Endometrial Cancer Detection using Image Processing Techniques

Author: Snehal N. Patil[1]; Prof. Dr. K.V.Kulhalli[2]; Smita S. Patil[3]

Affiliation: ME (E & TC) student, D. Y. Patil college of Engg. & Tech. Kolhapur, Maharashtra, India[1];

H.O.D. Dept. of Information Tech., D. Y. Patil college of Engg. & Tech. Kolhapur, Maharashtra, India[2];

ME (E & TC) student, D. Y. Patil college of Engg. & Tech. Kolhapur, Maharashtra, India[3]

E-mail: sneha.patil2051992@gmail.com[1]; kvkulhalli@gmail.com[2]; smitarani1601@yahoo.co.in[3]

ABSTRACT

Uterine-cancer is considered to be one of the most common malignant gynecological tumors which cause a serious threat to women health. The early symptoms of uterine cancer: its entire uterus is often accompanied by many clusters of fine, granular micro calcifications (tumor) and individual grains appearance. Hence, study on extracting calcifications has important significance in diagnosis of clinical medicine. The paper develops Computer Aided Diagnostic (CAD) System that helps the physician as well as the radiologist to detect suspicious cancerous nodules to take correct decisions for the patients.

General Terms

Image Acquisition, Iterations, Segmentation, SNR, Uint.8

Keywords

Averaging filter, Computer-Aided Detection, Median filter, Morphological Features, Region growing approach, Wiener filter.

1. INTRODUCTION

The interpretation of any medical image is done by humans. The accuracy of this diagnosis depends both on the quality of image acquired and its interpretation. But there are several problems with human based diagnosis; these include perception, experience, fatigue, bias, and noise. To avoid them, computer-aided diagnosis (CAD) system has become popular. By using a CAD system, a radiologist considers the output from a computer analysis of the interpreted image, though the final diagnosis is made by the radiologist. The goal of CAD is to reduce search and interpretation errors as well as variation between and within observers. Thus, to reduce the mortality rate due to endometrial cancer, CAD systems prove to be the best tool.

2. METHODOLOGY

The projected CAD system involve following steps as shown in the Fig.1.
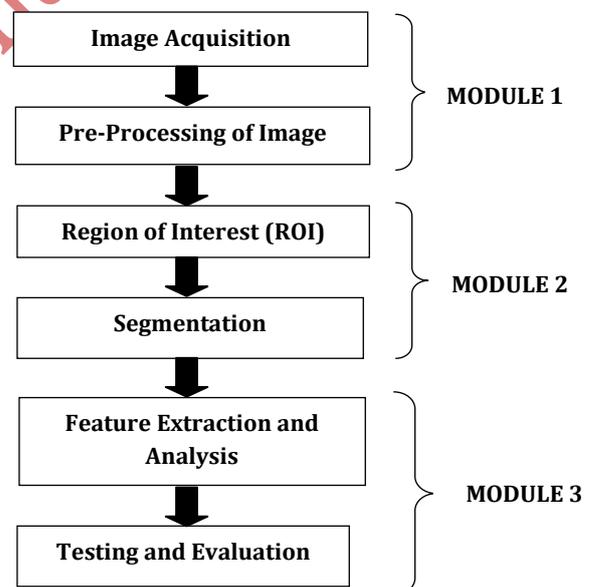
2.1 MODULE 1 :

2.1.1 Image Acquisition: Different images either malignant or benign are acquired from different medical atlases, pathological labs, internet websites & hospitals. The images that are acquired are completely unprocessed. The images can be in the form of DICOM, TIFF, JPG, PNG etc. All these images are converted into uint.8 format. Uint.8 is a format

where the image is converted into integer value so that further pre-processing can be carried out on it.

2.1.2 Image Pre-Processing: Pre-processing technique consists of Noise removal or noise suppression. Several filters are used for noise removal that is well established in gray value image processing. Few of them are Wiener Filter, Averaging Filter & Median Filter. The acquired images are filtered using wiener filter, averaging filter & median filter & are illustrated in the Figure 2: (2a to 2f)
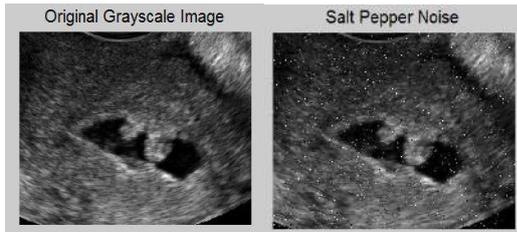
(2a)   **(2b)**
Figure 2: (2a) Original Grayscale image (2b) Image with Salt Pepper Noise
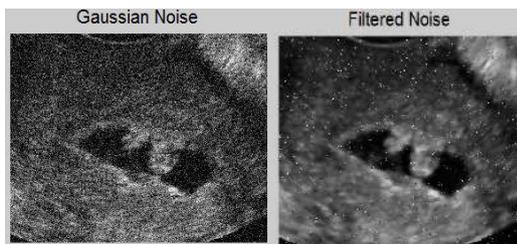
(2c)   **(2d)**
Figure 2: (2c) Image with Gaussian Noise (2d) Filtered image using wiener filter
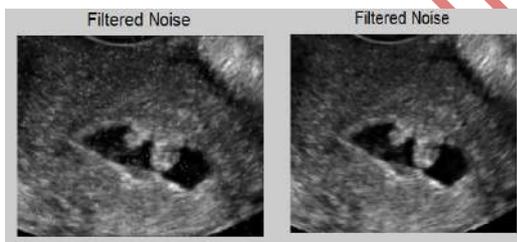
(2e)   **(2f)**
Figure 2: (2e) Filtered image using averaging filter (2f) Using median filter

Figure 2:
(2a) Original Grayscale image in the format of jpg is taken as input
(2b) Salt Pepper Noise is added to the Original Image
(2c) Gaussian Noise is added
(2d) Wiener filter is used to remove the noise but some salt pepper noise & artifacts are still seen from the graphics
(2e) Averaging filter is used but still some Gaussian noise & artifacts are remaining
(2f) Finally Median filter removes all the noise, artifacts & provides better SNR as seen from the figure.

Hence, Median Filter proves to be the best that improves salt & pepper noise from the image & provides an improved quality of image.

2.2 MODULE 2 :

2.2.1 Segmentation: Image segmentation is considered to be another major step. Successful biological image analysis usually requires satisfactory segmentations to identify regions of interest as an intermediate step. Segmentation subdivides an image into its constituent regions or objects. Segmentation will stop when ROI of the object is detected. Segmentation algorithms are based on the properties of intensity values, like discontinuity and similarity [5]. Out of the several existing Image Processing Algorithms, Region Growing Segmentation approach is used here, so that only the affected ROI from the image could be considered.

The results obtained from a Benign Endometrium image are shown in the below Figure 3: (3a to 3e)
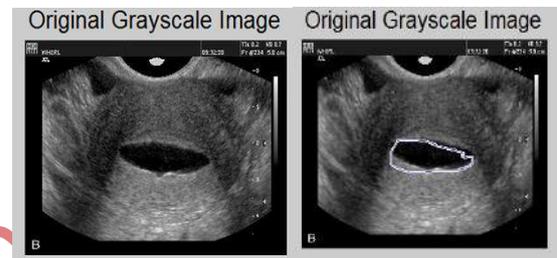
(3a)   **(3b)**
Figure 3: Segmentation of Benign Endometrium (3a) Original Grayscale image (3b) Original Grayscale image with selected ROI
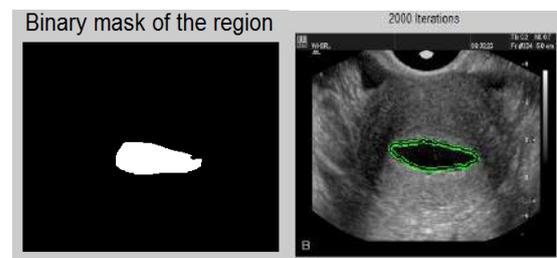
(3c)   **(3d)**
Figure 3: (3c) A 1-Bit Mask (having pixel intensity values of 1 (White) and 0 (Black) created from the selected ROI (3d) Image (ROI) after 2000 iterations
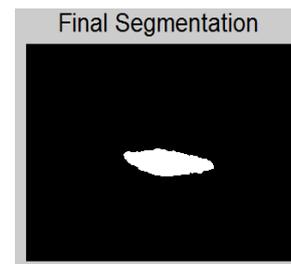
(3e)
Figure 3: (3e) Final Segmented Image after 2000 iterations

The results obtained from a Malignant Endometrium Image are shown in the below Figure 4: (4a to 4e)
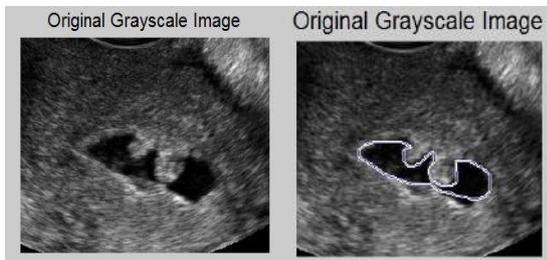
(4a)   **(4b)**

Figure 4: Segmentation of Malignant Endometrium (4a) Original Grayscale image (4b) Original Grayscale image with selected ROI
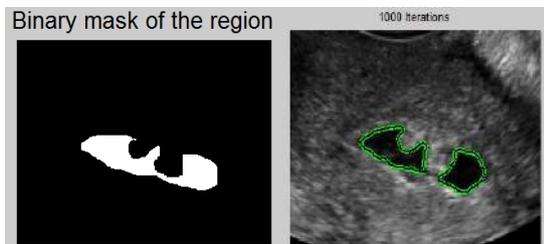
(4c)   **(4d)**

Figure 4: (4c) A 1-Bit Mask (having pixel intensity values of 1 (White) and 0 (Black) created from the selected ROI (4d) Image (ROI) after 1000 iterations
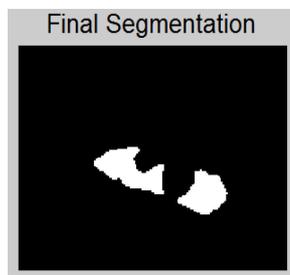
(4e)

Figure 4: (4e) Final Segmented Image after 1000 iterations

The first image obtained in Fig (3a) is the original image. Fig (3c) shows the binary conversion of the ROI. Although Image Masks can be created by manually tracing around a cell's edge, this approach is labor intensive for a single image let alone many multi-plane image stacks. Therefore for image processing, masking is usually a semi-automated endeavor. Images are first segmented on the basis of pixel Intensity; this must be done on a plane-by-plane basis for an image stack. In Metamorphism the segmented overlay planes are then extracted to a separate image stack for the purpose of creating a Binary Mask. The next Fig (3d) & (3e) shows the result after 2000 iterations.

Thus, Segmentation accuracy determines the eventual success or failure of computerized analysis procedure.

The tests carried out on acquired Benign & Malignant Uterine images. The Morphological Features such as Radius, Area, Compactness, Roundness, and Irregularity Index are extracted. The Table1 & 2 illustrate the morphological features for benign & malignant samples. Graphical illustration is shown in Chart 1 & 2.

Table 1: Features Extracted from 5 Samples of Benign Uterine

Images	Radius	Area (A)	Compactness (C)	Roundness (R)	Irregularity Index (I)
bImg 1	35	1695	28.50	2.27	0.44
bImg 2	35	831.375	58.11	4.62	0.22
bImg 3	29	855.625	38.76	3.08	0.32
bImg 4	27	675.375	42.57	3.39	0.29
bImg 5	23	561.500	37.16	2.96	0.34

Table 2: Features Extracted from 5 Samples of Malignant Uterine

Images	Radius	Area (A)	Compactness (C)	Roundness (R)	Irregularity Index (I)
Img1	15	54.16	164.00	13.05	0.077
Img2	15	50.52	175.82	14.00	0.071
Img3	15	34.74	255.69	20.35	0.050
Img4	18	22.38	571.53	45.48	0.022
Img5	18	21.68	590.00	46.95	0.021

Where,
Compactness (C) = Perimeter^2/ Area;
Roundness = C/4π;
Irregularity Index (I) = 4π x Area/ Perimeter^2

Chart 1: Bar Chart of 5 Benign Samples
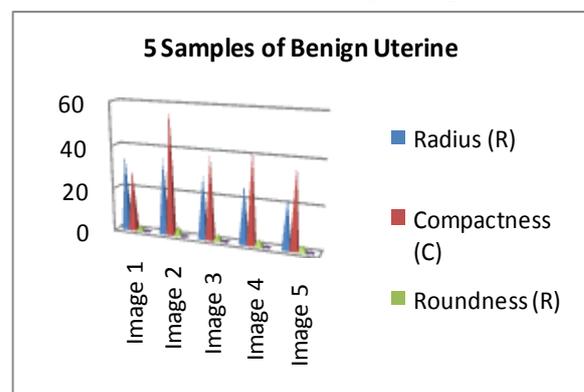
Chart 2: Bar Chart of 5 Malignant Samples

5 Samples of Malignant Uterine

suspicious nodules of cancers and thus increases its sensitivity, specificity, accuracy & efficiency of the diagnosis. The CAD Systems are beneficial to detect cancerous nodules. Thus, the process was implemented accordingly & the work under Module 3 is in progress.
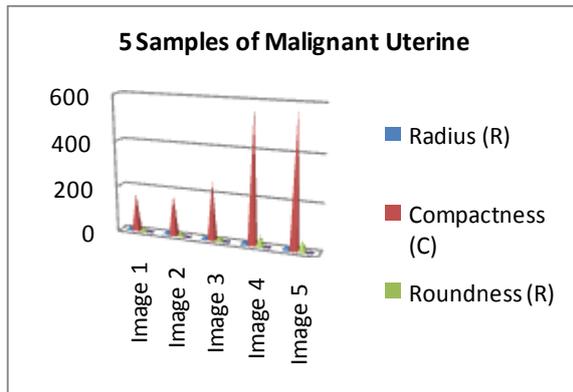
2.3 MODULE 3 :

2.3.1 Feature Extraction & Analysis of ROI: Feature extraction is a method of capturing visual content of images for indexing as well as retrieval. Feature extraction is used to denote a piece of information that is relevant for solving the computational task related to certain application system [3].

After segmentation, set of features are required for each image. In feature extraction stage every image is assigned a feature vector which is used to identify it & to distinguish the image. The features that could be extracted are morphological features, topological features & statistical features. The extracted features act as the basis for classification process. These features are used to develop diagnostic rules to detect cancer nodule to train the Network.

2.3.2 Decision Making & Evaluation: After all the algorithms are been performed the last & the final step is testing & evaluation of the system. ANN- using Error Back Propagation Algorithm, SVM- Scalar Vector Machine, Fuzzy logic are some of the Decision Making systems which can be implemented in the future work.

3. FUTURE WORK

The Module 1 & Module 2 are implemented & satisfactory results are obtained. Implementation of Module 3 is in progress.

4. CONCLUSION

Endometrium cancer is the third most common cancer amongst women. The CAD system helps the physician as well as the radiologist to identify the

5. REFERENCES

[1] Tartar, Ahmet, Akan, Aydin– "Performance of ensemble learning classifiers on malignant-benign classification of pulmonary nodules" IEEE, PP. 722-725, April 2014

[2] Q Zheng, Yingjie liu, WeiLiang Zhu – "Uterine calcifications segmentation and extraction from ultrasound images based on level set" IEEE, Volume 2, PP. 591 – 594, Nov 2013

[3] K. Anuradha, Dr. K. Sankaranarayanan – "Comparison of Feature Extraction Techniques to classify Oral Cancers using Image Processing" IJAIEM, Volume 2, Issue 6, PP. 456-462, June 2013

[4] Thampi, L.L., Malarkhodi S. – "An automatic segmentation of endometrial cancer on ultrasound images" IEEE, Volume 2, PP. 139 – 143, April 2013

[5] Anuradha.K, Dr. K. Sankaranarayanan – "Detection of Oral Tumor based on Marker – Controlled Watershed Algorithm" IJCA, Volume 52, No.2, PP. 15-18, August 2012

[6] Ziqian Zhang, Tiexiang Wen, Jia Gu, Lei Wang – "Cancer area extraction for uterine cervical image based on spectral matting" IEEE, Volume 3, PP. 1351 - 1354, Oct 2010

[7] Krishna Kant Singh, Akansha Singh – "A Study of Image Segmentation Algorithms for Different Types of Images" IJCSI, Vol. 7, Issue 5, PP. 414-417, September 2010

[8] Milan Sonka, Vaclav Hlavac, Roger Boyle – "Image Processing, Analysis and Machine Vision" Second Edition

[9] Li, Q. Improvement of bias and generalize ability for computer-aided diagnostic schemes. Computerized Medical Imaging and Graphics 2007, 31, 338–345.

[10] Lee, A.Y. and J.A. Wertz, Harris operator is used to improve the exact position of point feature, 2002. 39(1): p. 153-155.