|| Volume 3 || Issue 10 || October 2018 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

Survey on Process and Classification of Cervical Cancer for the Neural Pap System

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Abstract— **Cervical cancer been known to be the cause of many deaths each year. Screening tests, such as the Pap smear test used for the detection of the precancerous stage are able to avoid the occurrence of cervical cancer. However, the Pap smear test does have some disappointing disadvantages such as the fact that it has less effective slide preparation and also that it is laden with human error. Therefore, a computer-aided diagnosis system is introduced as a solution to the problem. Recently, artificial neural networks have been widely implemented as a cervical cancer diagnosis system i.e. to classify cervical cancer into normal and abnormal cells. In this recent study, neural network architecture i.e. the Hybrid Radial Basis Function (HRBF) network with Adaptive Fuzzy K-Means Clustering (AFKM) as a centre positioning algorithm is used to diagnose cervical cancer. Four extracted features of cervical cell are used as input data to the networks, which are the size of nucleus and cytoplasm and its grey level. Cells from normal, Low-grade Squamous Intraepithelial Lesion (LSIL) and High-grade Squamous Intraepithelial Lesion (HSIL) categories are used as the training as well as the testing data. The data are fed randomly into the neural networks via 5-folds cross validation techniques. The network performance is compared with the HRBF network with the Moving K-Means algorithm as the centre positioning algorithm. The proposed network produces better accuracy, sensitivity and specificity which illustrate the promising capability of the network to be implemented as cervical cancer diagnosis system for Pap test performance improvement.**

Keywords: *Cervical Cancer; Diagnosis System; Clustering Algorithm; NeuralPap.*

I INTRODUCTION

Cervical cancer is the second most common cancer in women worldwide and the leading cause of cancer mortality for women in developing countries. A Papanicolaou test, also called Pap smear or Pap test, is a medical screening method that can help prevent cervical cancer. The main purpose of the Pap smear is to detect for cell abnormalities that may occur from cervical cancer or before cancer develops. In Pap smear, sample cells are taken from the cervix and smeared onto a glass slide. These cells are stained and fixed with a preservative to keep cells from becoming air dried and distorted. The slides are then delivered to a laboratory where they are screened by a cytologist. In many developing countries where there are still inadequate numbers of cyto technicians who can examine slides. Therefore, it is urgently necessary to develop the automated Pap smear analysis system that can help cytologists in Pap screening.

At time, however, the determination of abnormal or cancerous cervical cells can be missed due to technical or human errors. Studies by Othman et al. (1997) and Hislop et al. (1994) have shown that some Pap smear cytology images are blurred and highly affected by unwanted noises, such as blood, air artifact, vagina discharge etc. These problems can hide and obscure the important morphologies of cervical cells. Thus, the Pap smear cytology image will be referred as inadequate samples for cervical cancer screening process.

The Pap smear slides usually contain both of single cells and clusters of cells. Most of cells are found with high degree of overlapping. The physical appearance of cells in an image depends how the specimen, which collected from cervix, was smeared, stained, and captured. The stained process makes cells appear in different colors. In the image acquisition process, the size of cells in an image will be large or small depends on which magnification lens used. The quality of image also depends on the resolution of a digital camera. The cervical cell microscopic images were obtained from the Pathologic Anatomy Department of 1° of October Regional Metropolitan Hospital in Mexico City by means of use of Leica DME microscopy with integrated Leica EC3 digital camera, software LAS EZ (PC), and lens Leica ∞/0.17 Hi Plan 100x/1.25 oil, the size of cell images is 2048x1536 pixels.

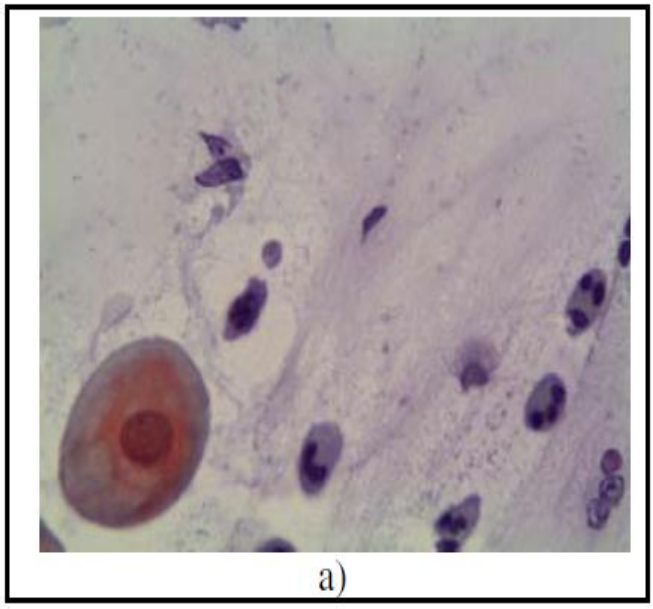


Figure 1 shows sample images which contain normal and abnormal cells.

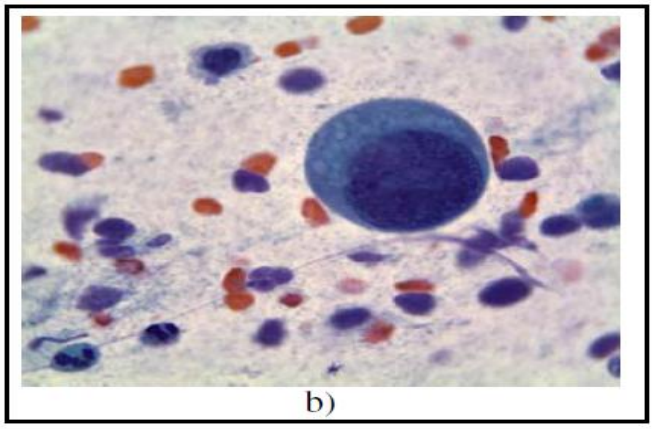
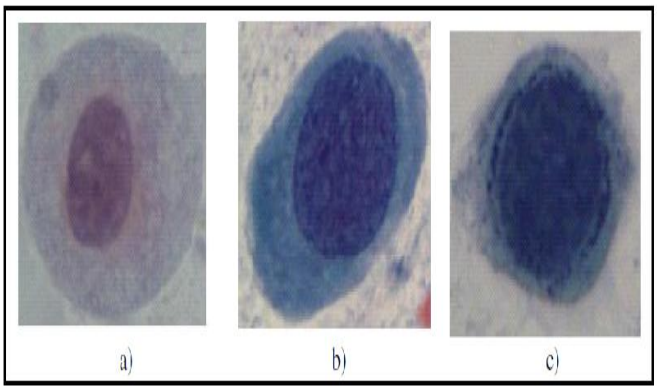


Figure 2: Sample of cervical cell microscopic images, a) Normal cell, and b) Abnormal cell

The cervical cells consist of two main components. One is nucleus locates about the center of cell surrounded by the cytoplasm. Normally, nucleus shape is small and almost round. Its intensity is darker than cytoplasm. The specimens, which are taken from several areas of the cervix, most often contain cells from columnar epithelium and the squamous epithelium. The squamous epithelium consists of 4 layers of cells: basal, parabasal, intermediate, and superficial cells. The Cervical intra-epithelial neoplasia (CIN), also known as dysplasia has the potential to become invasive cervical cancer. CIN is graded into three stages of severity, from CIN 1 (mild dysplasia) through CIN 2 (moderate dysplasia) to CIN 3 (severe dysplasia).

In Pap smear microscopic image analysis, cervical cells can be divided into several classes categorized by cell appearance, especially in cell nucleus. Since a cell nucleus can present the significant changes when the cell is affected by a disease, the identification and quantification of these changes contribute in the discrimination of normal and abnormal cells in Pap smear images.



II REVIEW OF LITERATURE

A. R. Chang, Lin WF, Chang A [1], the usefulness of the automated screening equipment of the papanicol screening was examined. And, the diagnosis by each method was compared. Autopap using LGS sufficiently determined the validity of the Pap smear, and the remarkable abnormal cell for the inspection of the human was identified. Accurate diagnosis was possible when only the marked cells were examined, and this method was reduced to less than half of the screening time required for conventional screening, and the conventional 37 cases and 29 cases of LGS group, when the low-grade squamous intraepithelial lesion was taken as a threshold value. There was an atypical squamous cell as a threshold, and it was the LGS group of 111 examples, 93 examples in the conventional group. LGS AutoPap can significantly facilitate Pap smear examinations without lowering the detection rate of clinically significant lesions, and therefore helping alleviate cytotechnologist deficiencies.

Lee js, kaun L, Oh s,Patten FW, Wilbur DC [2], the author examine the feasibility of the location guide screening of the autopep system and to select the location of the potentially abnormal cell material, an autopepp system may be used. The accuracy of the location-guided slide triage was high and did not change significantly in different slide populations. Also,>80% of abnormal slide For, the location of the AutoPap system-selected FOV slide, the estimated location of the LSIL+slide, by pairing the AutoPap primary screening with the re-screening by most diagnostic location guides used to assign an accurate diagnosis to the slide.

Wilbur DC, Prey MU, Miller WM, Pawlick GF, Colgan TJ [3], the author evaluate the effectiveness of the AutoPap System in detecting abnormal and normal cervical smears when used in a primary screening/quality control mode, as compared with currently established laboratory practices. Slides were obtained prospectively and were initially processed in the routine fashion with cytotechnologist screening followed by 10% random quality control rescreening. The AutoPap System-assisted arm of the study was superior to the current practice arm for the identification of abnormal slides at the level of atypical squamous cells of undetermined significance and above (ASCUS+), low grade squamous intraepithelial lesion (LSIL) and higher LSIL+. AutoPap System-assisted practice was equivalent to current practice for the identification of unsatisfactory and satisfactory but limited by slides. All results showed statistical significance. In addition, AutoPap System-assisted practice in the study indicated improved specificity of diagnosis.

M. Y. mashor[4], this study is a new hybrid algorithm for training RBF networks. This algorithm
RBF center of the proposed clustering algorithm position Givens least squares this section describes clustering issues for placing RBFS after that, they proposed an algorithm for a moving k-means Clustering called a clustering algorithm, and examined its effect reduce the problem. We compared the performance of this algorithm with the adaptive k-means, Non-adaptive k-means and fuzzy c-means clustering algorithms. Overall performance of RBF Network suggestions algorithm uses something like other clustering the algorithm simulation results are also stored in the initial Center, which shows that there is no algorithm revealed.

Mirabal, Y.N., Chang, S.K., Neely Atkinson, E., Malpica, A., Follen, M., Richards- Kortum, R[5], By using accurate, objective, and instantaneous point-of-care diagnostic tools, the specific goal of this study is to analyze the reflectance spectra of normal and neoplastic neck tissues in vivo and to analyze the data for use in the development of diagnostic algorithms in vivo. It was carried out. As the separation of the source detector increases, the greater tissue depth is probed. The average spectrum of each diagnostic class differs from the

separation of all source detectors, with the largest difference in the separation of the smallest source detectors. An algorithm based on Principal Component Analysis and mahalanobis distance classification was developed.

Plissiti, M.E., Charchanti, A., Krikoni, O., Fotiadis, D.I [6], an automated method for cell nuclear segmentation in pap smear images is proposed. This method combines a holistic knowledge of the appearance of cells and nuclei and local features of the region of the nucleus in order to achieve precise nuclear boundaries. Filters and morphological operators in all three channels of the Color Image, even if the cell overlap occurs, the boundary of the nucleus in the image the location of the nucleus is determined by a deformable model. This result is very promising even if the image with the high overlap degree is used.

Table 1: Literature Survey

Sr. No	Paper Title	Author	Method Proposed	Disadvantages
1	Can Technology Expedite the Cervical Cancer Screening Process? A Hong Kong Experience Using the AutoPap Primary Screening System Location-Guided Screening Capability	A. R. Chang, Lin WF, Chang A	The AutoPap with LGS can significantly speed the examination of Pap smears without lowering the detection rate of clinically important lesions, thus helping alleviate the cytotechnologist shortage.	LGS detects more abnormal cases than do experienced human screeners using the conventional manual method.
2	A Feasibility Study of the Autopap System Location-Guided Screening	Lee js, kaun L, Oh s,Patten FW, Wilbur DC	To study the feasibility of AutoPap System location-guided screening and to evaluate the accuracy of the AutoPap System in selecting locations of potentially abnormal cellular material	The location-guided triage sensitivities to the few difficult abnormal slides that the AutoPap System classified as no review if the device was operated at higher no review rates
3	The Autopap System for Primary Screening in Cervical Cytology: Comparing the Results of a Prospective, Intended-Use Study with Routine Manual Practice	Wilbur DC, Prey MU, Miller WM, Pawlick GF, Colgan TJ	AutoPap System-assisted practice in the study indicated improved specificity of diagnosis.	Collecting large numbers of rare abnormal slides from the prospective portions of a clinical trial is very difficult.
4	Hybrid Training Algorithm for RBF Network	M. Y. mashor	Performance of the RBF network that used the proposed algorithm is much better than the ones that used other clustering algorithms.	Problems of clustering for positioning RBF centers.
5	Reflectance spectroscopy for in vivo detection of cervical precancer	Mirabal, Y.N., Chang, S.K., Neely Atkinson, E., Malpica, A., Follen, M., Richards-Kortum, R	The goal of this study is to analyze the reflectance spectra of normal and neoplastic neck tissues in vivo and to analyze the data for use in the development of diagnostic algorithms in vivo.	Performance of this method is not good.
6	Automated segmentation of cell nuclei in PAP smear images	Plissiti, M.E., Charchanti, A., Krikoni, O., Fotiadis, D.I	An automated method for cell nuclear segmentation in pap smear images is proposed.	Does not always produce good diagnostic performance due to bad samples.

III CONCLUSION

In this paper discussed about the cervical cancer and pap smear test. A Papanicolaou test, also called Pap smear or Pap test, is a medical screening method that can help prevent cervical cancer. The main purpose of the Pap smear is to detect for cell abnormalities that may occur from cervical cancer or before cancer develops. In this recent study, neural network architecture i.e. the Hybrid Radial Basis Function (HRBF) network with Adaptive Fuzzy K-Means Clustering (AFKM) as a centre positioning algorithm is used to diagnose cervical cancer. Four extracted features of cervical cell are used as input data to the networks, which are the size of nucleus and cytoplasm and its grey level. Cells from normal, Low-grade Squamous Intraepithelial Lesion (LSIL) and High-grade Squamous Intraepithelial Lesion (HSIL) categories are used as the training as well as the testing data. The data are fed randomly into the neural networks via 5-folds cross validation techniques. The network performance is compared with the HRBF network with the Moving K-Means algorithm as the centre positioning algorithm. The proposed network produces better accuracy, sensitivity and specificity which illustrate the promising capability of the network to be implemented as cervical cancer diagnosis system for Pap test performance improvement.

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