CERVICAL CANCER DETECTION SYSTEM USING VARIOUS TEXTURAL APPROACHES

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Abstract- Cervical cancer is one of the types of cancer which is found to be deadliest among women. The cervical cancer affects the cervix region of the uterus. The vital problem is that the cancer will be identified only at the final stages and does not show any symptoms. Therefore it is necessary to give the accurate treatment volume to the patient. Nowadays Image processing uses some diagnosing tools like X-ray, CT, MRI, etc. to obtain the staging of disease. This paper proposes the texture related research works on cervical cancer detection carried out by various research community, and authors who explores the textural feature extraction in their investigations.

Keywords: *X rays,CT,MRI,cervix,stroma,cervigram,etc..*

INTRODUCTION:

Cancer is a deadliest disease which is caused when cells in the human body grow old and when they die they become damaged or they do not die and form a mass of tissue which grows into a tumor. Cervical cancer occurs in women of all age group. This cancer does not have any symptoms and it is very difficult to detect at the earlier stage of cancer development. Pap smear test is the diagnostic method proposed for the women from age group 15 and above for manually screening the cervical cancer. The cervical cancer is caused by the human Pamplona virus (HPV).

Different cytologists, show subjective disparity in screening the results of Pap smear tests. It provides more inconsistencies. The test output shows more of false results, which make the reliability of the screening process a question mark and the possibility of human errors, become High. Thus textual approaches of image processing techniques are proposed. Texture is the predominant innate property used in identification of certain objects or region regardless of image types. Spectural, textural and contextural are kinds of patterns for describing the visual information meaningfully.

So it is indeed to move toward the extraction of features in a view to achieve our goal by the way of describing the medical image accurately. This section reviews the texture related research works carried out by various research community, and authors who explores the textural feature extraction in their investigations.

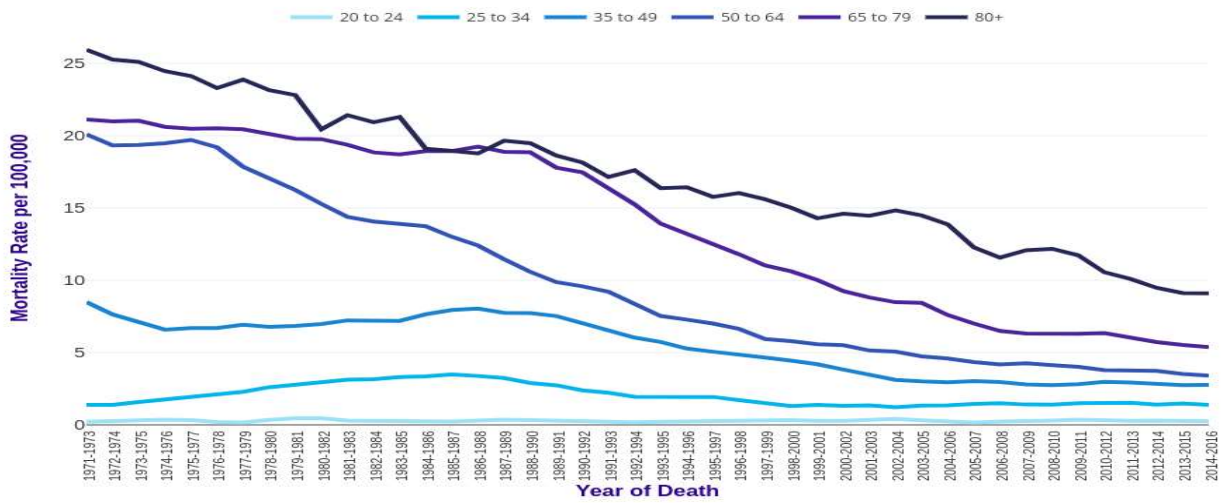

Figure 1. Cervical cancer mortality statistics.

Material and Methods

Here we can study more about the texture classification in details. These can be very useful in finding out the good direction towards the research**.** Santa & Elisa, (2017) have presented basics of automated texture analysis in many applications of biomedicine such as the detection and grading of several types of cancer, the various diagnosis levels of autoimmune diseases, and the study of physiological processes. They have also reviewed the concepts of geometrical methods, statistical methods, local binary patterns, and model based methods, transform based methods in the application of image segmentation, and object classification, image and video compression, content based retrieval and 3D reconstruction and rendering. This study also investigated about the latest trend i.e. deep learning architectures to learn the texture model directly from the images. It is very sensible to imagine that deep learning and more attention in the future, as its full ability in the aspect of biological textural analysis are yet to be discovered.

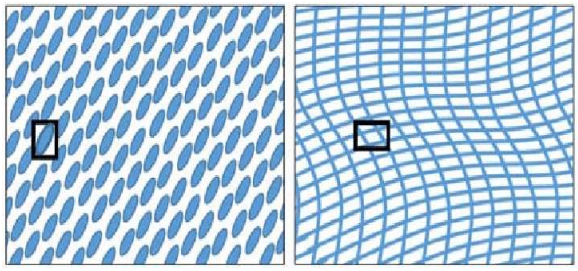

Figure2: visual textures with corresponding sub patterns.

Francesco et al. (2015) have proposed the visual perception based image features for differentiating epithelium and stroma in histological images. The following five features i.e. coarseness, contrast, directionality, line-likeliness and roughness were reviewed which enables functioning with a very small dimensional feature vector and allows a relevant analysis of the feature values with respect to sound visual properties. Also, three classifiers were analyzed based on Support Vector Machines (SVM), Nearest Neighbor rule (1-NN) and Naïve Bayes rule (NB). It is observed that the proposed features can appropriately distinguish epithelium from stroma.

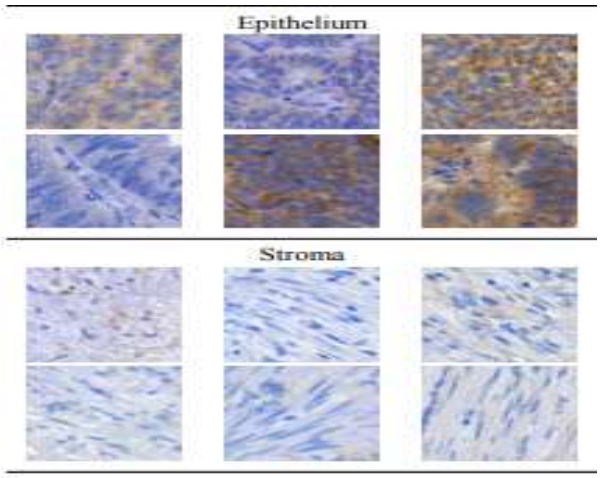

Figure 3. Sample images of tumor epithelium and stroma.

Jayachandran & Dhanasekaran, (2014) have presented a brain tumor classification method by incorporating structural analysis on both timorous and normal tissues. This framework involves the preprocessing, segmentation, and feature extraction and classification steps to be followed in detecting tumor. As a preprocessing step, anisotropic filter is applied to eradicate the noise which improves the image quality for skull-stripping process. Some of the features are captured from the intensity and some are from the modified multi-texton structure descriptor. The hybrid kernel is formulated to train the SVM classifier to carry out automatic categorization of tumor in magnetic resonance imaging (MRI) images.

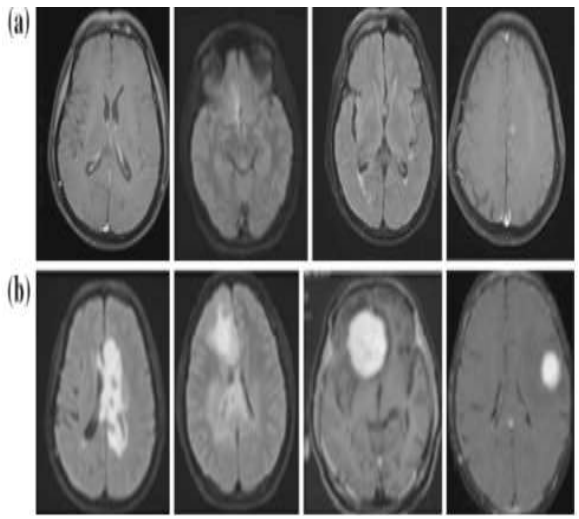

Figure 4: sample MRI Image Dataset, (a) Normal image, (b) tumor image.

Sun, Park et al (2011) have developed a domain specific computerized image analysis for the identification of pre-cancerous and cancerous lesions of the cervix. Here, features are extracted in a probabilistic manner using conditional random field and also introduced a window based assessment scheme for 2D image analysis which solves the missed alignment problem. Various tissue types of image regions are obtained for the extraction of domain oriented anatomical features. Diagnostic relationship between tissue types is also obtained using conditional random field.

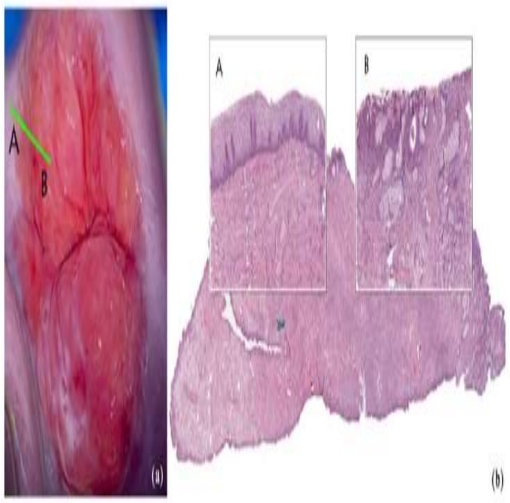

Figure 5: (a) Cross polarized white light image; and (b) histopathology slide of a patient's cervix

Hayit et al. (2009) have proposed a multi-stage scheme for segmenting and labeling of anatomical region inside the cervigrams and also features of cervix region are extracted thereby detecting cervix boundary. Besides that, specular reflection has been destroyed in the preprocessing step and entry of the endo-cervical canal is also detected. Cervigram analysis include two step process in which undesirable image regions are ignored by an ROI detection method and as a second step, specular reflection has been detected and removed. Geometric measure of local concavity method is incorporated for detection of the os (neck of the uterus).

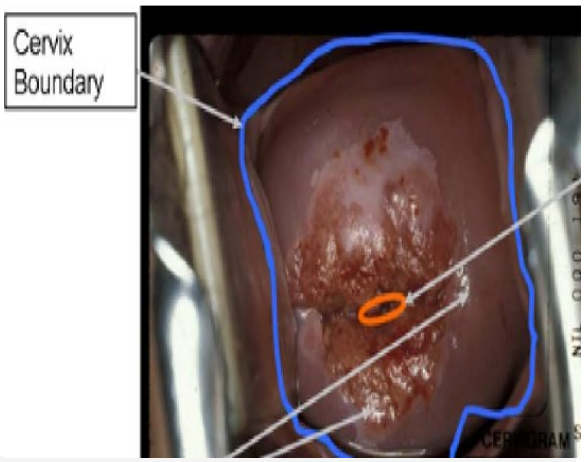

Figure. 6. An example cervigram: the cervix boundary, the os, and SR artifacts are marked

Ji et al. (2000) have generalized the statistical texture technique for recognizing vascular patterns related to cervical lesions from colposcopic images. Texture primitive extraction method is incorporated that approximate vascular structures which include image preprocessing, skeletonization, and vectorization. Nine set of textural features can be extracted from two marginal distributions, four features from the joint distribution, and two features directly from the vectorized images, totally 24 features. Peak density, entropy, density have also been analyzed and the linear correlation coefficients have been computed for linearly correlated features between any two features. The figure 7 shows the pattern.

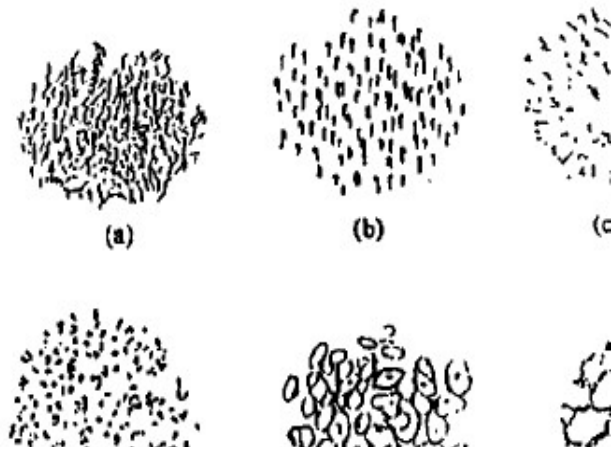

Figure 7. Typical vascular patterns encountered in cervical lesions. (a) network capillaries in orignal squamous epithelium; (b) hairpin capillaries in original squamous epithelium; (c) and (d) punctation vessels in dysplasia and carcinoma in situ; and (e) and (f) mosaic vessels as seen in dysplasia and carcinoma in situ

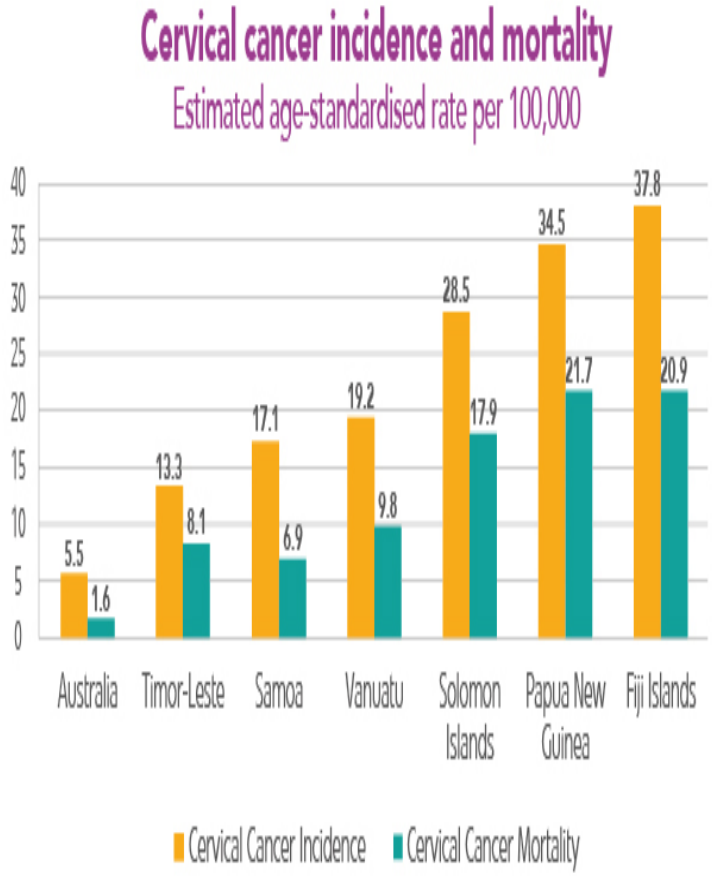

Figure 8. Cervical cancer incidence rate and mortality rate in various regions of the world.

Table 2.1 provides the detailed report of the existing cervical cancer detection frameworks which are emphasized on textural features. On proper monitoring the merits and demerits of these papers, some of the papers do not consider textural features and only basic methods were applied for extracting textural features like first order statistics features and simple co-

occurrence pattern. These features do not exhibit efficient feature representation for increasing the performance of the cancer detection systems in terms of precision and recall.

Table 2.1 Textural feature based Cancer detection system

Author	Technique	Inference	Pros	Cons
Santa & Elisa, (2017)	Review of geometrical methods, statistical methods, local binary patterns, and model based methods, transform based methods	Review of textural features in the application of image segmentation, and object classification, image and video compression, content based retrieval and 3D reconstruction and rendering	Allows the subtle properties of cells and tissues that cannot be easily quantified	Deep learning has yet to be analyzed.
Francesco et al. (2015)	Visual perception based image features, Support Vector Machines , Nearest Neighbor rule and Naïve Bayes rule	Image features for differentiating epithelium and stroma in histological images	Very low-dimensional feature vector	Not focused on classifying into normal or abnormal cells.
Jayachandran & Dhanasekaran, (2014)	Modified multi-Texton co-occurrence matrix, kernel based SVM	Automatic categorization of tumor in magnetic resonance imaging (MRI) images.	Multiple kernels are combined and a hybrid kernel-SVM classifier for improving the classification process	Applied only to axial T1-weighted post contrast Brain MRI images.
Sun, Park et al (2011)	A window based assessment scheme for 2D image analysis	Features are extracted in a probabilistic manner using conditional random field	Diagnostic relationship between tissue types is also obtained	Could not fully investigate the diagnostic value of abnormal vascular patterns
Hayit et al. (2009)	ROI detection, specular reflection	Segmenting and labeling of anatomical region inside the cervigrams.	Invariant to scale and rotation and in the case of a circular prior, Computed only once.	Color and texture will not be explored for the os detection task,

Ji et al. (2000)	Texture primitive extraction method is incorporated	Statistical texture technique for recognizing vascular patterns related to cervical lesions from colposcopic images	The loss in accuracy seems to be minimal compared to the computational saving	More experiments are needed to validate this.

CONCLUSION:

Cervical cancer is screened by the manual method (pap smear test) does not give accurate results in classifying the tumoured cells and normal cells located at the cervix of uterus. In this paper, a study and analysis is done for detecting the cervical cancer automatically using various textural approaches. The study was made to investigate the features derived from image processing of MR images of patients could be used in predicting the disease stage. Thus, textural approaches outperformed transform and statistical features in staging prediction. This idea which has been proposed by many journalists and researchers are taken as a survey in this paper. From this we come to a conclusion that the textural approaches will become a best method of diagnosing the earlier stages of cervical cancer. It is better to predict the treatment volume will help the radiologist for a better treatment planning according to the staging.

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