Diagnosis of Dental Cavities using Image Processing

Mrs. Hemavathi M N[1], Tasmiya Firdose[2], Simran Siddique[3], Pragathi S[4], Poojashree M J[5]
[1]*Asst. Prof,* [2,3,4,5]*UG Scholars*
Dept of ISE, MIT, Mysore.

Abstract **-** Dental cavity is the disease inside the human mouth which is caused by different bacterial activities. Cavities make an everlasting damage in the tooth and it results in holes inside tooth. Dealing properly with dental cavities and taking an urgent treatment is always recommended to avoid more damage. Dentist recognizes the caries in patients' teeth by looking directly with eyes and sometimes with help of x-ray (radiograph) of teeth. The automated system would help the dentist to identify the caries in teeth by making use of x-ray. This paper proposes a model to detect the cavities using x-ray images by making use of various image processing techniques, involving RGB to Gray conversion, generation of binary image, finding the region of interest, removing background, identifying regions and dividing image into multiple blocks and finally identifying the cavities present in x-ray image.

I. INTRODUCTION

A human tooth is a structure made up of dentin, pulp and enamel. Mouth normally consists of various types of bacteria, they causes infection in human teeth. These infections generally termed as dental caries. Caries further damage the teeth permanently and results in tooth cavity. It is a very common disease found in world, about 60 to 90% of school children and nearly all adults have dental cavities [1]. Dental cavity affects the daily task of teeth by weakening the biting capacity, increased sensitivity, tooth ache, etc. Commonly when after meals, if the mouth is not washed properly, the food stays in corners of teeth, this deposited food generates acid. Such type of acid and sugar on teeth cover produces bacteria and it leads to breakdown of the tooth enamel (hard tissue of the teeth). Which causes caries in teeth, but if ignored at initial stage, caries can harm more neighboring teeth and go deeper inside the teeth till the pulp inside the teeth which can cause severe toothache. Research has shown that over ninety percent of all adults have carious lesions. It has been reported that with the advent of modern dentistry, the rate of caries growth has changed due to advances in dentistry and preventive care. In particular, visual inspection or visual-tactile inspection has very low sensitivity rate; that is, human inspection alone misses a high percentage of caries. For these reasons the development of computer-aided caries detection and diagnosis systems has become a priority. Currently, no computer-aided systems exist that can provide user-friendly and easily understandable quantified information about tooth damage due to caries. This project outlines our image processing algorithm for classification of carious lesions in images of teeth, and demonstrates the feasibility of using advanced image processing techniques to identify carious lesions on the surfaces of teeth.

II. METHODOLOGY

1. A Digital image is given as input to the system.
2. The features are extracted from the image of the tooth.
3. Segmentation of the tooth to identify carious regions for classification training.
4. Classification of caries using the pixel feature vectors.

The feature vectors are used to classify the pixels from the images as either carious or not carious.

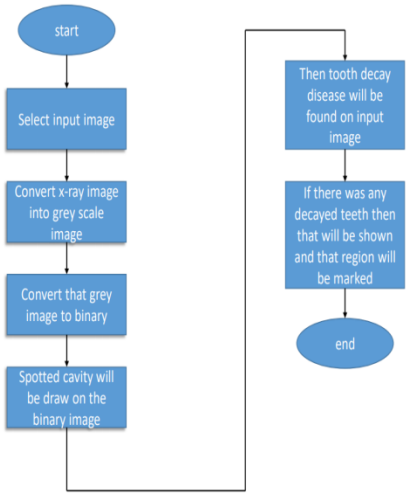

Figure 1

A. Pre-processing - Image Preprocessing is a collection of operations performed for enhancing the image data and removing unwanted noise and background data. Following subsections explain image pre-processing steps in detail. 3.2.1 RGB to Gray Conversion The captured x-ray images are saved in jpeg format. These images are very similar to gray images; that is, almost all pixels in entire image have all three colors Red, Green and Blue hold same intensity value. The x-ray images are thus converted to gray images for saving storage space and processing speed.

B. Binary Conversion - Gray color x-ray images are converted to binary images. A binary image has basically two colors only, black and white. This binary image is then compared with gray image of same sample and the black portion of image is trimmed down from original gray color x-ray image. Following Fig. 4 shows the binary image of above image shown

C. Highlight Suspicious Cavity Pixels - Image preprocessing step is followed by the classification step; in this step, the pixel values of cavities are accepted from dataset of dental x-ray images. 3.3.1 Suspected Cavity

Pixels The pixel's values are classified in two classes one is named 'class 1' (indicates class of cavity pixels) and remaining pixels are classified under 'class 2' (indicates class of non-cavity pixels). The image after highlighting the suspected cavities.

D. Region Identification - Identify Cavity Regions the cavity pixels highlighted in the image shown in are represented in regions with proper outline. These regions are further examined and the regions centroid and circular area is observed.

E. Block Division - All the identified regions are further examined and then by making use of Major Axis Length and Minor Axis Length, some of the regions are removed which doesn't fall in category of true cavity regions. Following Fig. 8 displays the selected regions with their centroids.

III. CONCLUSION

Dental cavity is a widespread disease that affects many people worldwide. Due to human dependency the caries can sometimes be ignored. This paper proposes a model to easily identify the cavities in teeth by availing the potential of Image Processing. Many of the Image Processing functions used are RGB to Gray conversion, generation of binary image, finding the region of interest, removing background, identifying regions and dividing image into same sized blocks and finally coming up with identifying the cavities present in x-ray image with proper position. In future, cavity detection work can be further improvised by using the final identified blocks as input to ANN model with back propagation algorithm. Supervised learning of ANN helps to generate patterns by itself from training dataset. The trained ANN can be later tested and validated. Finally the model can be used for new unseen samples of dental x-ray to detect the cavities.

IV. REFERENCES

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