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DETECTION OF POLYP IN SMALL INTESTINE USING SURF ALGORITHM

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Abstract- Wireless Capsule Endoscopy (WCE) is used to detect the polyps with bleeding in the small intestine. The acquired wireless capsule endoscopy images are analysed in small intestine polyps through image classification algorithm based on feature extraction methods involving color and texture analysis and surf algorithm. In existing system an improved Bag Of Feature (BOF) method is used to classify the polyps in small intestine with images captured using WCE. Texture feature are extracted around the neighborhood of the key point which is integrated with Scale Invariant Feature Transform (SIFT) Feature, which produce complex result. BOF for polyp detection application depends critically the low level local descriptors. In proposed system we can use key point selection methods based on the Color and texture feature needed to detect the polyps. Color feature is extracted using color-correlogram algorithm. Further the texture feature can be extracted using contourlet algorithm. These two features are combined to the Speed Up Robust Feature (SURF) feature and SVM classification, in order to get the best performance of polyp detection. Finally we can also extend the disease detection such as ulcer and bleeding detection in small intestine

Index terms – Scale Invariant Feature Transform (SIFT), color-correlogram, contourlet, Speed Up Robust Feature (SURF)

I. INTRODUCTION

Purpose of review here, we review the clinical applications of small bowel capsule endoscopy. Moreover, we provide an outlook on the exceptional future developments of small bowel capsule endoscopy. We discuss clinical algorithms for diagnosis of small bowel diseases. Multiple studies have shown the potential of capsule endoscopy for identification of the bleeding source located in the small bowel and the increased diagnostic yield over radiographic studies. Capsule endoscopy could detect villous atrophy and severe complications in patients with nonresponsive celiac disease. In addition, small bowel capsule endoscopy was proven as a valid tool to diagnose polyps and tumors and Crohn's disease. Major current clinical indications of capsule endoscopy in the small bowel include evaluation of obscure gastrointestinal bleeding, diagnosis and surveillance of small bowel polyps and tumors, celiac disease and Crohn's disease. Recent developments have also passed the way for small bowel capsule endoscopy to become a therapeutic instrument.

A wireless capsule endoscopy (WCE) innovative diagnostic that allows direct visualization and choose the path of the small intestine of a patient. A WCE is a disposable dome-shaped capsule which is composed of an optical device, an illuminator, an imaging sensor, a battery and a radio frequency transmitter. Once swallowed by a patient after examination of patient, WCE is pushed by moving along the digestive tract takes pictures of the inside of mucus and digestive peristalsis track at a rate of two frames per second. Wireless capsule endoscopy (WCE) can directly take digital images in the gastrointestinal tract of patients. Capsule endoscopy (CE) has been widely used to diagnose diseases in human digestive tract. One of the most efficient color spaces for WCE-based disease detection is the hardware-based Red-Green-Blue (RGB). An endoscope consists of a rigid or flexible tube. A light delivery system to illuminate the organ or object under inspection. The light source outside the body is typically directed into the body using optical fiber system. A lens system transmits the image from the objective lens to the viewer. Relay lenses system is used in the case of rigid endoscopes and a bundle of fiber optics is used in the case of a fiberscope. An eyepiece Modern instruments may be video scopes, with no eyepiece, a camera transmits image to a screen for image capture. An additional channel to allow entry of medical instruments or manipulators. The procedure

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requires sedation, which includes its own risks, including permanent cognitive impairments.

Doctors will often recommend endoscopy to evaluate, Stomach pain, Ulcers, gastritis, or difficulty swallowing .Digestive tract bleeding, Changes in bowel habits. Polyps or growth in the colon. In addition, your doctor may use an endoscope to take a biopsy to look for the presence of disease. Endoscopy may also be used to treat a digestive tract problem.

Figure 1 . Wireless Capsule Endoscopy

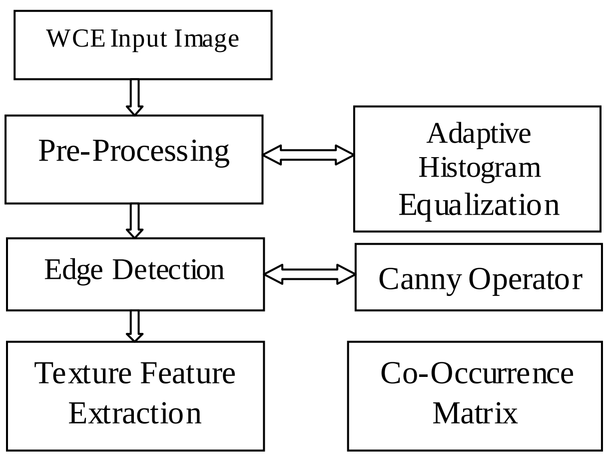
For example, the endoscope might not only detect active bleeding from an ulcer, but devices can be passed through the endoscope that can stop the bleeding. In the colon, polyps can be removed through the scope to prevent the development of colon cancer. Also, using ERCP, gallstones that have passed outside the gallbladder and into the bile duct can be removed. Polyps are abnormal growths of tissue that can be found in any organ that has blood vessels. Most polyps are not cancerous but if one becomes larger than a centimetre (1cm), it can turn into cancer by great chance. So one of the most important advantages of WCE is used to detect polyps and cancer in early.

II. RELATED WORK

Starting in 1997, small intestine bleeding obvious to the obscure (ie, visible bleeding) in the case, the device of enteroscopy helped detect and treat the source of bleeding is recommended in hemodynamically stable patients. Barium radiographic studies, including the small intestine and is located on top of increased diagnostic yield of capsule endoscopy to identify the possible source of the bleeding, and computed tomography (CT) enteroscopy follow through, and push enteroscopy . The meta-analysis of patients with obscure gastrointestinal bleeding diagnostic yield of capsule endoscopy in the evaluation of other diagnostic imaging modalities. Tumors of the small intestine represent 5-7% of patients with obscure gastrointestinal bleeding is the most common reason for patients who are under 50 years old. The Acquired Wireless capsule endoscopy images are analysed in intestinal polyps through image classification algorithm based on feature extraction methods involving texture analysis and SIFT feature. Step1 the input image is converted into gray scale image to enhance the grayscale image here we are using adaptive histogram equalization method. Step 2 after that image is to find out the edges using canny operator. Step 3 texture feature extraction method. An image texture is a set of metrics calculated in image processing designed to quantify the perceived texture of an image. Image texture gives us information about the spatial arrangement of color or intensities in an image or selected region of an image. Step4 one the co-occurrence properties in energy to be consider in matching technique. This matching technique here we used SIFT feature based on key point selection and measured their stability. An important aspect of this approach is that it generates large numbers of features that closely cover the image over the full range of scales and locations. A typical image of size 500x500 pixels will give rise to about 2000 constant features. The quantity of features is particularly important for object recognition, where the ability to detect small objects in disorderly backgrounds requires that at least 3 features be correctly matched from each object for reliable identification. Step5 finally to classify the polyps using SVM classification.

III. SYSTEM DESIGN

A computer-aided system for inputting a user's description for the input design is the conversion process. Data input process to avoid errors in the design and management to get the right information from the computer system is important to show the right direction. To handle the volume of data that the data input is performed by the creation of a user-friendly screen. Input for the design and targeting data entry easier and be free of errors. The data entry screen is designed so that all data processing can be performed. This achievement provides visualization facilities. When data is entered, it is credibility, viewing. Including with the help of data screens. The users will not maize appropriate messages are immediately delivered when needed. Thus, an input system which is easy to follow the input design object.



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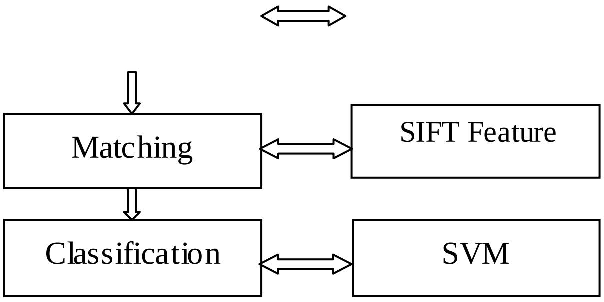

Figure 2 . System Configuration

A. IMAGE CONVERSION

To take the input image after converted into input image to gray Scale image. Pre-processing refers to removal of any noise and other disorder in the image so that the image is ready for feature extraction. Here Grayscale images are different from one-bit black-and-white images, with only the two colors, black, and white. Smoothing is performed to remove blurriness in the image. Noise in image is random variation of brightness or color information in images. The Grayscale image after filtering should be enhanced for better recognition of image. So adopt a method called Adaptive Histogram Equalization (AHE). It enhances the contrast of the grayscale image by transforming the values using Adaptive Histogram Equalization (AHE). AHE operates on small regions in the image, called tiles, rather than the entire image. Each tile's contrast is enhanced, so that the histogram of the output region approximately matches the histogram specified by the 'Distribution' parameter. The neighboring tiles are then combined using bilinear interpolation to eliminate artificially induced boundaries. The contrast, especially in homogeneous areas, can be limited to avoid amplifying any noise that might be present in the image.

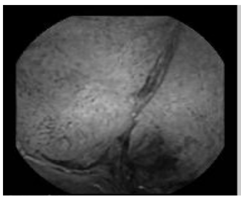

Figure 3 . Conversion of Grayscale Image

B. EDGE DETECTION

Edge detection is an image processing technique for finding the boundaries of objects within images. It detects discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing. Here canny Edge detection is used to find edges of WCE images of bleeding regions. The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in image discontinuities.

Canny Edge Detection

The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. Edge detection, especially step edge detection has been widely applied in various computer vision systems, which is an important technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. Canny has found that, the requirements for the application of edge detection on diverse vision systems are relatively the same. Thus, a development of an edge detection solution to address these requirements can be implemented in a wide range of situations. The general criteria for edge detection includes Detection of edge with low error rate, which means that the detection should accurately catch as many edges shown in the image as possible The edge point detected from the operator should accurately localize on the center of the edge.a given edge in the image should only be marked once, and where possible, image noise should not create false edges.

To satisfy these requirements Canny used the calculus of variations – a technique which finds the function which optimizes a given functional. The optimal function in Canny's detector is described by the sum of four exponential terms, but it can be approximated by the first derivative of a Gaussian. Among the edge detection methods developed so far, canny edge detection algorithm is one of the most strictly defined methods that provides good and reliable detection. Owing to its optimality to meet with the three criteria for edge detection and the simplicity of process for implementation, it becomes one of the most popular algorithms for edge detection.

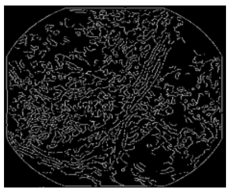

Figure 4 . Canny Edge Detection

C. TEXTURE FEATURE EXTRACTION

An image texture is a set of metrics calculated in image processing designed to quantify the perceived texture of an image. Image texture gives us information about the spatial arrangement of color or intensities in an image or selected region of an image. Image textures can be artificially created or found in natural scenes captured in an image. Image textures are one way that can be used to help in segmentation or classification of images. To analyze an image texture in computer graphics, there are two ways approaches Structured Approach and Statistical Approach.

a) Statistical Approach

A statistical approach sees an image texture as a quantitative measure of the arrangement of intensities in a region. In general this approach is easier to compute and is more widely used, since natural textures are made of patterns of irregular sub elements.

b) Edge Detection

The use of edge detection to determine the number of edge pixels in a specified region helps determine a characteristic of texture complexity. After edges have been found the direction of the edges can also be applied as a characteristic of texture and can be useful in determining patterns in the texture. These directions can be represented as an average or in a histogram. Consider a region with N pixels. The gradient-based edge detector is applied to this region by producing two outputs for each pixel p: the gradient magnitude Mag(p) and the gradient direction Dir(p). The edgeness per unit area can be defined by $F_{edgeness} = \frac{|\{p|Mag(p)>T\}|}{N}$ for some Threshold T.

To include orientation with edgeness we can use histograms for both gradient magnitude and gradient direction. Let Hmag(R) denote the normalized histogram of gradient magnitudes of region R, and let Hdir denote the normalized histogram of gradient orientations of region R. Both are normalized according to the size NR Then F_{mag dir}=(H_{mag}(R), H_{dir}(R)) is quantitative texture description of region R.

c) Co-occurrence Matrices

The co-occurrence matrix captures numerical features of a texture using spatial relations of similar gray tones. Numerical features computed from the co-occurrence matrix can be used to represent, compare, and classify textures. The following are a subset of standard features derivable from a normalized co-occurrence matrix:

One negative aspect of the co-occurrence matrix is that the extracted features do not necessarily correspond to visual perception.

$$Contrast = \sum_i \sum_j (i-j)^2 N_d(i,j)$$

$$Energy = \sum_i \sum_j N_d^2(i,j)$$

$$Homogeneity = \sum_i \sum_j \frac{N_d(i,j)}{1+|i-j|}$$

$$Correlation = \frac{\sum_i \sum_j (i-\mu_i)(j-\mu_j) N_d(i,j)}{\sigma_i \sigma_j}$$

Here μ_i, μ_j are the means and σ_i, σ_j standard deviation of the row and column.

```
Texture =

     Contrast: [0.1861 0.2053]
  Correlation: [0.9559 0.9514]
       Energy: [0.2052 0.2049]
  Homogeneity: [0.9561 0.9555]
```

Figure 5 . Texture Feature Result

D. SIFT FEATURE EXTRACTION

For any object in an image, interesting points on the object can be extracted to provide a "feature description" of the object. This description, extracted from a training image, can then be used to identify the object when attempting to locate the object in a test image containing many other objects. To perform reliable recognition, it is important that the features extracted from the training image be detectable even under changes in image scale, noise and illumination. Such points usually lie on high-contrast regions of the image, such as object edges. Another important characteristic of these features is that the relative positions between them in the original scene shouldn't change from one image to another. For example, if only the four corners of a door were used as features, they would work regardless of the door's position; but if points in the frame were also used, the recognition would fail if the door is opened or closed. Similarly, features located in articulated or flexible objects would typically not work if any change in their internal geometry happens between two images in the set being processed. However, in practice SIFT detects and uses a much larger number of features from the images, which reduces the contribution of the errors caused by these local variations in the average error of all feature matching errors.

SIFT can robustly identify objects even among clutter and under partial occlusion, because the SIFT feature descriptor is invariant to uniform scaling, orientation, and partially invariant to affine distortion and illumination changes. This section summarizes Lowe's object recognition method and mentions a few competing techniques available for object recognition under clutter and partial occlusion.

SIFT key points of objects are first extracted from a set of reference images and stored in a database.

An object is recognized in a new image by individually comparing each feature from the new image to this database and finding candidate matching features based on Euclidean distance of their feature vectors. From the full set of matches, subsets of key points that agree on the object and its location, scale, and orientation in the new image are identified to filter out good matches. The determination of consistent clusters is performed rapidly by using an efficient hash table implementation of the generalized Hough transform.

Each cluster of 3 or more features that agree on an object and its pose is then subject to further detailed model verification and subsequently outliers are discarded. Finally the probability that a particular set of features indicates the presence of an object is computed, given the accuracy of fit and number of probable false matches. Object matches that pass all these tests can be identified as correct with high confidence

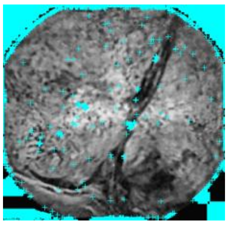

Figure 6 . SIFT Feature Extraction

E. CLASSIFICATION

Support vector machines (SVMs) are supervised learning methods widely used to classify data. The basic concept is that an SVM maps the input data to an *n*-dimensional space, where it tries to find the optimal hyper plane to separate the datasets. The key features of SVMs are the use of kernels, the absence of local minima, the sparseness of the solution, and the capacity control obtained by optimizing the margin. SVM finds the optimal hyper plane that will maximize the margin between the support vectors. Margin is the distance between the dashed lines. The vectors that define this margin are called support vectors.

Given training data (xi, yi) for i = 1 ...N, with (xi, yi) >= 34 if the threshold value is less than 34 the image is to be affected with bleeding in small intestine. It is a correct classification. Based on the feature values obtained from results of texture and SIFT, the WCEs small intestine images are classified.

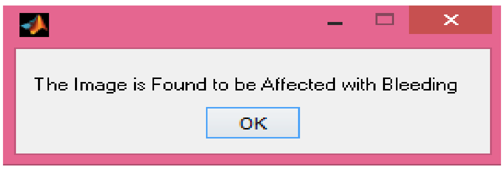

Figure 7 . Classification Result

IV. CONCLUSION

An improved BoF method is used to represent WCE images. Textures features in the neighborhoods of the key points is obtained in order to provide accurate description of the WCE images. To evaluate the relationships between the classification methods, and the classification performance. The best performance of polyp classification could be obtained with the feature of SIFT and SVM method. The obtained result of polyp detection accuracy is 93.2%. Improved BoF method provides a good characterization and description of the WCE images for polyp classification

FUTURE WORK

In proposed system to use key point selection methods based on the Color and texture features to detect the polyps. Color feature is extracted using color-correlogram algorithm. Further the texture feature can be extracted using contourlet algorithm. These two features are compared to the Speed Up Robust Feature (SURF) algorithm. SVM classification is used, in order to get the best performance of polyp detection. Finally it is extended to detect the disease such as ulcer and bleeding in small intestine

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