International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

Texture based Feature Extraction of Smear Images for Cervical Cancer

Mr. Joseph Satyadhas[1], Preetha V[2]

[1]*Assistant Professor, Department of Electronics and Communication Engineering, Meenakshi Sundararajan Engineering College, Chennai-24, India*

[2]*UG Student, Department of Electronics and Communication Engineering, Meenakshi Sundararajan Engineering College, Chennai-24, India*

Abstract - *Cervical cancer is one of the deadliest cancers and is also a key research area in image processing. The essential problem with this cancer is that it cannot be detected earlier as it doesn't throw any symptoms until the final stages. To detect cancer in each stage you need unique functions and it involves three important stages. Realizing the fact, a diffusion of screening test has therefore been advanced in attempting to be carried out as early cervical precancerous screening equipment. The proposed algorithm extracts features from the images extra accurately. My proposed work includes a classifier which can classify whether it is affected by disease or not. A pap smear image is taken from the pap test which collects the pap cells from the cervix , then is placed on the glass plate and then examined by using the image analysis method .The main purpose of this project is that, it identifies the disease by the presence of abnormal cells present in the image. A neural network is used which is a computing model whose layered structure resembles the networked structure of neurons in the brain, with layers of connected nodes. A neural network can learn from data so it can be trained to recognize patterns, classify data, and forecast future events. A neural network breaks down your input into layers of abstraction. It can be trained over many examples to recognize patterns in speech or images, for example, just as the human brain does. Its behavior is defined by the way its individual elements are connected and by the strength, or weights, of those connections. Using the training and the testing methods we find the difference in the image by comparing the images in training and testing.*

Key Words: **Cervical Cancer, Pap test, Neural network**

1. INTRODUCTION

Cancer is an uncontrolled division of body cells. Cervical cancer is the second most common type of cancer found in women [1]. Although breast cancer [2] is the most common type of cancer in females in India, cervical cancer mortality rate is higher. Infection of human papilloma virus (HPV) is strongly associated with cervical cancer. Other probable reasons are lack of awareness, early marriage, prolonged use of contraceptive pills, poor hygiene, multiple sex partners, and low immunity [3,4] . Vaccines for HPV virus-like HPV16 and HPV18 are now available in the market, but due to lack of awareness, these preventive measures are not commonly used. Although the government of India started many awareness programs, but this has not reached to the mass population yet. There are no accurate sign and symptoms of cervical cancer in the early stages. There are two tests to detect early changes of cervical cancer, Pap test and HPV test [5]. Pap test (Papanicolaou test) is the most commonly used screening test for early detection of cervical cancer.

1.1 Existing Method

The existing methods are the svm classifier- k means clustering and the computer vision method. In my proposed work, I would be using the image preprocessing techniques and the classifiers like the artificial neural networks. Hence six shape-based features of the nucleus are exacted. SVM is used to classify the cells into three classes. In cervical cancer, classification accuracy is determined by the feature extraction methods. In shape-based features [34] area, perimeter, major axis, minor axis, compactness and eccentricity of the nucleus are calculated and for cytoplasm the area, perimeter, compactness, and eccentricity are calculated. Nucleus and cytoplasm (N/C) ratio is a very important shape based feature. If the cell is normal its N/C ratio is low, and the nucleus is round, but in abnormal cells, its N/C ratio increases and shape of nucleus turns to elliptical. In some papers texture based features like grey level co-occurrence matrix (GLCM) [35] are used.

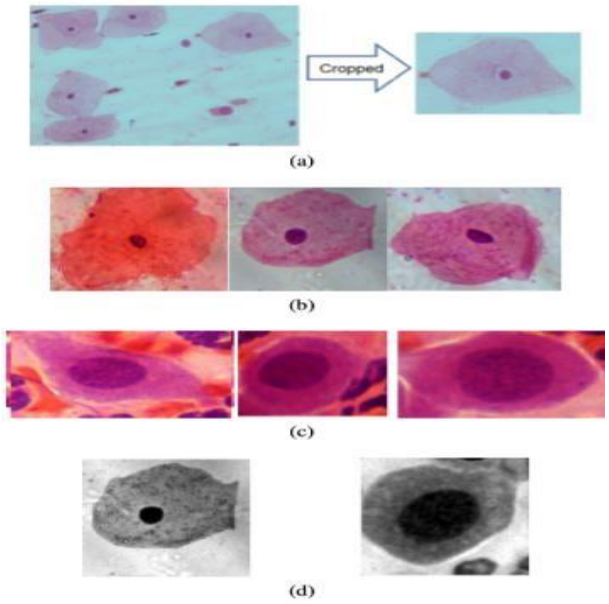
1.2 Literature Survey

According to the literature survey, many segmentation methods have been proposed to segment out the nucleus and cytoplasm from the smear images, and then shape-based and colour based features were used for the classification of

cells. Research is still going on to find out the best segmentation method. In this paper, high derivative texture-based features are used to find the properties of the cell because the texture based technique is acceptable on nonsegmented images. The texture is another feature that helps to segment the image into a region of interest according to the structural and statistical approach. The major advantage of using texture attribute is its simplicity. In this paper, a statistical approach is used because it shows the distribution and arrangement of intensities (grey levels) of an image. In this study first order, second order and high order derivative statistical texture features are used. The high order derivative statistical texture features show more potential for effective discrimination in biomedical images. Texture-based methods are used for extracting relevant features from smear slides and are applied on a self-generated dataset for the classification of the cell into normal and cancerous class.

2. Proposed Method

The proposed method is featured in cropping of the single cell from a real smear image containing multiple cells is shown. Cropped single normal cells and abnormal cells Pap smear cells are in the RGB format, and the RGB images take more time to process. To overcome this problem, images were converted into a grey-scale image. Median filter was used to remove noise and edge sharpening function to enhance the edges. Fig. shows the pre-processed images of normal and abnormal cell.



Feature extraction is the next step after preprocessing. In early papers, only shape-based features and some basic texture based methods were used to extract the features after segmentation and preprocessing of an image. But in this paper, the texture of the image is analyzed, and high order derivatives are used to find the features. So, the cells are classified according to that texture in normal and cancerous cell. Feature extraction is the first stage of image texture analysis. Texture analysis aim is to find a unique way of representing the underlying characteristics of textures and represent them in some simple but unique form. So that they can be used for robust, accurate classification and segmentation of objects .By using this method, the image can be segmented into regions of interest and those regions can be classified using structural and statistical approach. The structural approach represents some regular or repeated relationship pattern and works well on the regular pattern as well as man-made patterns, but statistical approach represents the arrangement of intensities in a region and is mostly used for real and general application or for images. In statistical texture analysis, texture features are computed from the statistical distribution of observed combinations of intensities at specified positions relative to each other in the image. According to the number of intensity point (pixels) in each combination, statistics are classified into a first-order, second-order and higher-order statistics.

The first-order histogram is a way of extracting firstorder statistical texture features. An image is represented as a matrix for two space variable x and y in numerical form (i = 1, 2, 3, ..., X-1 and j = 1, 2, 3, ..., Y1), which is basically a intensity distribution of level for function (i, j) with discrete values i = 0, 1, 2, ..., N-1 where, N is the number of intensity levels. The histogram is the numerical distribution of intensity levels in an accurate graphical representation. Histogram is first-order statistical information of the image. The shape of the histogram shows the characteristic of the image. There are different types of histograms like symmetric, bimodal, multimodal etc.

Grey Level Co-occurrence Matrix (GLCM) method is a way of extracting second order statistical texture features. It uses the relationship between neighboring pixels or in other words it is a joint probability distribution or pairs of pixels. A GLCM is

a matrix where the number of rows and columns are equal to the number of greys level in the image.

In this paper, the proposed method classify cervical cells into two classes: the normal and cancerous cell using texture-based features. If the cell is abnormal, it will go for further examination and tests. Our proposed approach is tested with two different classifiers, i.e. Artificial Neural Network (ANN) and Support Vector Machine (SVM) with different kernel values such as SVM-linear, SVM Quadratic and SVM-cubic. ANN is a non-linear statistical classifier. If the relation between input and output is complex, ANN classifies it very well. Multiple hidden layers with some neurons have been used in ANN .The number of neurons in hidden layer depends on the number of features that have been extracted.

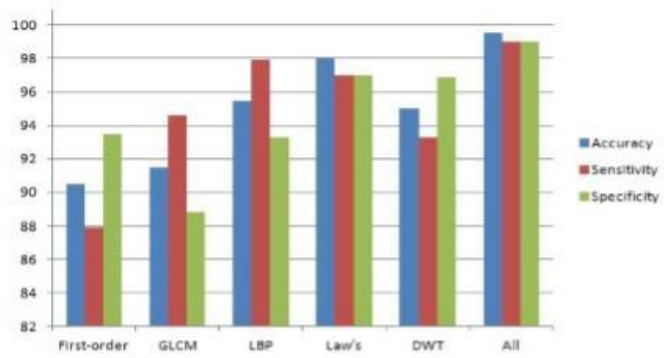


Table: Performance of Neural Networks

3. CONCLUSION

Cervical cancer has high morbidity and mortality in its advance stages. Pap smear test is a very effective and economical test for the early detection of cervical cancer in the early stages. India is a highly populous country having two third of its population living in rural areas where expert pathologists are not easily available. This automated system will help to detect cervical cancer in its early stages with accuracy and in shorter time. The texture of the cell contains a lot of information about the cell. Any changes in the cell are reflected in change in its texture. In this study, high order derivatives statistical features are used, and these methods are First-order histogram, GLCM and DWT. For the classification of a single cell into normal and abnormal classes.

REFERENCES

[1] 'What is Cervical Cancer: Causes, Symptoms, Treatment and Stages',http://www.medicinenet.com/cervicalcancer/articles,accessed 16 June 2017

[2] R. L. Siegel, K. D. Miller, and A. Jemal, "Cancer statistics, 2017," CA :A Cancer Journal for Clinicians,2017, vol. 67, no. 1, pp. 7-30

[3] A.Sreedevi,R.Javed,andA.Dinesh.:'EpidemiologyofcervicalcancerwithspecialfocusonIndia',IntJWomensHealth, 2015,vol.7, pp.405-14

[4] Rawat K, Rawat N, Mathur N, Mathur M, Chauhan N, Tinna R, Kakkar R. A study of cytological pattern of cervical papanicolaou smears in western Rajasthan, India. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2017 Feb 3;5(9):3186-90.

[5] 'Pap Tests and HPV Test: Screening for Cervical cancer', http://www.nccc-online.org/hpvcervicalcancer/cervical-cancer-screening, accessed 16 June 2017

[6] S.Y.TanandY.Tatsumura.:'GeorgePapanicolaou(18831962): Discoverer of the Pap smear', Singapore medical journal, 2015, vol.56,no.10, pp.586

[7] T.Chankong,N.Theera-Umpon, andS.Auephanwiriyakul.:'Automatic cervical cell segmentation and classification in Pap smears', Computer methods and programs in biomedicine, 2014, vol. 113, no.2, pp.539-556

[8] K. Bora, M. Chowdhury, L. B. Mahanta, M. K. Kundu, and A. K. Das.:'Automated classification of Pap smear images to detect cervical dysplasia', Computer methods and programs in biomedicine,2017,vol. 138,pp.31-47

[9] T. A. Sajeena and A. S. Jereesh.:'Automated cervical cancer detection through RGVF segmentation and SVM classification', International Conference on Computing and Network Communications (CoCoNet),2015,pp.663-669

[10] M.E.Plissiti,C.Nikou,andA.Charchanti.:'Automateddetection of cell nuclei in Pap smear images using morphologicalreconstruction and clustering', IEEE Transactions on Information Technology in Biomedicine,2011, vol.15, no.2,pp.233-241

[11] P.R.Paul,M.K.Bhowmik,andD.Bhattacharjee.:'Automated Cervical Cancer Detection Using Pap Smear Images',in

Proceedings of Fourth International Conference on
Soft Computing for Problem Solving,2015,pp.267-278

[12] Z. Lu, G. Carneiro, and A. P. Bradley.:'Automated nucleus and cytoplasm segmentation of overlapping cervical cells',in International Conference on Medical Image
Computing and ComputerAssisted Intervention,2013,pp.452-460

[13] F.-H. Cheng and N.-R. Hsu.:'Automated cell nuclei segmentation from microscopic images of cervical smear',in International Conference on Applied System Innovation (ICASI),2016,pp.1-4

[14] Y.-F.Chen,P.-C.Huang,K.-C.Lin,H.-H.Lin,L.-E.Wang,C.C.Cheng,T.-P.Chen,Y.K.Chan,andJ.Y.Chiang.:'Semi-automatic segmentation and classification of pap smear cells',Biomedical and Health Informatics,IEEE Journal of,2014,vol.18,no.1,pp.94-108

[15] Nayar, Ritu, and DavidC.Wilbur."The Pap Test and Bethesda 2014:â˘AIJThe reports of my demise have been greatly exaggerated.â˘A˙I(after a quotation from Mark Twain)." Journal of the American Society of Cytopathology 4.3 (2015): 170-180.

[16] M. E. Plissiti, C. Nikou, and A. Charchanti.:'Watershed-based segmentation of cell nuclei boundaries in Pap smear images',in Proceedings of the 10th IEEE International Conference on Information Technology and Applications in Biomedicine,2010,pp.1-4

[17] A. Kale and S. Aksoy.:'Segmentation of Cervical Cell Images',in 20th International Conference on Pattern Recognition (ICPR) Istanbul,2010,pp.2399-2402

[18] S.Pradeep Kumar Kenny and S.Allwin.:'Detecting Prominent Textural Features for Cervical Cancer Lesions Using Outlier Detection and Removal Techniques',CIS Journal,2014,vol.5,no.ISSN 2079-8407

[19] M.E.Plissiti,C.Nikou,andA.Charchanti.:'Combini ngshape, texture and intensity features for cell nuclei extraction in Pap smear images', Pattern Recognition Letters,2011,vol.32,no.6,pp.838-853

[20] S. Kaaviya, V. Saranyadevi, and M. Nirmala.:'PAP smear image analysis for cervical cancer detection',in 2015 IEEE InternationalConferenceonEngineeringandTechnol ogy(ICETECH),2015,pp.14

[21] M. Arya, N. Mittal, and G. Singh.:'Cervical Cancer Detection Using Segmentation on Pap smear Images', in Proceedings of the International Conference on Informatics and Analytics,2016,pp.29

[22] K. Li, Z. Lu, W. Liu, and J. Yin.:'Cytoplasm and nucleus segmentation in cervical smear images using Radiating GVF Snake', Pattern Recognition,2012,vol.45,no.4,pp.1255-1264

[23] S. Ragothaman, S. Narasimhan, M. G. Basavaraj, and R. Dewar.:'Unsupervised segmentation of cervical cell images using gaussian mixture model',in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops,2016,pp.7075

[24] Z. Lu, G. Carneiro, and A. P. Bradley.:'An improved joint optimization of multiple level set functions for the segmentation of overlapping cervical cells',IEEE Transactions on Image Processing,2015,vol.24,no.4,pp.1261-1272

[25] G. K. Lakshmi and K. Krishnaveni.:'Multiple feature extraction from cervical cytology images by gaussian mixture model', in World Congress on Computing and Communication Technologies (WCCCT), 2014, pp.309-311

[26] S. Zafari, T. Eerola, J. Sampo, H. KAolviAoinen, and H. Haario.:'Segmentation of overlapping elliptical objects in silhouette images',IEEE Transactions on Image Processing,2015, vol.24, no.12, pp.5942-5952

[27] N. Mustafa, N. A. Mat Isa, and M. Y. Mashor.:'Automated Multicells Segmentation of ThinPrep Image Using Modified Seed Based Region Growing Algorithm(Special Issue Biosensors: Data Acquisition, Processing and Control)',Biomedical fuzzy and human sciences: the official journal of the Biomedical Fuzzy Systems Association,2009,vol.14,no.2,pp.41-47

[28] A. GenÃ˘CÂ˘gtav, S. Aksoy, and S. Ander.:'Unsupervised segmentation and classification of cervical cell images',Pattern Recognition,2012, vol.45, no.12, pp.4151-4168

[29] Y. Song, L. Zhang, S. Chen, D. Ni, B. Lei, and T. Wang.:'Accurate segmentation of cervical cytoplasm and nuclei based on multiscale convolutional network and graph partitioning',IEEE Transactions on Biomedical Engineering,2015, vol.62, no.10, pp.2421-2433

[30] Z. Lu, G. Carneiro, A. P. Bradley, D. Ushizima, M. S. Nosrati,A.G.C.Bianchi,C.M.Carneiro,andG.Hamarneh .:'Evaluation of three algorithms for the segmentation of overlapping cervical cells',IEEE Journal of Biomedical and Health Informatics, 2017, vol.21,no.2, pp.441-450

[31] L. Zhao, K. Li, M. Wang, J. Yin, E. Zhu, C. Wu, S. Wang, and C.Zhu.:' Automaticcytoplasmandnucleisegmentation forcolor cervicalsmearimageusinganefficientgap-searchMRF',Computers in biology and medicine,2016,vol.71,pp.46-56

[32] L. Zhang, H. Kong, C. T. Chin, S. Liu, Z. Chen, T. Wang, and S.Chen.:' Segmentation of cytoplasmandnucleiofabno rmalcellsin cervical cytology using global and local graph cuts',Computerized Medical Imaging and Graphics,2014,vol.38,no.5,pp.369-380

[33] M. Zhao, A. Wu, J. Song, X. Sun, and N. Dong.:'Automatic Screening ofcervical cells using blockimage process ing', Biomedical engineering online, 2016,vol.15,no.1,pp.14

[34] A. H. Mbaga and P. Zhijun.:'Pap Smear Images Classification for Early Detection of Cervical Cancer',International Journal of Computer Applications,2015,vol.118,no.7

[35] P. Sukumar and R. K. Gnanamurthy.:'Computer Aided Detection of Cervical Cancer Using Pap Smear Images Based on Hybrid Classifier', International Journal of Applied Engineering Research, Research India Publications, 2015, vol.10,no.8,pp.2102121032 .