



An Exclusive Review of Popular Image Processing Techniques

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ABSTRACT:

This review paper brings out a summary of popular image processing techniques in practice for students, faculty members and researchers in medical image processing field. Through Image processing, we do some operations on an image, to get an enhanced image or we try to acquire some useful information from it. They help in manipulating digital images through the use of computers. We Perform Image Restoration, Linear Filtering, Independent Component Analysis, Pixelation, Template Matching, Image Generation Techniques even to image to obtain promisable results. This Review Paper also summarizes some of the enhancement approaches which have impacted image segmentation approaches over these years.

Keywords — Graph Cut Segmentation Approach; Geodesic Graph Cut Method; Live-Wire Method; Oriented Active Appearance Model; Massive Training Artificial Neural Network; Fuzzy K-C-Means Segmentation Approach; Fuzzy-MPSO Based Segmentation Approach; Gaussian Mixture Model with Expected Maximization; SuperPixel Division Algorithm; Hidden Markov Model with Expected Maximization.

I. INTRODUCTION

Image Processing is required to get finer details of image or converting an black and white image into color image or hiding data inside image and many more. Image processing includes filtering an image, enhancement of an image, colourisation of image and many more. Various techniques available like filter, enhancement techniques etc. to get details of image. It's a system that processes images or videos to enhance an image making it look even better, recognize objects in an image, recognize a person (tag your friend in Facebook), track the lane on the road (Autonomous car), and so on. Since images are defined by two or more dimensions digital image processing may be modeled in the form of multidimensional systems. The image processing mainly deals with image acquisition, Image enhancement, image segmentation, feature extraction, image classification. The usefulness of this technology is apparent in many different spheres right from medicine to remote sensing. The advances and wide availability of image processing hardware have further enhanced the usefulness of image processing. Image processing and Computer Vision gives eye functionality to machines. Camera can replace varieties of sensors. You can see how much we are depending on our eyes as compare to other sense organs. Our mind's most part is dedicated for processing image information from eye.

II. MATERIALS AND METHODS

A. Multi-shape GC-OAAM

[1] proposed a method in which the minimization is per-formed in a sequential manner by the fusion move algorithm that uses the QPBO min-cut algorithm. Multi-shape GCs are proven to be more beneficial than single-shape GCs. Hence, the segmentation methods are validated by calculating statistical measures. The false positive (FP) is reduced and sensitivity and specificity improved by multiple MTANN

B. Interactive Automatic Hepatic Tumour CT Image Segmentation

[2] proposed a system, this system has concentrated on finding a fast and interactive segmentation method for liver and tumor segmentation. In the pre-processing stage, Mean shift filter is applied to CT image



process and statistical thresholding method is applied for reducing processing area with improving detections rate. In the Second stage, the liver region has been segmented using the algorithm of the proposed method. Next, the tumor region has been segmented using Geodesic Graph cut method. Results show that the proposed method is less prone to shortcutting than typical graph cut methods while being less sensitive to seed placement and better at edge localization than geodesic methods. This leads to increased segmentation accuracy and reduced effort on the part of the user. Finally Segmented Liver and Tumor Regions were shown

from the abdominal Computed Tomographic image. [3] proposed a system, in which a predicate is defined for measuring the evidence for a boundary between two regions using Geodesic Graph-based representation of the image. The algorithm is applied to image segmentation using two different kinds of local neighborhoods in constructing the graph. Liver and hepatic tumor segmentation can be automatically processed by the Geodesic graph-cut based method. This system has concentrated on finding a fast and interactive segmentation method for liver and tumor segmentation. In the preprocessing stage, the CT image process is carried over with mean shift filter and statistical thresholding method for reducing processing area with improving detections rate. Second stage is liver segmentation; the liver region has been segmented using the algorithm of the proposed method. The next stage tumor segmentation also followed the same steps. Finally the liver and tumor regions are separately segmented from the computer tomography image.

C. FOBE Algorithm

[4] proposed a system in which the cross-diamond search algorithm employs two diamond search patterns (a large and small) and a halfway-stop technique. It finds small motion vectors with fewer search points than the DS algorithm while maintaining similar or even better search quality. The efficient Three Step Search (E3SS) algorithm requires less computation and performs better in terms of PSNR. Modified objected block-base vector search algorithm (MOBS) fully utilizes the correlations existing in motion vectors to reduce the computations. Fast Objected - Base Efficient (FOBE) Three Step Search algorithm combines E3SS and MOBS. By combining these two existing algorithms CDS and MOBS, a new algorithm is proposed with reduced computational complexity without degradation in quality. [5] proposed a system in which this study presented the implementation of two fully automatic liver and tumors segmentation techniques and their comparative assessment. The described adaptive initialization method enabled fully automatic liver surface segmentation with both GVF active contour and graph-cut techniques, demonstrating the feasibility of two different approaches. The comparative assessment showed that the graph-cut method provided superior results in terms of accuracy and did not present the described main limitations related to the GVF method. The proposed image processing method will improve computerized CT-based 3-D visualizations enabling noninvasive diagnosis of hepatic tumors. The described imaging approach might be valuable also for monitoring of postoperative outcomes through CT-volumetric assessments. Processing time is an important feature for any computer-aided diagnosis system, especially in the intra-operative phase. [6] proposed a system in which an automatic anatomy segmentation method is proposed which effectively combines the Active Appearance Model, Live Wire and Graph Cut (ALG) ideas to exploit their complementary strengths. It consists of three main parts: model building, initialization, and delineation. For the initialization (recognition) part, a pseudo strategy is employed and the organs are segmented slice by slice via the OAAM (Oriented Active Appearance method). The purpose of initialization is to provide rough object localization and shape constraints for a latter GC method, which will produce refined delineation. It is better to have a fast and robust method than a slow and more accurate technique for initialization. [7] proposed a system which uses intermediate features of maximum overlap wavelet transform (IMOWT) as a pre-processing step. The coefficients derived from IMOWT are subjected to 2D histogram Grouping. This method is simple, fast and unsupervised. 2D histograms are used to obtain Grouping of color image. This Grouping output gives three segmentation maps which are fused together to get the final segmented output. This method produces good segmentation results when compared to the direct application of 2D Histogram Grouping. IMOWT is the efficient transform in which a set of wavelet features of the same size of various levels of resolutions and different local window sizes for different levels are used. IMOWT is efficient because of its time effectiveness, flexibility and translation invariance which are useful for good segmentation results. [8] proposed a system in which OWT extracts wavelet features which give a good separation of different patterns.



Moreover the proposed algorithm uses morphological operators for effective segmentation. From the qualitative and quantitative results, it is concluded that our proposed method has improved segmentation

quality and it is reliable, fast and can be used with reduced computational complexity than direct applications of Histogram Clustering. The main advantage of this method is the use of single parameter and also very faster. While comparing with five color spaces, segmentation scheme produces results noticeably better in RGB color space compared to all other color spaces. [9] presented an automatic segmentation method which effectively combines Active Contour Model, Live Wire method and Graph Cut approach (CLG). The aim of Live wire method is to provide control to the user on segmentation process during execution. Active Contour Model provides a statistical model of object shape and appearance to a new image which are built during a training phase. In the graph cut technique, each pixel is represented as a node and the distance between those nodes is represented as edges. In graph theory, a cut is a partition of the nodes that divides the graph into two disjoint subsets. For initialization, a pseudo strategy is employed and the organs are segmented slice by slice through the OACAM (Oriented Active Contour Appearance Model). Initialization provides rough object localization and shape constraints which produce refined delineation. This method is tested with different set of images including CT and MR images especially 3D images and produced perfect segmentation results.

[10] proposed a work, in this work, a framework of feature distribution scheme is proposed for object matching. In this approach, information is distributed in such a way that each individual node maintains only a small amount of information about the objects seen by the network. Nevertheless, this amount is sufficient to efficiently route queries through the network without any degradation of the matching performance. Digital image processing approaches have been investigated to reconstruct a high resolution image from aliased low resolution images. The accurate registrations between low resolution images are very important to the reconstruction of a high resolution image. The proposed feature distribution scheme results in far lower network traffic load. To achieve the maximum performance as with the full distribution of feature vectors, a set of requirements regarding abstraction, storage space, similarity metric and convergence has been proposed to implement this work in C++ and QT. [11] discussed about an important work which presents a metal detecting robot using RF communication with wireless audio and video transmission and it is designed and implemented with Atmel 89C51 MCU in embedded system domain. The robot is moved in particular direction using switches and the images are captured along with the audio and images are watched on the television. Experimental work has been carried out carefully. The result shows that higher efficiency is indeed achieved using the embedded system. The proposed method is verified to be highly beneficial for the security purpose and industrial purpose. The mine sensor worked at a constant speed without any problem despite its extension, meeting the specification required for the mine detection sensor. It contributed to the improvement of detection rate, while enhancing the operability as evidenced by completion of all the detection work as scheduled. The tests demonstrated that the robot would not pose any performance problem for installation of the mine detection sensor. On the other hand, however, the tests also clearly indicated areas where improvement, modification, specification change and additional features to the robot are required to serve better for the intended purpose. Valuable data and hints were obtained in connection with such issues as control method with the mine detection robot tilted, merits and drawbacks of mounting the sensor, cost, handling the cable between the robot and support vehicle, maintainability, serviceability and easiness of adjustments. These issues became identified as a result of our engineers conducting both the domestic tests and the overseas tests by themselves, and in this respect the findings were all the more practical.

D. Vision based Path Planning

[12] discussed about Vision based Path Planning and Tracking control using Mobile Robot. This paper proposes a novel methodology for autonomous mobile robot navigation utilizing the concept of tracking control. Vision-based path planning and subsequent tracking are performed by utilizing proposed stable adaptive state feedback fuzzy tracking controllers designed using the Lyapunov theory and particle-swarm-optimization (PSO)-based hybrid approaches. The objective is to design two self-adaptive fuzzy controllers, for x-direction and y-direction movements, optimizing both its structures and free parameters, such that the designed controllers can guarantee desired stability and, simultaneously, can provide satisfactory tracking



performance for the vision-based navigation of mobile robot. The design methodology for the controllers simultaneously utilizes the global search capability of PSO and Lyapunov theory-based local search method, thus providing a high degree of automation. Two different variants of hybrid approaches have been employed in this work. The proposed schemes have been implemented in both simulation and experimentations with a real robot, and the results demonstrate the usefulness of the proposed concept. [13] discussed about a model, a new model is designed for boundary detection and applied it to object segmentation problem in medical images. Our edge following technique incorporates a vector image model and the edge map information. The proposed technique was applied to detect the object boundaries in several types of noisy images where the ill-defined edges were encountered. The proposed techniques performances on object segmentation and computation time were evaluated by comparing with the popular methods, i.e., the ACM, GVF snake models. Several synthetic noisy images were created and tested. The method is successfully tested in different types of medical images including aortas in cardiovascular MR images, and heart in CT images. [14] discussed about the issue of intuitive frontal area/foundation division in still pictures is of awesome down to earth significance in picture altering. They maintain a strategic distance from the limit length predisposition of chart cut strategies and results in expanded affectability to seed situation. Another proposed technique for completely programmed handling structures is given taking into account Graph-cut and Geodesic Graph cut calculations. This paper addresses the issue of dividing liver and tumor locales from the stomach CT pictures. The absence of edge displaying in geodesic or comparable methodologies confines their capacity to exactly restrict object limits, something at which chart cut strategies by and large exceed expectations. A predicate is characterized for measuring the confirmation for a limit between two locales utilizing Geodesic Graph-based representation of the picture. The calculation is connected to picture division utilizing two various types of nearby neighborhoods in building the chart. Liver and hepatic tumor division can be naturally prepared by the Geodesic chart cut based strategy. This framework has focused on finding a quick and intuitive division strategy for liver and tumor division. In the pre-handling stage, Mean movement channel is connected to CT picture process and factual thresholding technique is connected for diminishing preparing zone with enhancing discoveries rate. In the Second stage, the liver area has been divided utilizing the calculation of the proposed strategy. Next, the tumor district has been portioned utilizing Geodesic Graph cut strategy. Results demonstrate that the proposed strategy is less inclined to shortcutting than run of the mill diagram cut techniques while being less delicate to seed position and preferable at edge restriction over geodesic strategies. This prompts expanded division exactness and decreased exertion with respect to the client. At long last Segmented Liver and Tumor Regions were appeared from the stomach Computed Tomographic picture.

E. Patterns for Next generation Database Systems

[15] discussed about efficient content-based medical image retrieval, dignified according to the Patterns for Next generation Database systems (PANDA) framework for pattern representation and management. The proposed scheme use 2-D Wavelet Transform that involves block-based low-level feature extraction from images. An expectation-maximization algorithm is used to cluster the feature space to form higher level, semantically meaningful patterns. Then, the 2-component property of PANDA is exploited: the similarity between two clusters is estimated as a function of the similarity of both their structures and the measure components. Experiments were performed on a large set of reference radiographic images, using different kinds of features to encode the low-level image content. Through this experimentation, it is shown that the proposed scheme can be efficiently and effectively applied for medical image retrieval from large databases, providing unsupervised semantic interpretation of the results, which can be further extended by knowledge representation methodologies. [16] discussed about Automatic Number Plate Recognition (ANPR), Automatic Number Plate Recognition (ANPR) is a real time embedded system which automatically recognizes the license number of vehicles. In this paper, the task of recognizing number plate for Indian conditions is considered, where number plate standards are rarely followed. The system consists of integration of algorithms like: 'Feature-based number plate Localization' for locating the number plate, 'Image Scissoring' for character segmentation and statistical feature extraction for character recognition; which are specifically designed for Indian number plates. The system can recognize single and double line number plates under widely varying illumination conditions with a success rate of about 82%. [17] discussed about adaptive MED filter, this



improved method is a simple, and efficient way to remove impulse noise from highly corrupted digital images. This method has two stages. The first stage is to detect the impulse noise in the image. In this stage, the pixels are divided into two classes (noise free pixels/ noise free pixels) based on only the intensity values. Then, the second stage is to eliminate the impulse noise from the image. In this stage, only the “noise-pixels” are processed. But the “noise-free pixels” are not modified and are copied directly to the output image. The method used gradient based adaptive median filter, so that this method adaptively changes the size of the median filter based on the number of the “noise-free pixels” in the neighborhood. For the filtering, the gradient value of every pixel location at (x,y) is calculated. Then the median value can be found out under the consideration of only “noise-free pixels”. In this algorithm for effective noise detection is proposed. The Proposed algorithm produces better edge and fine details preservations and reduces blurring at the high density impulse noise. Because of its simplicity, this proposed method is suitable to be implemented in consumer electronics products such as digital television, or digital camera.

F. Melanoma

[18] narrated about a type of skin malignant growth which is melanoma. There are numerous types of skin malignancy, for example, Basal Cell Carcinoma (BCC), Squamous Cell Carcinoma (SCC) and Melanoma. In which the deadliest type of skin disease is the Melanoma. Malignant melanoma has expanded among skin malignant growth patients and it is hazardous. The death rate is highest among middle aged and elderly individuals. It is seen as risky when it develops beyond the dermis of the skin. This paper deals with a survey on a few computerized analysis procedures for diagnosing melanoma. These procedures extract different parameters, for example, shape, size, surface, shading and different properties of lesions which is utilized for additional exploration. The precise skin affected region which is the skin lesion or area of intrigue will be taken out for automated medical procedure. The ATLAS dataset or PH2 dataset pictures are considered for investigation in the majority of the papers.

[19] discussed that Tumor segmentation required also the identical automatic initialization as regarding the liver. This phase was applied only in order to liver volume, obtained following automatic delineation of lean meats surface: this latter, used to original dataset quantity, was used as a new mask in order to be able to prevent processing overloads and even avoid errors related to be able to arsenic intoxication surrounding tissues delivering similar gray scale droit. In addition, for this particular purpose, the voxels from the intensity range domain had been removed from the segmented liver volume. This alternative allowed the correct id of liver respect to be able to other organs, optimizing the particular calculation resources and growing the tumor segmentation precision. This work has regarding the most part focused consideration around Clustering approaches, particularly k-means what's extra, fluffy c-means grouping measurements. These calculations were signed up with together to concoct one other technique called fluffy k-means bunching calculation, which features a superior outcome mainly because far as time use. The calculations have recently been actualized and tried together with Magnetic Resonance Image (MRI) pictures of Human cerebrum. The proposed strategy provides expanded effectiveness and reduced emphasis when contrasted using different techniques. The characteristics of picture is considered by figuring the skills as far as range of rounds plus the moment which the picture will take to make one concentration. [20] discussed about detection of leukaemia using a small picture handling method that distinguishes between red blood cells and young white cells. Visual examination of minuscule photos by looking at alterations such as surface, calculation, shading, and measurable research of photographs is now the only recognisable proof of blood trouble. One of the leading causes of death in humans is leukaemia. Its success rate and prognosis are largely dependent on the early detection and detection of infection. The goal of this project is to identify and test leukemia-affected cells. Leukemia can be recognised and classified based on the presence of juvenile cells, as well as whether it is persistent or intense. A variety of procedures, including histogram levelling, straight difference extending, and morphological methods such as region opening, region closing, disintegration, and expansion, are used to differentiate juvenile cells. When compared to current procedures, the Proposed Method has produced better results.

G. Enhancing Segmentation Approaches

[21] discussed that Biomedical and anatomical data are made simple to acquire because of progress



accomplished in computerizing picture division. More research and work on it has improved more viability to the extent the subject is concerned. A few techniques are utilized for therapeutic picture division, for example, Clustering strategies, Thresholding technique, Classifier, Region Growing, Deformable Model, Markov Random Model and so forth. This work has for the most part centered consideration around Clustering techniques, particularly k-means what's more, fuzzy c-means grouping calculations. These calculations were joined together to concoct another technique called fuzzy k-c-means bunching calculation, which has a superior outcome as far as time usage. The calculations have been actualized and tried with Magnetic Resonance Image (MRI) pictures of Human cerebrum. The proposed strategy has expanded effectiveness and lessened emphasis when contrasted with different techniques. The nature of picture is assessed by figuring the proficiency as far as number of rounds and the time which the picture takes to make one emphasis. Results have been dissected and recorded. Some different strategies were surveyed and favorable circumstances and hindrances have been expressed as special to each. Terms which need to do with picture division have been characterized nearby with other grouping strategies. [22] discussed about the combination of Graph cut liver segmentation and Fuzzy with MPSO tumor segmentation algorithms. The system determines the elapsed time for the segmentation process. The accuracy of the proposed system is higher than the existing system. The algorithm has been successfully tested in multiple images where it has performed very well, resulting in good segmentation. It has taken high computation time for the graph cut processing algorithm. In future work, we can reduce the computation time and improves segmentation accuracy. [23] discussed that Automatic liver tumor segmentation would bigly influence liver treatment organizing strategy and follow-up assessment, as a result of organization and joining of full picture information. Right now, develop a totally programmed technique for liver tumor division in CT picture. Introductory liver division comprises of applying a functioning form strategy. In the wake of separating liver applying Super pixel division Algorithm for portioning liver tumor proficiently. In the proposed work, we will investigate these procedures so as to improve division of various segments of the CT pictures. The exploratory outcomes indicated that the proposed strategy was exact for liver tumor division.

[24] discussed that Live wire with Active Appearance model (AAM) strategy is called Oriented Active Appearance Model (OAAM). The Geodesic Graph-cut calculation creates much better division results than some other completely programmed strategies distinguished in writing in the expressions of exactness and period preparing. This strategy besides viably consolidates the Dynamic Appearance Model, Live Wire and Graph Cut tips to abuse their integral focal points. It comprises of a couple of fundamental parts: model creating, instatement, and depiction. As to the instatement (acknowledgment) part, a pseudo methodology is typically utilized and the real organs are portioned cut essentially by cut by means of the OAAM strategy. The reason with respect to instatement is to give harsh item confinement in addition to shape imperatives for a last GC technique, which frequently will deliver refined outline. The proposed (Fuzzy K-C-Means) procedure offers extended viability and diminished accentuation when stood out together from various strategies. The estimating of picture is assessed by calculating the ability as much as number of units and the time which generally the image takes for making one accentuation. Some different systems were reviewed in addition to great conditions and burdens have been communicated in light of the fact that extraordinary to each. Words which have to do with photograph division are really portrayed close by with other gathering strategies. [25] discussed that Tumor segmentation required also the identical automatic initialization as regarding the liver. This phase was applied only in order to liver volume, obtained following automatic delineation of lean meats surface: this latter, used to original dataset quantity, was used as a new mask in order to be able to prevent processing overloads and even avoid errors related to be able to arsenic intoxication surrounding tissues delivering similar gray scale droit. In addition, for this particular purpose, the voxels from the intensity range domain had been removed from the segmented liver volume. This alternative allowed the correct id of liver respect to be able to other organs, optimizing the particular calculation resources and growing the tumor segmentation precision. This work has regarding the most part focused consideration around Clustering approaches, particularly k-means what's extra, fuzzy c-means grouping measurements. These calculations were signed up with together to concoct one other technique called fuzzy k-c-means bunching calculation, which features a superior outcome mainly because far as time use. The calculations have recently been actualized and tried together with Magnetic Resonance Image (MRI) pictures of Human cerebrum. The proposed strategy provides expanded effectiveness and reduced emphasis when contrasted using different



techniques. The characteristics of picture is considered by figuring the skills as far as range of rounds plus the moment which the picture will take to make one concentration. [26] discussed that Liver tumor division in restorative pictures has been generally considered as of late, of which the Level set models show an uncommon potential with the advantage of overall optima and functional effectiveness. The Gaussian mixture model (GMM) and Expected Maximization for liver tumor division are introduced. In the early liver division process Level set models are utilized. This proposed strategy uses Gaussian blend models to demonstrate the portioned liver image, and it transforms the division issue into the most significant probability parameter estimation through the use of Expected Maximisation (EM) calculations. The proposed methodology outperformed existing techniques by a significant margin, according to the results of our comparison.

III. CONCLUSION

This review paper brings out a summary of popular image processing techniques in practice for students, faculty members and researchers in medical image processing field. Through Image processing, we do some operations on an image, to get an enhanced image or we try to acquire some useful information from it. They help in manipulating digital images through the use of computers. We Perform Image Restoration, Linear Filtering, Independent Component Analysis, Pixelation, Template Matching, Image Generation Techniques even to image to obtain promisable results. This Review Paper also summarizes some of the enhancement approaches which have impacted image segmentation approaches over these years..

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