

An Analysis on Cervical Cancer Classification of Medical Digital Images Using Various Classifiers

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ABSTRACT

In this analysis, Cervical cancer took over the place four in the world level and it is the most prevalent cancer that is affecting women. If the cancer is detected in the earlier stages it can be cured and treated successfully. And it is also the leading gynecological malignancy disease worldwide. This is a paper which presents the classification techniques of cervical cancer. And also, this paper shows the advanced feature solution approaches of cervical cancer. The dimensionality reduction technique is used for the improvement of the classifier with great accuracy. There are two categories of feature selection and they are filters and wrappers. By using all these analytic techniques, we can classify cancer and its approaches. Therefore, this paper classifies the approaches of Cervical cancer.

Keywords : Cervical Cancer, Gynecological, Wrappers

I. INTRODUCTION

Densely populated countries like Indian, the screening for cervical cancer is very difficult. The women diagnosed with the disease is 527,624. The women dying with the affect of cervical cancer is 265,672. In Africa, 3.48 new cases of cervical cancer are diagnosed and 22.5 women die from the disease[1], 80% of the cervical cancer are occurred in less developed countries. This cancer is like a slow poison which kills the women slowly without cause or indicating the occurrence of the cancer. It can be able to treat and get clear when we found or trace cancer in the earlier stage but this cervical cancer normally gave symptoms in the advanced stage.

It has trained cytopathologist for each patient by hundreds of images with in a single slide to be examined under a microscope[2]. Screening success always depends on the facts like the testing quality of screening, regular follow-up, treatment taken to avoid further growth and facilities towards the accesses.

Developing countries and very low middle-class families, the presence of trained and known workers are very minimum in count.[3]

II. METHODS AND MATERIAL

The intention of image classification is to sort out the image according to its visual contents, for example, does it contain an object or not. The basic classification process involves training a visual classifier, measure the performance of the classifier by computing specificity, sensitivity, varying the visual representation of feature vector, and the feature map for the classifier and acquiring training data for new classifiers. This survey analyses different classifiers employed in the various applications by multiple authors.

Peng et al.[4] introduced novel cellular and atypical cell features calculated from vertical partitions of the epithelium in the histology images. Epithelium

classification of images is examined with voting fusion of vertical segments by means of support vector machine (SVM)[5] and Linear Discriminant Analysis (LDA)[6] methods. Training and testing is based on leave-one-out method for obtaining exact grade labelling accuracy. First order structural measures and second order statistics measures based on GLCM were used for extracting textural features. Sample cell obtained from microscope is divided into three parts: cytoplasm areas, nucleus areas and a cellular area. Classification results are evaluated using three scoring schemes and its differences are compared by means of classifiers.

Anousouya et al [7] have employed Artificial Neural network for classification of cervical cancer cells in the cervix region of the uterus. Here, multi-layer (MLP) has been incorporated to discover the cervical cancer cells which have two stages: preprocessing and feed forward MPL neural networks[8]. The unsegmented cell features are classified into normal, LSIL, HSIL cells by Levenberg-Marquarat feed forward MLP neural network. The cascaded multi-layered preceptor (C-MLP) and extreme learning machine (ELM)[7] and its performance also were analysed. Fuzzy C means algorithm was also utilized in the neural network to create middle layer.

Turid et al.[9] have presented Pharmacokinetic modeling for analysing the vascular properties of tissue. To capture textural features of Brix parameters, first order statistics such as mean, variance were used and Bix map was built from gray level co-occurrence matrix to look into texture analysis which leads to the resulting of second order features for extracting spatial relationships within the tumours. Features gathered from first and second order statistics were availed as variables for SVM classification. Leave-one-out validation method has been engaged as classification validation purpose. It can be observed from the result that the spatial relations within the tumor, obtained by texture features associated to tumor heterogeneity, are more robust for outcome

prediction than first order statistical features.

Yung-Fu et al[10] have developed semiautomatic PC-based cell image analysis for the segmentation of nucleus and cytoplasm region. Also morph metric and textual features were computed to be fed into SVM classifiers to classify four kinds of cells and to distinguish dysplastic from normal cells. Furthermore, a software function like image viewing and displaying all file names was incorporated to assist in cell analysis. On the other hand, two unique feature selection methods were introduced for eliminating undesirable features i.e. filter method using statistical analysis and the other being wrapper method using recursive feature elimination (RFE)[11], recursive Feature Addition (RFA), GA.

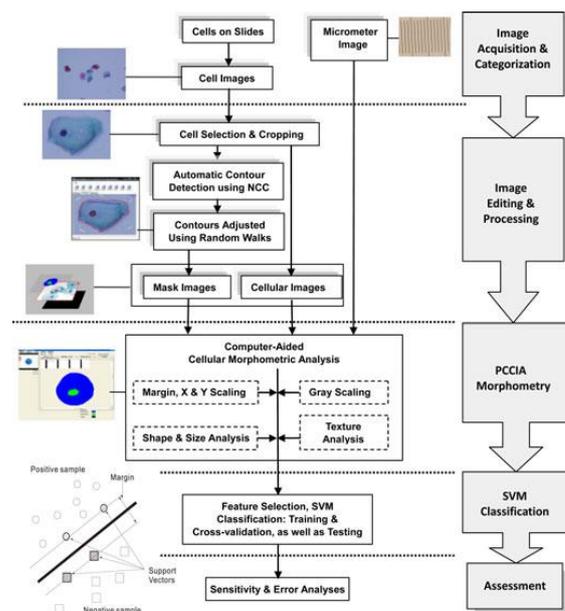


Figure 2 : 1 Flow chart of the Process

Allwin et al[12] have developed a novel approach to classify the various stage of malignancies in cervical cyto images by using textural properties and decision based support system of the cervical cyto image.

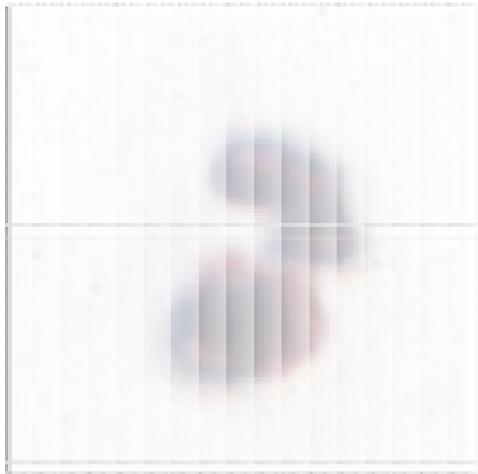


Figure 2 : 2 Cervical Cyto Image

The whole system for detection of cyto image includes pre-processing, feature extraction and classification. Different set of features were used to detect cancer in each stage that will not only show in which region, the symptoms of the cell lies, but also shows the stage of the cancer. Mean, standard deviation, skewness and kurtosis were captured for generating feature vector and binary classification has been employed for cervical cancer image classification which is used to generalize linear decision boundaries wherein decision space is built in a huge transformed version of the original feature space.

Jorng-Tzong[13] et al have analyzed the genetic factors that determine the changes from precancerous to cervical cancer where in single-nucleotide polymorphism (SNP) markers and micro satellites are regarded as the desired genetic factor. In addition, this framework employed a Bayesian network and four various decision tree algorithms and made a comparison of these learning algorithms. A web-

based system that predicts SNPs and microsatellites as cofactors of cervical cancer has also been introduced trees. For comparison of various decision trees, batched processing mode is utilized which selects the optimal model from different decision tree models based on the F measure of contingency matrix.

Mitra P et al[14] have designed an integrated medical decision support system using soft computing paradigm for the identification of various stages of cervical cancer. Interactive Dichotomize 3 (ID3) algorithm and knowledge-based sub network modules with genetic algorithms using rough set theory and comprised the integration of decision support system. This system can be able to use the parallelism, fault tolerance properties of artificial neural network, self-learning and knowledge encoding characteristics of rough set theory. The algorithms involve the usage of synthesis of different MLP modules, encoding rules formed by rough set theory and ID3 algorithm. It is observed that the modular network decomposition offers superior performance with modular network decomposition results in superior performance with respect to classification score, training time, and network sparseness.

Table 2.3 provides the detailed description of pros and cons of the cancer detection systems based on classifiers for ranking the cancer affected regions. Of these systems, it is understood that though these systems incorporate various classifiers, textural features are not taken into account for increasing the performance of the detection process.

Table 2.3. Classification based Cancer detection system

Cons	Pros	Inference	Technique	Author
Focused only on segmentation, not on textural features	Layer by layer and vertical segment nuclei features	Fused on CIN grades of vertical segments using voting method	Fusion-based epithelium image classification method	Peng et al. (2016)

Focus only on classification	Fit for classification of cells	Artificial Neural network for classification of cervical cancer cells in the cervix region of the uterus	Multi-layer (MLP) has been incorporated	Anousouya et al (2016)
Classification models presented here are not diagnostic tools ready for clinical use,	Spatial relations within the tumor, obtained by texture features associated to tumor heterogeneity is more robust	order statistics such as mean, variance were used and Bix map was built	Pharmacokinetic modeling was used	Turid et al. (2014)
More investigation with statistical measurements is needed to elucidate its practical utility in a laboratory	Effective tool in evaluating cytological specimens	Software function like image viewing and displaying all file names was incorporated	Morphometric and textual features were computed to be fed into SVM classifiers	Yung-Fu et al (2013)
Only first order statistics measures were utilized	Feature extraction process were performed properly	Classify the various stage of malignancies in cervical cyto images	SVM and textural features	Allwin et al (2010)
Emphasized only on classifiers	A web-based system that predicts SNPs and microsatellites as cofactors of cervical cancer	Various the genetic factors are analyzed.	Employed a Bayesian network and four various decision tree algorithms	Jorng-Tzong et al (2004)
More emphasis is given to only soft computing for classification	Superior performance with respect to classification score, training time, and network sparseness	Can be able to use the parallelism, fault tolerance properties of artificial neural network	Interactive Dichotomizer 3 (ID3) algorithm and knowledge-based sub network modules with genetic algorithms using rough set theory	<u>Mitra</u> P et al (2000)

III. RESULTS AND DISCUSSION

This is the paper which assort the cervical cancer based on cancer detection system. An complete analysis of various technique with distinct inference are used to classify to cervical cancer .The knowledge based sub-network module with genetic algorithm(ID3) gives the excellent classification with respect to network sparsness. Bayesian network and decision tree algorithm are used to predict the cofactor of cervical cancer and SNPs. Further studies are done, as a result textural features are the robust technique used for differentiating the normal cell from the cancer cells in the cervix region of the uterus. At last, support vector machine(SVM) and fuzzy based technique is an ultra efficient tool to classify the cervical cancer.

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