

## **DENTAL IMAGE SEGMENTATION USING PSO BASED CLUSTERING ALGORITHM FOR DENTAL IMAGES**

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### **ABSTRACT**

In the presented work, it is proposed to design and analyze a high order FIR filter based on canonical signed digits representation of coefficients in order to minimize the power consumption and fast implementation of the filter. The designed FIR filter is proposed to implement using matlab tool and to be tested on high speed communication signal. Although a few works addressed the problem of reducing the complexity of coefficient multipliers in reconfigurable FIR filters, hardly any work demonstrated reconfigurability in higher order filters. Moreover, it is observed that there is sufficient scope for more work on complexity reduction in reconfigurable filters especially for wireless communication applications where higher order filters are often required to meet the stringent adjacent channel attenuation specifications. The CSD based computation and selection of filter coefficients for higher order FIR filters has been identified as a problem to solve in the presented work. An additional approach is proposed i.e. factored canonical signed digits based coefficients computation that serves a great purpose while reducing the power consumption in FIR filter design, the main filter design, selection and implementation parameter.

**Keywords:** *PSO, Image Segmentation, Thresholding*

### **INTRODUCTION**

Clustering is defined as the Technique of data mining in which data objects are grouped into multiple groups whose members are similar in some way (Coleman and Yurdakul, 2001).

There are many applications in which Clustering is used like Statics, Engineering, Marketing etc. Data mining and Data analysis are main applications in which Clustering is applied. The algo is good when it is able to identify cluster rather than their shapes and also deals with noisy data.

#### **Related Works**

Root Infection is the cause for the Dental cysts and tooth get affected by carious decay. There are mainly three types of Dental cyst i.e., Ameloblastoma, Keratocyst and Dentigerous cyst and treatment depends on the type. Odontogenic Keratocysts and Ameloblastoma have high reoccurrence rates compared to other types. It is very necessary to differentiate between different forms of cysts to prevent disease progression and conventional radiography and Computed Tomography methods for the differential diagnose are not suitable.

The dentists plan the treatment based on the dental radiography images and categorize the cyst. At first stage, the dental radiography is improved using contrast enhancement. Then, based on GLCM approach, categorization is done based on the texture information which in turn depends on parameters like Contrast, Correlation, Energy, Homogeneity, and Mean and these features are used to differentiate the dental cyst with the help of K-means. At last, the proposed work is analysed for the precise and accurate results (Coleman and Yurdakul, 2001).

Dual Energy X ray Absorptiometry method is used to quantitatively measure Bone Mineral Density which eventually helps to identify the Osteoporosis. The Early signs of Osteoporosis can be detected effectively using Dental Panoramic radiograph. The images from micro CT scan are used as gold standard of bone density. The images from Panoramic radiography are processed through filtering and segmentation and these images are assessed to determine bone density. The results from both micro CT and radiography panoramic images are compared to find the accuracy of dental panoramic radiograph.

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Although the results of this have potential to detect early signs of Osteoporosis but for clinical purposes improvement is needed (Hewlitt and Swartzlander Jr, 2000).

The Mandibular cortex is measured on panoramic dental tomogram is a inferior method so required improvements. Earlier Active Shape Model is used to find out mandibular edges, which had little lateral positioning information the superior border defined not clearly in Osteoporosis case and this leads to low quality of the measurement of cortical width.

On the other hand, Active Appearance Model including complex texture model that is obtained from an Osteoporosis, enriched training set is relatively more accurate and precise method. When this method was carried out on 663 subjects with known bone mineral density, the diagnostic results were superior (DeBrunner *et al.*, 2002).

Core beam Computed Tomography volume is used to analyze variations in trabecular patterns that can be correlated with bone diseases as Osteoporosis and for this multi-feature multi-ROI approach is purposed. Feature like fractal spectrum and gradient Band are derived from eight regions of interest and for each CBCT volume, to address the inferior quality images of trabecular pattern. These features from different groups are intermix to distinguish trabecular pattern deploying generalized multi-Kernel learning (GMKC). To find the accuracy of this method, oit is applied to varied trabecular pattern from different age and gender groups and CBCT volume from 96 subjects and this results in 96.1% average classification rate, which is tremendously better approach (Mahesh and Vinod, 2007).

This is about non –contact optical technique for detection of early stage dental caries. Initially, tooth decay is a small, white, subsurface lesion in the enamel. At present methods like visual and tactile evaluation and X-ray radiography are not accurate at initial stage due to small size of lesion. So to detect tooth decay at early stage, we introduced a fine resolution ultra- broadband all optical photoacoustic imaging (AOPAI) system. In this method photoacoustic signals are generated using a Neodymium-doped Yttrium Aluminium Garnet.

The ultrasounf waves thus produced is detected at the surface of the tooth with a Michelson interferometer and 2D images are produced with K-wave reconstruction methods. In decayed tooth at lesion region PA signal generated were large compared to healthy enamel. So, this contrast technique helps to measure lesions at earlier stage and is proved to be superior to older ultrasound methods with sufficient sensing depth which is due to combination of ultrasound system and fine spatial resolution of an optical system.

Dental caries is a chronic disease and requires diagnose of carouse lesions at early stage. The purpose of this study is to formulate a system asper the ICDAS requirements to diagnose caries lesions. This system detects the eroded regions and derive 77 features from each image like statistical measure of color space, grayscale image and wavelet Transform and Fourier Transform also. 88 Photographs of extracted teeth, scored by International Caries Detection and Assessment System were used for this. The Seven ICDAS codes that depict the various stages of caries development were categorize into three classes as Score 0 0, Scores 1 and 2, Scores 3 to 6. The system although was ten times more accurate but still it needs refinement. It has capability for accurate clinical diagnostics that to be at comparatively low cost, which is a remarkable benefit of it over the existing systems (Mahesh and Vinod, 2010).

## MATERIALS AND METHODS

### Algorithm

The dental radiograph based biometric system starts with image acquisition. Dental Image is acquired using X-Ray image Source. The x-ray image is in gray color format and needs to be binarized in order to obtain the black and white image with white as background and teeth objects as black color.

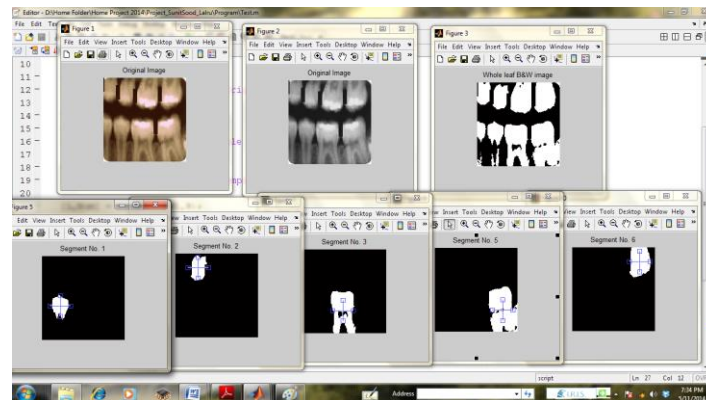
The image thresholding is done using Otsu algorithm. Otsu algorithm works on the principal of minimum within class variance. Once the threshold T is selected. The image pixels with gray color intensity less than T are made black and those greater than T are made white. This gives the binary image with some noisy pixels in the form of salt and pepper noise.

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Further, noise pixels are removed using salt and pepper algorithm. The pixels of either white or black color intensity lying alone are removed to get the noise free image. A dental image is shown below:



The binary image using the Otsu algorithm of the above is shown below:



The binary image is now divided into four parts: top left, Top right, Bottom left and Bottom right. Each jaw has fixed no. of teeth and information about the missing teeth. Missing teeth can be found by analyzing the distance between the two teeth. If a tooth is missing between two teeth, then the distance between the same will be higher than the normal case.

All the feature parameters are normalized with respect to size i.e. mean radius. This gives the feature parameters independent of the size of the teeth that may vary on account of the distance of x-ray m/c from the jaw. Or the image may be zoomed in or out after getting the x-ray.

The feature vector set is computed for each single tooth. For, the teeth are segmented using `bwareaopen` and `bwlabel` command in matlab. Both of the commands are based on 8-coonectivity of pixel neighborhood. The pixel's group is labeled based on their association within group and labels are assigned as number. Based on the labels, the teeth are segmented in single frame and feature vector set is computed.

An 8-connected pixel neighborhood is shown below:

|    |    |    |
|----|----|----|
| P8 | P1 | P2 |
| P7 | P0 | P3 |
| P6 | P5 | P4 |

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### RESULTS AND DISCUSSION

The presented algorithm has been tested on a test image as shown below:



The teeth are counted in all four parts and summarized in as below:

No. of teeth in top left = 2;

No. of teeth in top right = 2;

No. of teeth in bottom left = 2;

No. of teeth in bottom right = 2;

| Teeth No. | Area | Perimeter |
|-----------|------|-----------|
| 1         | 213  | 100       |
| 2         | 219  | 112       |
| 3         | 256  | 134       |
| 4         | 299  | 176       |
| 5         | 110  | 78        |
| 6         | 156  | 89        |
| 7         | 239  | 122       |
| 8         | 312  | 170       |

The teeth shape may be estimated by computing the standard deviation of the teeth profile. A high value of standard deviation may suggest the breakage in tooth. For a regular shape tooth, the standard deviation should be as that of an elliptical shape. If the tooth is broken, then the standard deviation will increase.

### Conclusion

The presented algorithm is designed using the matlab 7.5 version and is under testing phase. Further, the dental radiograph is not readily available for use. There is a dependency of the same on availability of x-ray m/c and even the person willingness. However, the algorithm has been tested on no. of radiographs and a correlation is established between the feature vector and the person bearing the same. The feature vector set has ability to identify the person from the data base if the feature vector set is used for search purposes.

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