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Lips and Tongue Cancer Classification Using Deep Learning Neural Network

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***Abstract*: One of the major diseases in developing countries is Oral Cancer, caused by alcohol, tobacco product and smoking which creates uncontrolled and abnormal cells in parts of human body. Recent Convolution Neural Network (CNN) has helped in medical industry to used medical images for finding the different types of diseases. The objective of research to build new CNN model which use for analysis the oral cancer images and determine the cancerous and noncancerous image. In this paper, CNN technique and image processing are used to categorize cancer or non-cancer lips and tongue image dataset. Deep Learning approaches is used to develop and check the performance of proposed CNN model. For experiment small Kaggle dataset that contains cancerous and non-cancerous lips and tongue images and apply proposed CNN model (Oral_Cancer_Detection). The result of Oral_Cancer_Detection model is very effective and accurate with low complexity. The Oral_Cancer_Detection model found 94% accuracy in our experiment and achieved better accuracy results in less time.**

Keywords: Image Dataset, CNN, Deep Learning, Lips and Tongue Cancerous and Non-cancerous Images.

I. INTRODUCTION

Naturally it is obvious that mouth is the source for humans to inhale all kinds of food and liquid. Recent observations found that lips and tongue cancer cases are increasing worldwide, which is playing the pivotal role in oral cancer. International Agency for Research on Cancer (IARC) [1] was found that new cases and death cases of oral cancer were approximated 377,713 and 177, 757 respectively in 2020. Biopsy and Surgery are the basic treatment in most of the cases of oral cancer but this treatment cost is very expensive and survival rate is very minimal [2, 3].

The Oral Cancer is diagnosed using several techniques of image processing and computer vision on CT scan, Electroencephalogram (EEG) and Magnetic Resource Image (MRI). MRI image is the most effective and widely used modality as compared to other medical images because MRI is invasive and pain less technique in which radio waves generate internal images of the organs within the body.

Advancement in computer science technology and AI, now Deep Learning and machine techniques are playing a significant contribution in medical sciences. Initially Image processing techniques were used in analysis of medical images like MRI and CT images for detection of disease was comparatively easy, but it was a time-consuming process. Due to such kind of problems, computer-based detection system (CBDS) is much needed using deep learning techniques because time is a very important factor for cancer patients and diagnosis of disease at a very early stage required in developing country. Therefore, deep learning model is required, which is easy to automate and predict the most of the cases of cancer like oral cancer, which provides the facility to healthcare professionals for examining the patient and individual to detect the oral cancer from oral cancer image dataset.

In developing countries like India such cases are increasing due to consumption of alcohol and tobacco products. So, it is required to develop efficient and reliable CNN technique which decreases the mortality ratio and diagnose the life threating disease like oral cancer. In this paper, a new CNN model (Oral_Cancer_Detection) is proposed for classification of lips and tongue cancerous and non-cancerous images.

II. LITERATURE REVIEW:

The scope of this study mainly focuses on mouth cancer [4, 5] and lips and tongue cancer [6]. These are main types of oral cancer, which affect millions of people in developing countries.

Worldwide Oral cancer [7] disease has been increasing rapidly but is still not fully diagnosed at early stage. India is facing a lot of problems due to these cases in both genders (male and female) approximately 86% instances of oral cancer [8] were identified. The first and primary reason of oral cancer disease is alcohol and using tobacco products that damage body parts of many persons every year.

It is a well-acquainted fact that lip and tongue are very sensitive part of our body. The major disease in oral cancer is Oral Squamous Cell Carcinoma (OSCC), which is very critical in advanced stage (Phase IV) [9, 10]. Even stages III and IV of OSCC are spread to other parts of body like mouth organs and tissues, ultimately leaving very less chance of survival [11, 12].

Oral cancer cases are the highest in the world and the number of cases in males is larger in comparison with females [13]. Oral cancer is a category of head and neck cancer which occur in various parts of body like tongue, lip, mouth floor, hard palate, gums and teeth [14]. MRI images show white and red patches of patients, who have diseases of oral cancer. Therefore, classification of oral cancer is required, mainly white ones, which is very difficult to diagnosis.

Authors have proposed a three-dimensional CNN model for binary image classification and detect oral cancer [15]. Some pretrained CNN model like Alex-net, Res-net, Mobile-net and Google-net used by researchers in recent work but one limitation of these pretrained model is that it uses many layers which contains the large number of training parameters for classify 1000 of objects.

Authors [16] use Res-net-101 and R-CNN for detection of oral lesions through transfer learning and achieved 87% F1 score in oral cancer classification.

Authors have developed Convolution model for the recognition and characterization for the primary stages of oral cancer. They have implemented image categorization and object detection using pre-trained model [17]. But it is very time consuming and high complexity.

III. OBJECTIVES:

The objective of the study to build new convolutional model (CNN) for determine the prediction of lips and tongue image is cancerous or not. The developed CNN model is very simple, contains few layers and taking less time in classification.

IV. PROPOSED METHOD:

Fig. 1 show the steps of proposed method to develop CNN model for classifying the lips and tongue images. Mainly focus on three steps Data augmentation, Features extraction and classification in proposed classifier.

The one of the important concepts for deep learning is that "more data increase more features through training ultimately increase the more accuracy". In the proposed CNN the first step Data augmentation artificially increasing training set which provide more features, which can be extract by convolutional layer and polling layer in features extraction step then tuning up hyper parameter like learning rate, batch size and epochs in classification step.

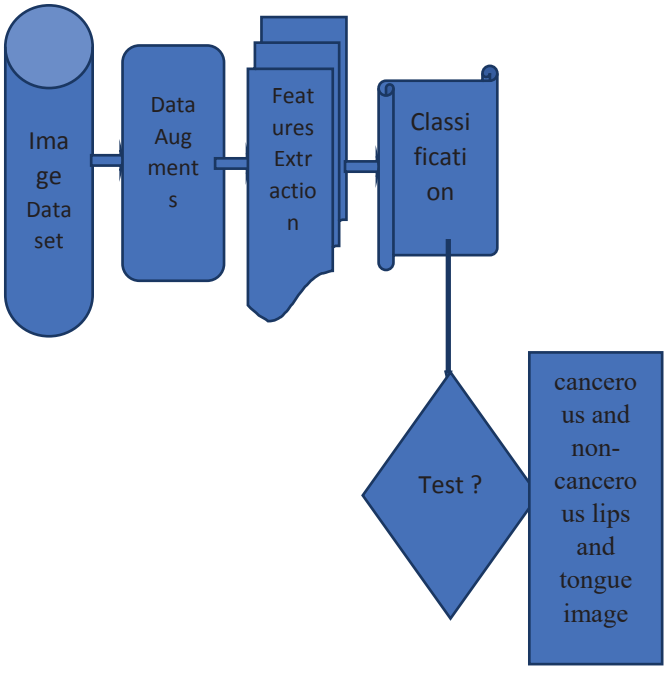

Fig. 1. :Deep Learning Flow

V. DATASET:

In our experiment, we used Kaggle oral cancer dataset of lips and tongue images. Small dataset of 131 images is used in Image Processing and Data Augmentation techniques, in which 87 and 44 are cancerous and non-cancerous images respectively [18]. We divided the dataset into 2 separate parts i.e. randomly training dataset and testing dataset in the ratio of 90:10 respectively. Remaining training dataset is divided into training and validation data in the ratio of 70:30, in which training dataset used for model learning and validation dataset is sample data for model evaluation and model parameters tuning. Finally, 10% of test data is checked for the final result performed in proposed CNN model. The training dataset related to lips and tongue cancerous and non-cancerous images are depicted in Fig. 2.

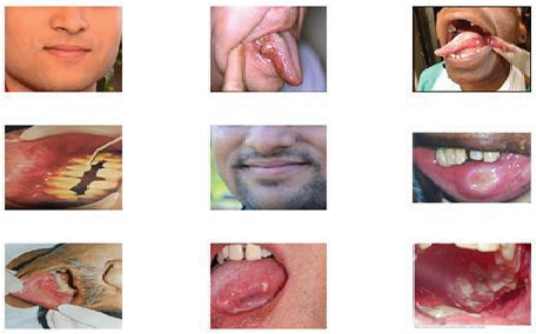

Fig. 2. Training Dataset

VI. CONVOLUTIONAL NEURAL NETWORK MODEL:

In a proposed CNN model, first of all the lips and tongue cancerous and non-cancerous images from Kaggle were download. Since dimension of images are different therefore, we used image batch processor and converted all images into size of 224 x 224. As the Image dataset is very small that's why we applied the data augmented technique for image dataset having RGB Color channels. In a proposed CNN model, it contains 16 layers in which convolution layer, fully connected layer and classification layer with hyper parameter are defined. To train the CNN Model, training options were also provided. The proposed CNN model describes and analyzes deep learning network analyzer in Fig. 3.

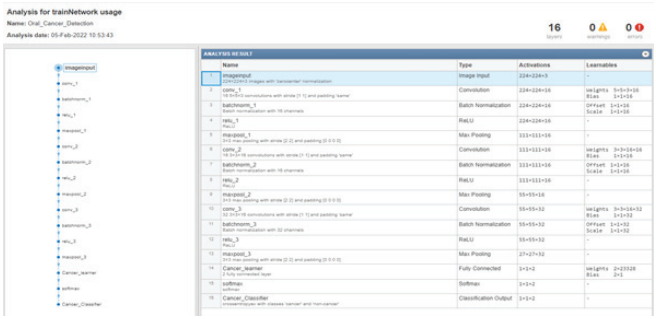

Fig. 3. Details of CNN Architecture

VII. RESULT:

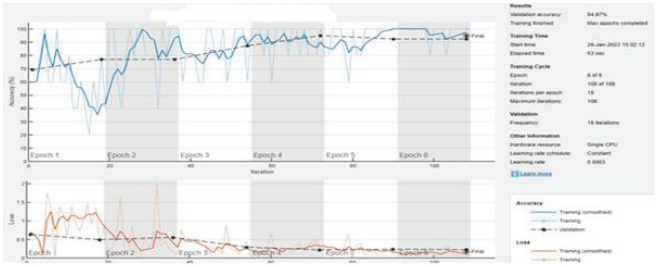

Fig. 4. Training Progress

Proposed CNN Model is implemented in MATLAB; find the validation accuracy shown in Fig. 4. The validation

accuracy is 94% achieved after 132 iterations using proposed method.

Fig. 5 demonstrate the performance measures of the model is represented by confusion matrix, which determine the precision, sensitivity, average, specificity and F1 score, shown in Table 1.

Fig. 5. Confusion Matrix

The key classification matrix of any deep learning model is demonstrated by accuracy, precision, sensitivity, specificity and F1 score. The precision and specificity are 100% in proposed classifier. The accuracy is 91% and F1 score is 94% which is better than accuracy, which means harmonic average of precision and recall provides improved measure of the wrongly classified cases than the accuracy, which give promising result in the proposed work.

TABLE I. CLASSIFICATION MEASURE

CNN Model	Accuracy	Precision	Recall (Sensitivity)	Specificity	F1 Score
Oral_Cancer_Detection	91.7%	100%	88.9%	100%	94.12

For verification of our CNN model, applied test data on proposed model. Fig. 6 show cancerous and non-cancerous image with percentage of accuracy.

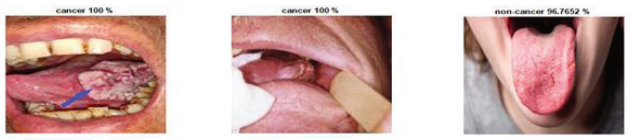

Fig. 6. Testing of Test Images

VIII. CONCLUSION:

In this paper, a new CNN model (Oral_Cnacer_Detection) is developed for classifying lips and tongue cancer. This is an effective technique for classification of cancerous and non-cancerous images by proposing a simple CNN model. The experimental result of our CNN model is very satisfactory for small amount of dataset. This CNN model takes less computational specifications and achieved good accuracy. So, accuracy can be increased with number of training parameters, epochs and use large amount of dataset but it increases the processing time.

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