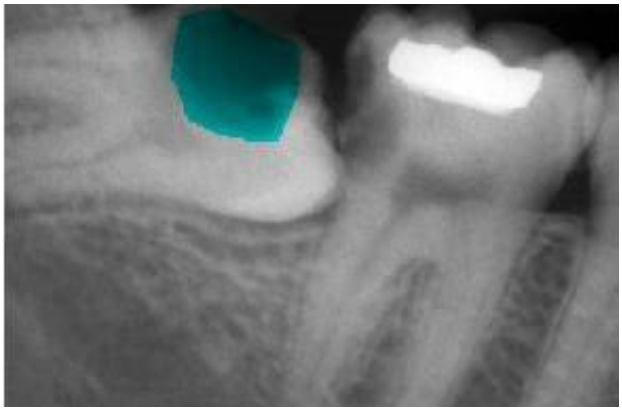

Figure 6: Cavity Inside Region

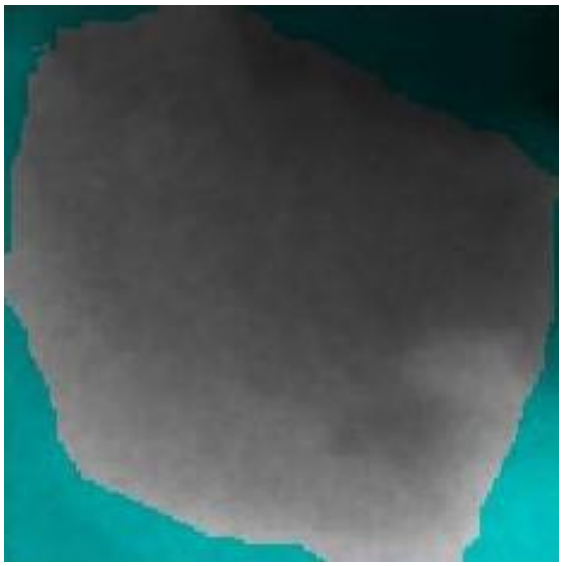

Figure 7: Cropped cavity Image

V. CONCLUSION

Almost everytypeofcavitywouldbetreatablewithoutcausing much trouble. If the affected teeth are not identified atthe early stage and treatment is delayed, then lengthy and cost-effective treatment will be become required. There may be arisk of pain, infection, cancer, etc. The regular dental check-upis necessary to identify any tooth caries. In this paper, a simplemodelbasedonthebasicimageprocessingconceptisproposed to detect an interproximal cavity, which is generallynot identified in a simple vision. This proposed model can alsobe used in detecting other types of caries. The proposed modelprovides an excellent view of the cavity contour. It would bevery effective for the dentist to detect and find the location ofthe cavity. It tries to overcome the prevalent disease of peoplesirrespectiveoftheiragesatthe earlystage.

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