A SURVEY ON ESOPHAGEAL ADENOCARCINOMA DETECTION OF DIAGNOSIS USING DEEP LEARNING AND TRADITIONAL METHODS

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Abstract-Image mining refers to a data mining technique which is used to extract and derive knowledge directly from the collection of images.Image mining plays vital role in medical field to detect the earliest stage of diseases and treatment stage.Image mining provides four information levels in an image that are pixel, color, texture, edge information and image clear enhancement of a detected region. In the medical field, image mining is used to detect tumors in a human body. It solves the problem of machine vision so as to attain the good result. This survey is dependent on the detection of esophagus adenocarcinoma which is considered the early stage of esophageal cancer. In the recent medical analysis of a tumor, various techniques, methods and algorithms are used to detect the abnormal regions. This research work investigates various image mining techniques and algorithms clearly view the abnormal regions in esophagus and study about the behavior of esophagus adenocarcinoma. The conclusion of this survey studies the merits and disadvantages for every methodology. The goal of this paper is to present a study of various image mining techniques and different algorithms used to detect the esophagus adenocarcinoma.

Keywords: HD –WLE images, classification, feature extraction, pre-processing, segmentation

I.INTRODUCTION

A medical problem that emerging is esophagus adenocarcinoma which is the early stage of esophageal cancer. It is a cancer that occurs in the esophagus, the esophagus a hollow tube which is long that runs from throat to the stomach. Esophageal cancer is a type of cancer that occur in esophagus, It usually begins in the esophageal tube inside line of the esophagus. Symptoms of esophageal cancer include: Difficult to swallow, Loss of weight, Pain in chest, Pressure, Burning in the esophagus tube etc. A number of risk factor include Diet, Alcohol drinking, Regular smoking, Obesity etc.Most patients are diagnosed late in the course of the disease, and by the stage it result in bad prognosis. Image mining is used in the detection of esophagus adenocarcinoma. The image mining is used in detection process; Image mining is a vital technique which is used to mine and extract the patterns from the images and derives knowledge from the images. By using the image mining technique, the extraction and identification of unique features are selected. Image mining has two techniques, first technique is to mine the image from the huge number of images and the second technique is to mine from the collection of images and related data. The image process has the following functions that the image is taken from the image database and the image is preprocessed to improve the quality of the image, the feature of the image is extracted to produce the desired features from the image content such as shape, color etc.the extracted feature are used for mining and various mining

techniques to discover the patterns and finally patterns are evaluated and interpreted the knowledge required, In medical field, the image mining is used for disease detection and classification are specific to human organ and images. Sequence of processing operations stages is required such as image recognition, image processing and enhancement. In enhancement following operations are done on the image such as noise suppression, sharpening, contrast enhancement, image segmentation, feature extraction, classification based on classifier etc. Image processing is having significance for disease detection on medical images. Image mining helps to automate and assist the physicians in clinical diagnosis.

II. LITERATURE SURVEY

1. **Noha Gateway, MassoudZolgharni, Xujiong Ye (2019)** describes to automatically identify esophageal adenocarcinoma (EAC) regions from high-definition white light endoscopy (HD-WLE) images by detection methods. Convolutional Neural Networks (CNNs), Regional-based Convolutional Neural Network (R-CNN), Fast R-CNN, Faster R-CNN, and Single-Shot Multibox Detector (SSD) are used to detect the regions which are abnormal. CNN methods are used to automatically detect the abnormal regions in the esophagus HD-WLE images, for feature extraction in the image the backbone architecture VGG'16 is used. When compared to other methods. SSD and Faster R-CNN networks gives the better results in the experiment, in this paper, object detection methods of deep learning is used to automatically detect the esophageal abnormalities in the detected region. The results in this method proved that the abnormal regions are located in the esophagus of endoscopic images. The automatic early detection and treatment of cancer is a difficult step, the growth in the abnormal region should be monitored with outcome of regular treatment is to be improved.

2. **F. V. D. Sommen, S. Zinger, W. L. Curvers, and et al (2016)** focus on the early cancerous tissue in high definition endoscopic images which are automatically detected. The novel algorithm is used to evaluate the color and feature of texture that is detected based on image that is filtered. By using appropriate filters, the feature is extracted in the abnormal region and it is classified using Support Vector Machine (SVM) classifier .The comparisions are made from the tissue of 7 patients are evaluated and performed by the experiment.

3. **M. Kandemir, A. Feuchtinger, A. Walch, and F. A. Hamprecht (2014)** focuses onstudy the diagnosis of Barrett's cancer from hematoxylin-eosin stained histopathological biopsy images and multiple instances learning (MIL) and SVM classifiers are used in the diagnosis. In this partitions are done on the tissue cores and the identification of rectangular patches are made, for each patch a feature vector is calculated based on features of levels of cell and patches . The tissue core was considered as a container and each patch an example. By using Bayesian logistic regression, authors found that an accuracy is 82 % around, and in area under curve is 0.89 .

4. **A. Souza Jr, C. Hook, J. P. Papa, and C. Palm (2017)** describes a study to test the feasibility of automatic adenocarcinoma classification of images in endoscopic .In this abnormal regions are detected and the feature is extracted using Speeded up Robust Features (SURF) and SVM is used for classification. In the database 100 expert-annotated endoscopic images are kept . The sets of two protocols are used in the experimental section, one is used for the full images of esophagus and other is used only for the adenocarcinoma regions.

5. **R. Mendel, A. Ebigbo, A. Probst, H. Messmann, C. Palm [2017]** focuses on deep learning methods. The deep learning methods are applied to endoscopic images that was annotated by the specialist and it consists of only the images of adenocarcinoma and esophagus disease. For experimentation purposes the dataset was taken from Endovis Challenge and used for the experiment .It consists of 100 identified endoscopic images (50% containing adenocarcinoma) from 39 patients (17 consists of non-cancer and 22 consists of adenocarcinoma cancer). For a set of images , a transfer learning approach in a leave-one-patient-out cross-validation (LOPOCV) and the convolutional neural network was used for identification .With positive results of sensitivity and specificity of 94 %. This study demonstrates that it is possible to extend its

results of BE's esophageal segmentation by using deep learning to reach the abnormal region affected by adenocarcinoma . By using this method it was inefficient in cost and it was time-consuming.

6. **NohaGhatwary, Xujiong Ye, And MassoudZolgharni [2017],** focuses on deep learning methods. In this work Faster Region-Based Convolution Neural Network (Faster R-CNN) is used to identify the regions which are abnormal in esophagus .The images are endoscopic images. Here the combination of Gabor handcrafted features with CNN features is used. The Densely Connected Convolution Networks (Dense Nets) architecture is used to extract CNN features which are propagation between the boundary layers of detected region by avoiding problems. The main focus in this study is by using Gabor features with CNN features is concatenation of the region and to enhance the details of the texture in the detection stage. An experimental result shows that without any human, the system is able to detect the abnormal region in the endoscopic images and the result was good and there was a high performance.

7. **Luis A. Souza J, Christoph Palm Ostbayerische, Jo˜ao P(2017)** describes about the endoscopic images that are computer assisted and helpful to diagnosis and classification of neoplastic lesions. In this work, the Optimum-Path Forest (OPF) classifier is used identify the esophagus, with promising results and Support Vector Machines (SVM) in the context for classification .With the help of key points of Speeded up Robust Features (SURF) and Scale-Invariant Feature Transform (SIFT) the features are extracted, for further designing a bag-of-visual-words that is used to feed both OPF and SVM classifiers. The best result was obtained by OPF classifier for feature extraction.

8. **Xin Qi, Michael V. Sivak Jr, Joseph. E, Andrew M. Rollins (2006)** describes Barrett's esophagus (BE), the objective of this work is to develop computer-aided diagnosis CAD algorithms that aid the detection of dysplasia in BE. The image dataset was derived from a total of 405 EOCT images and 13 patients that were paired with highly correlated biopsies. 106 images were included in this work. The CAD algorithm used in this work and it was based on a standard texture analysis method which is center-symmetric auto-correlation. Using the histology as the reference, this CAD algorithm had a sensitivity of 82%, and accuracy of 83%. CAD has the standardization to the diagnosis of dysplasia and high throughput over the image evaluation for applications in EOCT screening. CAD has the poor performance identification of dysplasia in BE and has to improve the EOCT.

9. **Sato, F., Shimada, Y., Selaru, F. M., Shibata, D., Maeda, M., Watanabe, G Meltzer, S. J. (2005)** focuses on artificial neural networks (ANNs), the ANNs is applied to the patient analysis and tumor-related variables. In this work, pathological data were collected from 418 patients with esophageal carcinoma who underwent Surgery to remove all malignant (cancerous) tissue, which is meant to cure the diseases . The accuracy of this ANN model subsequently was compared with the accuracy of the conventional statistical technique such as linear discriminate analysis (LDA). The result of this work was that the optimal ANN models for predicting outcomes at 1 year and 5 years consisted of 65 variables respectively. Optimal data sets were significantly more accurate than the original data set of 199 variables. By using ANN models in this work has improved the accuracy, which was compared with corresponding LDA models for survival predictions. ANNs is a powerful tool and proved the better one for seeking optimal data sets.

10. **Yang, F., Hamit, M., Yan, C. B., Yao, J., Kutluk, A., Kong, X. M., & Zhang, S. X. (2017)** focuses on image preprocessing processes such as feature extraction, selection of the feature, classification of images, and evaluation of performance of the images. X-ray images of 300 original esophageal were resized to a ROI (Region of Interest) and then given to median filter to enhance the images and histogram equalization method is applied. 37 features from textual, frequency, and complexity domains were extracted. The two methods Sequential forward selection and principal component analysis were employed to select the discriminative features for classification. Then, to classify the esophageal cancer images with respect to their specific types the SVM (support vector machine) and K-nearest neighbors algorithms were applied. The performance of classification was evaluated in terms the area under the accuracy, precision receiver operating characteristic curve, and recall respectively. Therefore, the proposed computer-aided diagnostic system is promising for the diagnostics of esophageal cancer.

TABLE 1: INFERENCES OF TRADITIONAL METHODS FOR ESOPHAGEAL ADENOCARCINOMA (EAC) DETECTION

S.NO	AUTHOR NAME	METHOD NAME	YEAR	ADVANTAGES	DISADVANTAGES
1	Noha Gateway, Massoud Zolgharni, Xujiong Ye	RCNN, Fast RCNN and SSD	2019	Detect abnormalities	It is not suitable for monitoring regular growth of abnormal region
2	F.V.D. Sommen, S. Zinger, W. L. Curvers, and et al	Novel Algorithm (SVM)	2016	Evaluate the color and feature of texture	It cannot focus on edge enhancement
3	M. Kandemir, A. Feuchtinger, A. Walch, and F. A. Hamprecht	Multiple Instances learning (MIL) and Support Vector machine (SVM)	2014	Identification of rectangular patches on esophagus images	Independent patches become less interpretable
4	A. Souza Jr, C. Hook, J. P. Papa, and C. Palm	Speeded up Robust Features (SURF) and Support Vector Machine (SVM)	2017	improves the classification	Cannot focus on earlier stages of cancer
5	R. Mendel, A. Ebigbo, A. Probst, H. Messmann, C. Palm	Deep learning methods	2017	Endoscopic images of adenocarcinoma	Inefficient in cost and time consuming
6	Noha Ghatwary, Xujiong Ye, And Massoud Zolgharni	Faster RCNN	2017	Better esophageal cancer detection	slow convergence and large time time-consuming
7	Luis A. Souza J, Christoph Palm Ostbayerische, Jo˜ao P	Optimum Path Forest (OPF) classifier	2017	Feature extracted on esophagus images	Not on the entire circumferential scans
8	Xin Qi, Michael V. Sivak Jr, Joseph. E, Andrew M. Rollins	CAD Algorithms	2006	Detection of dysplasia in Esophagus	Poor performance and has to improve
9	Sato, F., Shimada, Y., Selaru, F. M., Shibata, D., Maeda, M., Watanabe, G Meltzer, S. J.	Artificial Neural Networks (ANN)	2005	Accuracy rate improved for Pathological data	Seeking better performance in Optimal data sets
10	Yang, F., Hamit, M., Yan, C. B., Yao, J., Kutluk, A., Kong, X. M., & Zhang, S. X.	Support Vector Machine (SVM) and K – Nearest neighbor	2017	Feature extracted, classified and performance is evaluated	Promising for diagnostics of esophagus cancer

III.CONCLUSION

This paper surveys the related works to find the esophageal adenocarcinoma by using various techniques that have been used in preprocessing, feature extraction, segmentation and classification. Some works shows accurate results, moderate results. The future works may carry with more features could be employed to identify the esophagus. In this review result and discussion in various classification techniques. Thus the classification will acts as main role in image processing system it will be used to classify cancer and non-cancer images. So, the earlier stage of detection of esophageal adenocarcinoma will prevent a person from the death.

IV. REFERENCE

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