COMPARISON OF COMPUTER AIDED DETECTION OF BLEEDING REGIONS FOR CAPSULE ENDOSCOPY IMAGES

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***Abstract*- Nowadays cancer is the leading cause for death this triggered a development in automated screening system which can easily detect the cancer tissues in early stage and help the physician for better diagnosis. Wireless Capsule Endoscopy (WCE) is a modernmodality, which is used to view the entire gastrointestinal tract. But the quality of the images plays an important role in the diagnostic procedure. In this paper, we compared various filtering technique for WCE images and we analysed the statistical values like Mean, Standard Deviation, Skewness and Kurtosis using Aphelion Dev software.**

***Keywords*-WCE, Enhancement, Skewness, Tumor**

I.INTRODUCTION

Wireless capsule endoscopy, measuring 26mm × 11mm, is a pill-shaped device which consists of a short-focal-length CMOS camera, light source, battery and radio transmitter. The WCE was approved by U.S. Food and Drug Administration (FDA) in 2001, and it has been reported that this new technology shows great value in evaluating gastrointestinal bleeding, Crohn's disease, ulcer and other diseases existed in the digestive tract.An early radio transmitting capsule for the Gastrointestinal (GI) tract examination was released by the Rockefeller Institute of New York in 1957. The total number of cancer related to GI tract in United States is about 149,530. WCE have been used about 12 years for clinical procedure. WCE has become a popular method, which is used to visualize and diagnose the human gastrointestinal tract estimate the location of the capsule without going through the usual intermediate stage of first estimating received signal strength, and then a second stage of estimating the location. The capsule used by WCE have dimension of 2.8 cm long and 0.9 cm in diameter.In one end of the capsule is housed a minute replaceable battery which is able to supply the electrical power of 15 hours. The other end of the capsule is sealed by a rubber membrane which transmits the body pressure variations to the armature of an inductance coil, and so changes the frequency of the radio signal.

When the capsule is swallowed by a patient and pursues its course through the GI tract, it transmits frequency signals which are varied by the pressure changes in the tract. These signals from the capsule are picked up on a receiver with an antenna held close to the body. The output responses can be displayed on the CRT screen.WCE has advantages. The usage of WCE technology is convenient and safe procedure to analyze the affect ulcer bleeding area of the gastrointestinal, and the entire GI tracts is examined without dead zones. Such endoscopy is a realistic alternative to traditional invasive endoscopy and revolutionizes the methods of diagnosing the GI tract diseases.

Dan Wang (2015) et al, proposed a novel method for acquiring an Intestinal Direction Vector (IDV) based on a single static wireless endoscopic image. It is based on a lumendetection, which involves Bayer-format down sample, adaptive threshold segmentation, and radial texture detection. The lumen detection method achieves 95.5% precision and 98.1% sensitivity [1].Gaffling, S Daum et al (2015), [2] described three-dimensional reconstruction of histological slice sequences offers great benefits in the investigation of different morphologies. The validity of this method is shown on synthetic data, simulated histology data using a CT data set and real histology data. In the case of the simulated histology where the ground truth was known, the mean Target Registration Error (TRE) between the unwrapped and original volume could be reduced to less than 1 pixel.GuanqunBao et al (2015), [3] presented a hybrid localization technique, which takes advantage of data fusion of multiple sensors inside the WCE, to enhance the positioning accuracy and construct the 3-D trajectory of the WCE. The hybrid algorithm is able to reduce the average localization error from 6.8 cm to <2.3 cm of the existing RF localization systems.Seung-Kyun Lee et al (2015), [4] described the capability of magnetic resonance imaging (MRI) to produce spatially resolved estimation of tissue electrical properties. It is based on a new theoretical formalism that allows calculation of EPs from the product of transmit and receive radio-frequency field maps. Our results show the feasibility of rapid EP mapping from MRI without B1+ mapping.

Mohammad Pourhomayoun (2014) et al, [5] described a wireless capsule endoscopy has become a popular method tovisualize and diagnose the human gastrointestinal tract. In this method through extensive Monte Carlo simulations for radio frequency emission signals within the required power and bandwidth range. In wireless capsule is effective and accurate, even in massive multipath conditions. SehyukYim (2014) et al, [6] described a new wireless biopsy method where a magnetically actuated untethered soft capsule endoscope carries and releases a large number of thermo-sensitive, untethered micro grippers (μ-grippers). The advanced navigation skill of centimeter-scaled untethered magnetic capsule endoscopes with highly parallel, autonomous, sub millimeter scale tissue sampling μ-grippers offers a multifunctional strategy for gastrointestinal capsule biopsy.

Jinn-Yi Yeh (2014) et al, [7] proposed a capsule endoscopy to detect abnormalities inside regions of the small intestine that are not accessible when using traditional endoscopy techniques. The novel method used for detecting bleeding and ulcers in WCE images. This approach involves using color features to determine the status of the small intestine.Shu Ting Goh (2014) et al, [8] proposed a new method of presurgery gastroscopy and colonoscopy monitoring procedure that allows the patient to freely move inside the medical ward. The DOA is estimated via antenna arrays installed within a medical ward and the IMU is installed on the capsule endoscopy. The number of available antenna arrays on multiplication required by UKF. Image based localization performance is affected by image quality, such as image resolution and distortion.

Holly S. lay (2014) et al, [9] proposed an endoscopy and colonoscopy has significantly advanced visualization of the gastrointestinal tract (GIT). To combine the imaging capabilities of endoscopic ultrasound with the full GIT transit of capsule endoscopy. In a hybrid MATLAB simulation was created, incorporating both KLM circuit elements for analog analysis and digitizing and beam forming elements to render a final grey-scale image for imaging quality analysis.Yuan Gao (2013) et al, [10] presented a chipset including an asymmetrical QPSK/OOK transceiver SoC and a JPEG image encoder for wireless capsule endoscopy. The transceiver SoC supports bi-directional telemetry for high data-rate image transmission with QPSK modulation and low data-rate command link with OOK modulation.The average power consumption of TX is 2.5 mW when transmitting at 3 fps frame rate.Jenna L. Gorlewicz (2013), [11] presented the potential benefits of insufflation and the need for an untethered air supply in a capsule endoscope, we now explore the potential of acid/base reactions in producing sufficient gaseous output to meet the visualization and locomotion requirements. The feasibility of enhancing visualization and locomotion of endoscopic capsules through wireless insufflation is explained.PawelTurcza et al (2013), [12] presented the design of hardware efficient, low power image processing system for next generation wireless endoscopy. The most significant part of the system is the image compressor. The presented system was prototyped in a single, low-power, 65-nm Field Programmable Gate Arrays (FPGA) chip. Its power consumption is low and comparable to other application-specific-integrated-circuits-based systems, despite FPGA-based implementation.

II. METHODOLOGY

The Flow diagram of developed technique is shown in Fig.1 and the steps involved in this work have explained as follows:

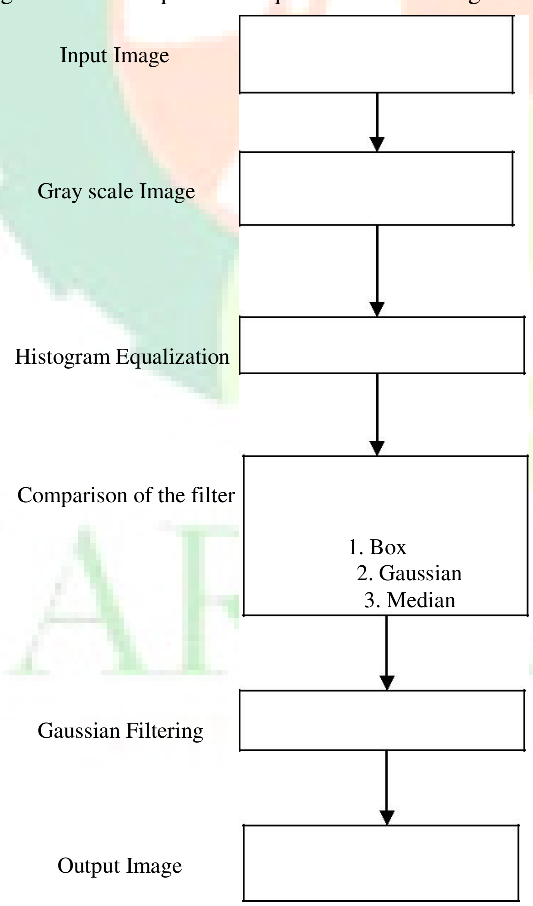

Fig.1 Flow Diagram for Capsule Endoscopy

The input image is gastrointestinal image. This color image can be converted into grayscale image. After converting into grayscale formal histogram equalization is applied and here we taking three filters which are Box, Median and Gaussian filter. By using these filters, we are analysing parameters such as Mean, Standard Deviation, Skewness and Kurtosis.

2.1 Input CE Image

Capsule Endoscopy (CE) has gradually seen its wide application in hospitals in the last few years because it can view the entire small bowel without invasiveness. However, CE produces too many images each time, thus causing a huge burden to physicians, so it is meaningful to help clinicians if we can employ computerized methods to diagnose.

2.2 RGB Modifications

RGB image is 24, each channel has 8 bits, for red,green, and blue—in other words, the image is composed of three images (one for each channel), where each image can store discrete pixels with conventional brightness intensities between 0 and 255.The graph representation of RGB color model using histogram equalization as shown in fig.2. From this graph Red color requires extracting the dominant of an image.

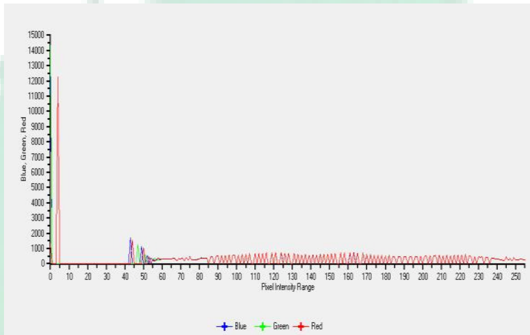

Fig.2 Comparison of RGB using HE

2.3 Gray scale Image

A gray scale digital image is an image in which the value of each pixel is a single sample that it is carries only intensity information. When converting an RGB image to gray scale, we have to take the RGB value for each pixel and make as output a single value reflecting the brightness of that pixel.

2.4 Histogram Equalization

Histogram Equalization is a method in image processing of contrast adjustment using the image's histogram. Histogram equalization is a popular technique for improving the appearance of a poor image. HE is one of the common methods used for improving contrast in digital images.

2.5 Box Filter

Box filtering is basically an average-of-surrounding-pixel kind of image filtering. They have the advantage of being fast to compute, but their adoption has been hampered by the fact that they present serious restrictions to filter construction. The power of box filtering is one can write a general image filter that can do sharpen, emboss, edge-detect, smooth, motion-blur, etcetera. Size of the filter window, by default set to 4 for filter.

2.6 Gaussian Filter

The Gaussian filtering technique has been used in the removal of speckles. Gaussian smoothing is also used as a pre-processing stage in computer vision algorithms in order to enhance image structures at different scales. Size of the filter window, by default set to 3 for filter.

2.7 Median Filter

The Median filter is a sliding-window spatial filter, but it replaces the center value in the window with median of all pixel values in the window. In a median filter, a window slides along the image, and the median intensity value of the pixels within the window becomes the output intensity of the pixel being processed. Size of the filter window, by default set to 5 for filter.

2.8 Threshold Segmentation

Threshold is one of the widely methods used for image segmentation. It is useful in discriminating foreground from the background. By selecting an adequate threshold value T, the gray level image can be converted to binary image. Threshold segment value is 65-85.

III.RESULTS AND DISCUSSION

The WCE Image has been applied for pre-processing.Fig 3a shows the acquired input image (color image). This color image can be converted into gray scale image value (0-255) as shown in fig.3b. Fig 3c shows the histogram equalization for improving contrast.Fig.3d shows threshold segmentation value is 65-85.Fig .3e shows normal colon image.

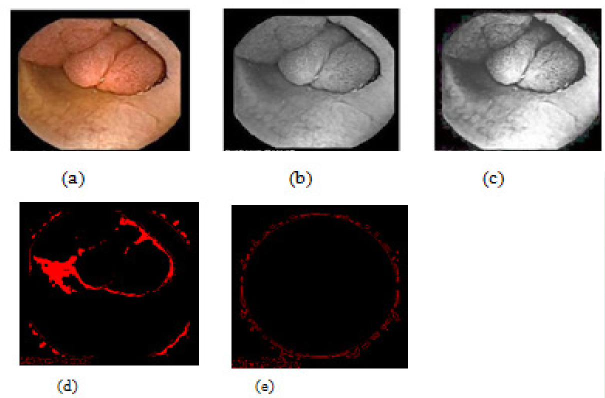

Fig.3 (a) Input Image, (b) Gray Scale Image, (c) Histogram Equalization
(d) Threshold Segmentation (65-85) (e) Normal colon Image

The obtained results from Aphelion Dev software have been shown in the table 1 and 2.

TABLE 1.HISTOGRAM EQUALIZATION OF CAPSULE ENDOSCOPY

	Mean RGB	**Standard Deviation RGB**	**Skewness RGB**	**Kurtosis RGB**
Histogram Equalization	123.072 122.373 123.470	78.926 79.807 78.267	-0.1346 -0.1468 -0.111	-1.128 -1.139 -1.153

TABLE 2.COMPARISON OF VARIOUS FILTERS

	Mean RGB	**Standard Deviation RGB**	**Skewness RGB**	**Kurtosis RGB**
Median	95.856 95.820 96.051	59.579 59.624 59.281	-0.517 -0.517 -0.510	-0.976 -0.976 -0.980
Gaussian	**96.336 96.291 96.539**	**64.519 63.980 62.908**	**-0.532 -0.533 -0.525**	**-0.990 -0.990 -0.994**
Box	95.855 95.815 96.029	58.9940 59.086 58.695	-0.520 -0.515 -0.514	-0.950 -0.951 -0.945

The statistical parameters such as Mean, Standard Deviation, Skewness and Kurtosis for different filtering techniques are obtained as shown in table.2. The comparative analysis shows that the Gaussian filtering provides better than other techniques.

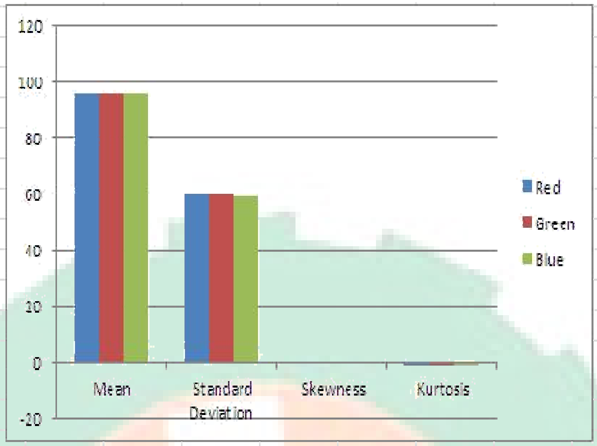

Fig.4 Bar Chart for Median filter

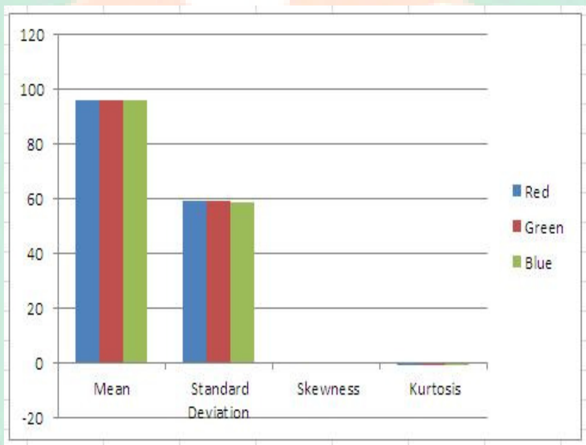

Fig.5 Bar Chart for Gaussian filter

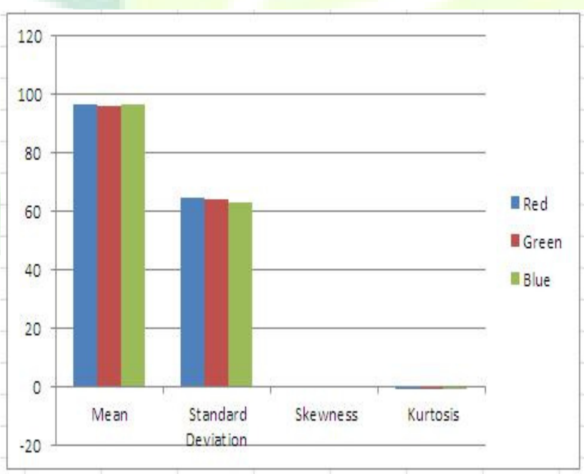

Fig.6 Bar Chart for Box filter

From this graph representation, it is observed that the Gaussian filter is superior to other filter. It gives better noise reduction when compared to other filters.

IV.CONCLUSION

In this paper, the problem associated with the diagnostics of WCE image. Image has been filtered using different methods such as Median, Gaussian and Box. The performances were analyzed using statistical values like Mean, Standard Deviation, Skewness and Kurtosis with the aid of Aphelion Dev software. The comparison of results shows that Gaussian filtering is more suitable for higher noise reduction than other techniques.

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