International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 9 Sep. 2022, pp: 421-424 www.ijaem.net ISSN: 2395-5252

Canny Edge Detection Based Preprocessing and Feature Extraction for Tooth Decay Classification Using CNN

BhadraBaburaj I P 1 , Akshaya M V [1], SonamSunil1, Jasna P C[1] , Mrs.Anusha E P[2]

Students[1] , Assistant professer[2], department of biomedical engineering,KMCT college of engineering for women ,Kozhikode,Kerala,India

---

Date of Submission: 05-09-2022 Date of Acceptance: 13-09-2022

ABSTRACT--As health is an important factor, taking care of it is also increasing day by day. Food habit is a considerable thing and dental diseases that is causing due to it have also been considered. So it is essential to develop a model that help in the prediction of tooth decay which help as to identify the decay. It helps in early detection without the help of a doctor. Segmentation is a process which is done for diagnosis of dental disease. Then preprocessing is done for the appropriate leveling of required features. Later canny edge detection method is used for segmentation process. Deep CNN method is used for prediction of images. This method ensures greater accuracy when canny edge segmentation method is used.

Keyword—GLCM—Grey level co-occurrence **Matrix; RELU Rectified Linear Unit; CNN—Convolutional Neural Network**

I.INTRODUCTION

Nowadays the dental decay are increasing day by day. Because our diet is changed. Now sugar products and candies are ruleing our diet. This food particles held up in the cavities and generate bacteria. Cavities are permanently damaged areas in the hard surface of our teeth that develop into tiny opening or holes. Cavities are also called tooth decay or caries permanently damaged ar caries, are caused by a combination of factors, including bacteria in your mouth, frequent snacking, sipping sugary drinks and not cleaning your teeth well. Dentists usually use X rays for analyzing and for prediction of human dental state. That can be used as a tool for analyzing the state of teeth, gum and other for predicting the human illness. There are various type of X rays available for prediction but most commonly used is panoramic X ray which help the dentists for preoperative examination.The process of dividing the biomedical image and the set of pixel is the segmentation process. Edge detection process is used for the segmentation process. Canny edge detection is used for this. To detect wide range of edges in the image canny edge detection is used. This method reduces the data to be processed and give greater accuracy than any other method. It get image smoother by reducing noises and suppress the pixel which is not up to the maximum. Thus pixel with maximum value can be obtained. Noises are removed by using the filters. The pixel values in each kernel is then measured for the further processing. For the image processing mainly acquisition, import, analyzation and analysis are done.

Image processing can be of analog and digital. Digital image made use of computer and analog processing for the print outs or for the hard copies. The proposed method is the prediction of tooth decay from x ray image using deep CNN by use of canny edge detection. The solution make use of deep learning method. This method allows for the automatic extraction of data which is used for the further process. The feature of deep learning is that they learn from the input that given during the training phase. Training phase and testing phase are the two phases used. Deep learning using CNN is most popular one which gives spatial relation between the objects which help to represent effectively the features.

Neural network method is used for detection of edges in dental X-ray images where inputs to the network are pixels of original image after minimizing the output error, and output pixels

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 9 Sep. 2022, pp: 421-424 www.ijaem.net ISSN: 2395-5252

are replaced in the edge-detected image. Convolution Neural Network (CNN) is used because in this iterative training and learning takes place from input to output mapping. This algorithm is helpful in finding problems such as tooth decay. This method may be extended for the diagnosis of major problems related to teeth

Neural network method is used for detection of edges in dental X-ray images where inputs to the network are pixels of original image after minimizing the output error, and output pixels are replaced in the edge-detected image. Convolution Neural Network (CNN) is used because in this iterative training and learning takes place from input to output mapping. This algorithm is helpful in finding problems such as tooth decay. This method may be extended for the diagnosis of major problems related to teeth. Before edge detection in dental X-ray images the two steps that are to be followed are image enhancement and teeth segmentation so that the proper identification of every teeth occurs. Image Enhancement is the process of protruding out the needed information otherwise it can be defined as the process of removing unnecessary information. Segmentation here used is the canny edge algorithm for the better results.

II.LITERATURE REVIEW

In 2018,Xu, X., Liu, C. and Zheng, Y proposed 3D tooth segmentation and labelling using deep convolutional neural network. In this method Traditional geometry-based methods tend to receive undesirable results due to the complex appearance of human teeth (e.g., missing/rotten teeth, feature-less regions, crowding teeth, extra medical attachments, etc.). Furthermore, labeling of individual tooth is hardly enabled in traditional tooth segmentation methods. To address these issues, we propose to learn a generic and robust segmentation model by exploiting deep Neural Networks, namely NNs. The segmentation task is achieved by labeling each mesh face.

In 2019, Al Kheraif, A. A.,Wahba ,A.A. and Fouad, H proposed Detection of dental diseases from radiographic 2D dental image using hybrid graph cut technique and CNN. The Data mining techniques, image processing, and Computational intelligence techniques are playing a vital role in biomedical research. Dental image processing helps to improve the early detection and classification of the diagnostic process to make accurate decisions. The radiographic 2d dental image is widely utilized for analytic thinking of several dental disorders. In this paper traces the complete steps such as classification and segmentation as well as pre-processing of dental images has been carried out.

In 2018,Silva,G,Oliveira,L. and Python,M proposed Automatic segmenting teeth in X ray images.This review presents an in-depth study of the literature on segmentation methods applied in dental imaging. Ten segmentation methods were studied and categorized according to the type of the segmentation method (region-based, thresholdbased, cluster-based, boundary-based or watershedbased), type of X-ray images used (intra-oral or extra-oral) and characteristics of the dataset used to evaluate the methods in the state-of-the-art works. We found that the literature has primarily focused on threshold-based segmentation methods (54%). 80% of the reviewed papers have used intra-oral Xray images in their experiments, demonstrating preference to perform segmentation on images of already isolated parts of the teeth, rather than using extra-oral X-rays, which show tooth structure of the mouth and bones of the face.
In2018,Hatvani,J,Horvat,A.,Michetti,J,Basarab,A., Kouame,D and Gyongy, M proposed Deep

Learning based super resolution applied to dental computed tomography. The resolution of dental computed tomography (CT) images is limited by detector geometry, sensitivity, patient movement, the reconstruction technique and the need to minimize radiation dose. Recently, the use of convolutional neural network (CNN) architectures has shown promise as a resolution enhancement method. In the current work, two CNN architectures—a subpixel network and the so called U-net—have been considered for the resolution enhancement of 2-D cone-beam CT image slices of ex vivo teeth. To do so, a training set of 5680 cross-sectional slices of 13 teeth and a test set of 1824 slices of 4 structurally different teeth were used. Two existing reconstruction-based superresolution methods using l2-norm and total variation regularization were used for comparison. The results were evaluated with different metrics (peak signal-to-noise ratio, structure similarity index, and other objective measures estimating human perception) and subsequent imagesegmentation-based analysis. In the evaluation, micro-CT images were used as ground truth.The results suggest the superiority of the proposed CNN-based approaches over reconstruction-based methods in the case of dental CT images, allowing better detection of medically salient features, such as the size, shape, or curvature of the root canal.

ApurvaSonavane,Rohit Yadav and Aditya Khamparia proposed Dental Cavity classification using CNN.Dental and Oral diseases are very

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 9 Sep. 2022, pp: 421-424 www.ijaem.net ISSN: 2395-5252

common diseases and half of the world population suffers from it. Due to poverty or unhygienic practices, these diseases are common, and it is estimated that 5% of total medical expenditure in the world is on oral diseases. In this paper, we have focused on detecting cavities. Recent developments Machine Learning and Artificial Intelligence have helped a lot in medical science. Due to these algorithms, diagnosis and treatment of diseases can be done efficiently. To detect dental cavities different imaging modalities are used by doctors, however, in this paper we have used visual images of teeth's and applied deep convolution neural network(CNN) to classify the teeth into caries or non-caries. We have used the images from the Kaggle dataset, and after tuning our model we were able to achieve 71.43% accuracy.

III.METHODOLOGY

A.FLOW CHART

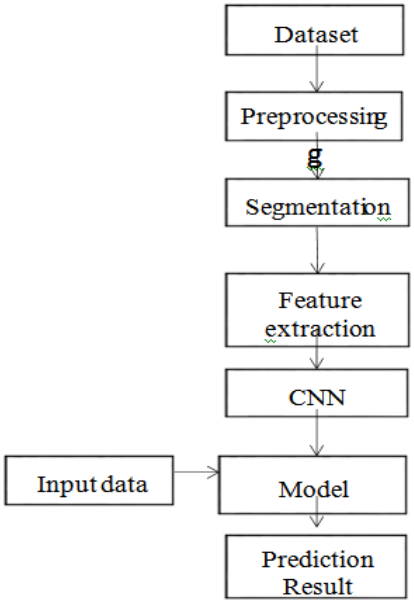

Fig 3.1 Flow chart of proposed system

Using the popular method digital X ray prediction of tooth decay is making possible. Passing the X ray through mouth of the patient it will give the image of teeth and jaw. Thus collecting the X ray image from the Kaggle site that means which contains both positive and negative images later used for training the model.

IV.RESULT AND DISCUSSION

The proposed segmentation for dental image achieved 92.60% accuracy by deep CNN algoritham for trained images.

The X ray image used for training was collected from the Kagglesite.Images were trained and tested several times for getting anaccuracy about 92%.X ray images were read by the processor and it was preprocessed and segmented.Thereaded image were converted into grey scale image and normalized using the numpy.Later for using CNN for the classification and prediction packages Tensor flow and Keras were used.Tensor Flow is used for storing and for running the program Keras package was used.And thus the model is created.Then input data for testing is inputed into the model and then the decay is predicted.

TABLE 1.Analysis Of Efficient Segmentation

Method	Precision	Recall	Accuracy	F1 score
Active contour	.756	.60	.789	.80
Sobel Edge	.79	.75	.802	.79
Canny Edge	.998	.93	.923	.92
Graph Cut	.802	.863	.831	.86

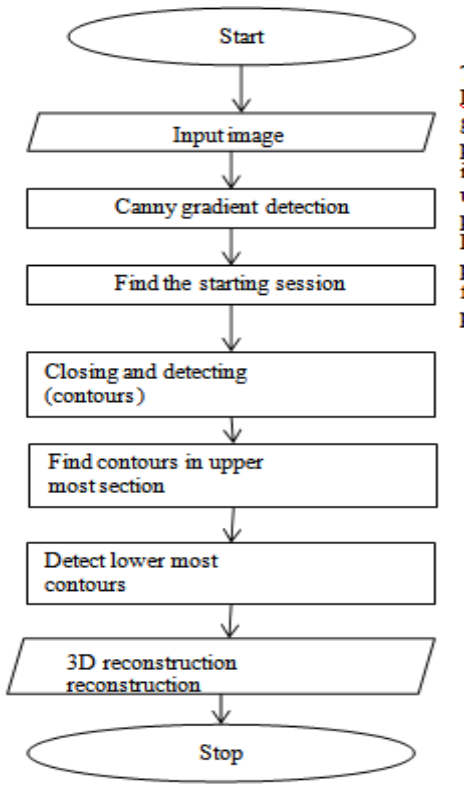

Fig 2 Canny edge detector

V.CONCLUSION

In thus project,dental X ray were collected about 1700 images and dataset were generated by splitting the images into 900 training wth 800 tests.They search the pixel for quality.Best precision for segmentation was in canny edge detection.

REFERENCES

[1] Xu, X., Liu, C. and Zheng, Y., 2018. 3D tooth segmen convolutional neural networks. IEEE transactions on visualization and computer graphics, 25(7), pp.2336-2348.

[2] Al Kheraif, A.A., Wahba, A.A. and Fouad, H., 2019. Detection of dental diseases from radiographic 2d dental image using hybrid graph-cut technique and convolutional neural network. Measurement.

[3] Silva, G., Oliveira, L. and Python, M.,2018.Automatic segmenting teeth in X-ray images: Trends, a novel data set, and future perspectives. Expert Systems with Applications, 107, pp.15-31.

[4] M. Attene, S. Katz, M. Mortara, G. Patane, M. Spagnuolo, and A. Tal, "Mesh segmentation - a comparative study," in IEEE International Conference on Shape Modeling and Applications, 2006, pp. 7–7.

[5] A. Shamir, "A survey on mesh segmentation techniques," Computer Graphics Forum, vol. 27, no. 6, pp. 1539–1556, 2008.

[6] S.Shlafman, A. Tal, and S. Katz, "Metamorphosis of polyhedral suraces219-228 2002

[7] G.Lavoue,F.Dupont, and A.Baskurt,"A new cad mesh segmentation method,based on Curvaturanalysis,"Computar ised Design,vol.37,no.10,pp.975-987,2005

[8] S. Katz and A. Tal, Hierarchicalmesh decomposition using fuzzy clustering and cuts. ACM, 2003,vol.22.no.3

[9] M. Attene, B. Falcidieno, and M. Spagnuolo, "Hierarchical mesh segmentation based on fitting primitives," The Visual Computer, vol. 22, no. 3, pp. 181–193, 2006.

[10] A. P. Mangan and R. T. Whitaker, "Partitioning 3d surface meshes using watershed segmentation," IEEE Transactions on Visualization and Computer Graphics, vol. 5, no. 4, pp. 308–321, 1999.

[11] Y. Lai, S. Hu, R. R. Martin, and P. L. Rosin, "Fast mesh segmentation using random walks," Statistical Methods and Applications, pp. 183–191, 2008. \

[12] A. Koschan, "Perception-based 3d triangle mesh segmentation using fast marching watersheds," in Computer Vision and Pattern Recognition, 2003. Proceedings. 2003 IEEE Computer Society Conference on, vol. 2. IEEE, 2003, pp. II–II.

[13] Golovinskiy and T. Funkhouser, "Randomized cuts for 3d mesh analysis," international conference on computer graphics and interactive techniques, vol. 27, no. 5, p. 145, 2008.

[14] Katz, G. Leifman, and A. Tal, "Mesh segmentation using feature point and core extraction," The Visual Computer, vol. 21, no. 8, pp. 649–658,2005.