Performance Analysis of Dysplasia Diagnosis for Cervical Cancer

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Abstract

Cancer cervix is the second most common cancer in women in the world, while it is the leading cancer in women in the developing countries. Globally, 15% of all cancers’ in females are cervical cancers’, while in Southeast Asia, cancer cervix accounts for 20%-30% of all cancers’. Cancer of cervix is a major cause of death in women living in developing countries. Unlike most other malignancies, cancer of cervix is readily preventable when effective programs are conducted to detect and treat its precursor lesions. Since the introduction of Pap test, a dramatic reduction has been observed in the incidence and mortality of invasive cervical cancer worldwide. Conventional methods used Multimodal Entity Co-reference for combining various tests to perform disease classification and diagnosis. Its performance is degraded due to its low sensitivity and specificity. In this project, we propose watershed segmentation algorithm to segment the abnormal region and this abnormal regions are classified into normal or cancer using feed forward neural network classifier. The performance of the proposed system is analyzed in terms of sensitivity, specificity and accuracy.

Keywords: Feed Forward Artificial Neural Network, Water shed Segmentation, Local Binary Pattern, Gray level Co-occurrence matrix, Wavelet Transform

I. INTRODUCTION

CANCER CERVIX death rate is reduced by combination of several screening and diagnostic procedures in western countries. And also due to the lack in screening methods and diagnostic procedures there is a need, for automated screening methods are increased. In Digital cervicography, the photographs of cervix is taken by cerviscope as a diagnostic device. The cervix is visualized with a vaginal speculum and 5% acetic acid is applied to the cervix. The image of the acetic-acid treated cervix is processed onto film and projected on a white screen for analysis. Due to the poor correlation in digital cervicography, computer-assisted diagnoses are used to detect cervical cancer in early stage. In that computer algorithms are used to detect cervical region. Accuracy in detection is improved by using images of cervigram, the normal clinical Pap test and HPV test images are combined with automated Pap and HPV test images. The effectiveness of the combination of several screening methods is poor in terms of sensitivity and accuracy, so that we further improves, the accuracy by cervigram images taken by scanning. The cervix is visualized with a vaginal speculum and optical rays are passed over that and the treated cervix is projected on a white screen for analysis. In cervix region, the region of interest is detected by Local Binary Pattern and Gray scale Co-occurrence matrix, after that image is classified. The image classification is done by color features and also Local Binary Pattern and Gray scale Co-occurrence matrix are used to classify different cervix regions. After that region classification texture features are used to classify vascular patterns in cervix region. Totally classifier is used to classify the abnormal cervix regions from normal cervix region. In that Feed Forward Neural Network classifier that classifies the cervigram images. To classify the vascular tissues and neural networks in cervix image this classifier is efficient. The classified cervix image, is further segmented by segmentation algorithm. Water Shed Segmentation algorithm is efficient for Neural networks. This algorithm segments the cancer regions in the cervical image. The image analysis result is combined with physician marked image to evaluate the performance of disease classification. International Federation of Gynecology Obstetrics is the system that staging the cervical cancer. The stages are Normal, Early, Late and Final stage. We develop a computerized program that taken these factors in to consideration for the treatment that should be much easier.

II. PREVIOUS WORK

We investigate and exploit various methods used to detect and diagnosis cervical cancer, and also the methodologies used in that also discussed, and also additional features included to overcome the limits in that effectiveness.
A. Automatic Detection of Anatomical Landmarks

We present a multistage scheme for segmenting and labeling regions of anatomical interest within the cervigram. In particular, we focus on the extraction of the cervix region and fine detection of the cervix boundary. Specular reflection is eliminated as an important preprocessing in addition, the entrance to the endocervical canal is detected [10]. In this method prior shape model is used for curve evolution. The effectiveness of this method is poor because of its low accuracy.

B. Automatic and Interactive Lesion Detection and Segmentation

The automatic extraction and segmentation method is used to extract and segment region by boundaries of the region. After that the watershed segmentation map of the input image is modeled using a Markov random field (MRF) in which watershed regions correspond to binary random variables indicating whether the region is part of the lesion tissue or not [11]. Arcs are there in watershed map, that indicating whether the arc is part of the region boundary. These arcs are formed by local pair wise factors, and the factors are based on supervised learning. The loopy belief propagation segment the final lesion region by applied that to the watershed arc-level Markov random field. The total time required for detection is more, that is the disadvantage in that method.

C. Domain Specific Image Analysis

A domain-specific automated image analysis is detecting the pre-cancerous and cancerous lesions of the uterine cervix. In that the diagnostic features are taken in a probabilistic manner using conditional random fields. A novel window-based performance assessment scheme is used. Different tissue types in the regions are identified for the extraction of anatomical features. The unique optical properties of each tissue and the diagnostic relationships between neighboring regions are used in the proposed method called conditional random field model [15]. The effectiveness of this method is concededly poor because of its sensitivity and specificity.

D. Soft Computing

A hybrid decision support system is used the different stages of cervical cancer. Hybridization includes the evolution of knowledge-based sub network modules with genetic algorithms using rough set theory and the Interactive Dichotomize 3 (ID3) algorithm [16]. The network weight and structure are used for analyzing the performance. But the accuracy of this genetic algorithm is not in the considerable rate.

E. Multimodal Entity Coreference

In this we develop a comprehensive algorithmic frame work based on Multimodal Entity Coreference for combining various tests to perform disease classification and diagnosis [7]. The computerized program is developed for Multimodal Entity that gives better accuracy. But the effectiveness of this method is poor in terms of sensitivity, specificity and accuracy. To overcome this limitation we develop the proposed method with abdominal scanning, that cervigram images are used to analysis the stages of cervical cancer and also detect that in early stage.

III. PROPOSED WORK

The main objective is to evaluate whether the cervigram images from abdominal scanning can be used as a good screening method to detect cancer lesions in early stage, and also performance can be obtained by comparing that disease classification images with physician marked images. The stages of cervical lesion are given Fig. 1.
The cervigram image is preprocessed to reduce the complexity of high bit rate. It is the process of resizing and also the RGB image is converted into a Gray scale image. The features in the preprocessed image are then extracted by feature extraction and then the image is segmented by watershed segmentation. The segmented image is classified by means of the classifier. The block diagram of analysis of cervical cancer is given in Fig. 2.

**A. Preprocessing**

Pre-processing is a common name for operations with images at the lowest level of abstraction both input and output are in low intensity. The aim of the method pre-processing is an improvement of the image data images. That suppresses the unwanted distortions or enhances some image features that are important for further processing. Four categories of image pre-processing methods according to the size of pixel neighborhood that is used for the calculation of a new geometric pixel brightness transformations. In that pre-processing method that can be use local neighborhood transformations, image restoration that requires knowledge of the processed pixel and other classifications of image pre-processing is about the entire image. Image pre-processing method uses the considerable redundancy in neighboring pixels that corresponding to the one object in real images.
Thus, the distorted pixel has essentially the same or similar brightness value. Pixel can often be restored as an average value of neighboring pixels.

### B. Feature Extraction

The features are extracted from the pre-processed cervical image. The features are used to differentiate the normal and abnormal cervical images for cervical cancer detection. In this project, local binary pattern (LBP), GLCM (Gray level co-occurrence matrix) are extracted. Feature extraction involves reducing the amount of resources required to describe a large set of data.

1) **Local Binary Pattern**

The Local Binary Pattern process is an efficient texture based operator. In that integer value of the pixels are taken into account, and also each and every pixels are considered during operation. We considered any one of the pixel in the image, and then the integer value of the pixel is compared with its neighboring pixels. If the value is equal or greater than the center pixel value we assigned the value of LBP is 1, otherwise the value is 0. This process is repeated for each and every pixel.

2) **Gray Scale Co-occurrence Matrixes**

The Co-occurrence features are extracted in Co-occurrence. The Co-occurrence features are Energy, Correlation, Intensity and Homogeneity. In that also the process used in LBP is used to find the Co-occurrence Matrix.

3) **Wavelet Features**

The Discrete Wavelet Transform is mainly based on wavelets. It is used to view both spatial domain and frequency domain image features simultaneously that gives the multi resolution image. It splits the output image into four different sub-bands. The sub-bands are LL, LH, HL and HH. In that LL is approximate input image represented as A. LH is horizontal detail of the input image and represented as H. HL is vertical detail of the input image and represented as V. HH is Diagonal detail of the input image and represented as D. The LL is the low frequency band and LH, HL and HH are high frequency band.

### C. Watershed Segmentation

Image segmentation is the process of partitioning a digital image into multiple segments. The main goal of segmentation is to simplify the image into more meaningful and easier to analyze. The process image segmentation is typically used to locate objects and boundaries in images. The cervical image is first segmented using marker controlled watershed segmentation. This segmentation process uses the Sobel operator to find the gradient image. Using the gradient image, the watershed transform is estimated. Therefore, the final segmentation map is get. That segments the cancer lesions from normal region. Then, the cell nuclei region is detected from the final segmentation map using morphological operation.

### D. Feed Forward Neural Network Classifier

The neural network (NN) classifier is defined as an information-processing system that is inspired by the structure of the human brain. The NNs consist of a number of interconnected neurons. A neuron is an information-processing unit that receives several signals from its input links, each of which has a weight assigned to it. These weights correspond to synaptic efficiency in biological neurons. Weights are the basic means of the long term memory in neurons. The back propagation algorithm is used in layered feed-forward ANNs. The network receives inputs by neurons in the input layer, and the output of the network is given by the neurons on an output layer. There may be one or more intermediate hidden layers. The training begins with random weights, and the goal is to adjust them so that the error will be minimal NNs. The neural network has two modes, they are training mode and classification mode. In that the images are trained in training mode and they are classified in classification mode.


IV. RESULTS

The cervigram images both normal and abnormal images are taken as input images and those images are analyzed. In the abnormal cervical image the cancer lesion is marked.

Fig. 4: Input Image

The RGB image converted into gray scale image that is preprocessed. Then the features in the image are then extracted. That extracting LBP and GLCM features.

Fig. 5: ROI Image

Fig. 6: LBP Feature

The values of the Co-occurrence features are given in Fig. 7.
After the image extraction, the segmentation process is performed. The watershed Segmentation is used to segment the abnormal regions. Then the disease classification is done by feed forward neural network classifier. The disease affected cell nuclei is separated by morphological based operations.

The ground Truth image marked by physician is compared with the segmented image.

The performance analysis is done by comparing the computerized output to the image marked by the physician. The performance comparison between existing and proposed method.
The performance of the proposed cervical cancer system is evaluated in terms of accuracy, sensitivity and specificity. The rate of sensitivity, accuracy and specificity of this method is higher than the previous method. In this method cervical cancer is simply detected by abdominal scanning.

V. CONCLUSION AND FUTURE WORK

The proposed cervical tumor detection system is evaluated for its performance appraisal. To keep the objectiveness of the evaluation, the results obtained are compared with the ground truth images. In that the segmented image is compared with the ground truth image obtained by expert physician. In future work the Genetic segmentation algorithm and Anti fish classifier is applied on the malignant cervical images. The segmentation algorithm that segments the carcinoma tissues and then the Anti fish classifier is used to classifying normal cervix images from abnormal cervix images. And also the classifier classifies the tumor in to three stages mild, severe, moderate.

REFERENCES