

Segmentation of Left Ventricle using local Motion Intensity Clustering

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ABSTRACT: The study of particular form, shape or structure and characteristic of the left ventricle (LV) can be used for the prediction and diagnosis of cardiovascular disorder. Magnetic Resonance Imaging (MRI) has become very powerful to accurately describe the structure and function of heart. The Noise interference and intensity inhomogeneity of MRI snap may be processed by means of the usage of a local intensity Clustering (LIC) version. However, the segmentation of the LV in MRI images nonetheless remains undertaking specially because of its excessive pace movement of heart, blood float and picture noise interference. To process one of these projects, and set of rules for segmenting the LV, primarily based on a local movement depth clustering (LMIC) model is proposed. The LMIC model combines the LIC version with the movement depth data, due to cardiac motion and blood drift. Lucas Kanade (LK) optical go with the flow method used to calculate motion intensity of LV and applied it in the LMIC model as an energy parameter. Because of the thin wall motion depth of the LV place is more potent than different regions the LV can be appropriately segmented by way of this technique. Experimental consequences show that the LMIC model is capable of address the stepped forward LV segmentation accuracy over present strategies.

KEYWORDS: Segmentation, Left ventricle, Local Motion Intensity Clustering.

I. INTRODUCTION

Cardiovascular diseases are the leading cause of death and group of disorders of the heart and blood vessels like coronary heart disease related to the blood vessels supplying to the heart muscle, peripheral arterial disease related to the blood vessels heart disease. Traditionally, lots of the research effort has already been done on the left ventricle (LV). Only some of studies of the right ventricle (RV) have been published and the importance of RV analysis has been neglected [2-3]. The segmentation is used to simplify exchange the illustration of an image into something this is extra significant and easier to analyze. But, segmentation of the ventricle still remains a challenge because of however, segmentation of the ventricle still stays a assignment due to the excessive speed movement of the coronary heart, blood glide and photo noise interference and its variable and irregular shape, and skinny wall and unwell-defined boundaries.

Diagnosis and treatment comply with-up of these pathologies can rely upon numerous cardiac imaging modalities, which include echography, CT (automatic tomography), coronary angiography and cardiac MRI. But MRI is reference modality for the non-invasive evaluation, the ability to modulate tissue contrast in response to several mechanisms and the ability to provide high quality functional and anatomical images in any anatomical orientation, MRI also resources correct data on morphology, muscle perfusion, tissue viability or blood go with the flow, the use of ok protocols. The cardiac contractile characteristic can be quantified or analyzed thru ventricle volumes, masses and ejection fraction (EF), via segmenting the left (LV) and proper (RV) ventricles from MR photos [4-5].

However, a number of those algorithms do not focus enough interest to photo noise interference and intensity inhomogeneity within the MRI snap shots, which further affects at the accuracy of segmentation outcomes. The local depth clustering (LIC) version [7] can address photograph noise and the depth inhomogeneity of MRI pix and does not need earlier anatomical knowledge. Further to cope with the demanding situations of sick-defined borders, new

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statistics related to movement depth we advanced the LIC model and here we propose a local motion intensity clustering (LMIC) model.

Here we advocate a nearby motion depth clustering (LMIC) model. In LMIC the motion intensity, is calculated the use of the Lucas Kanade (LK) optical flow technique [8] is simpler to acquire than the prior understanding of form. Movement intensity of the proper ventricular vicinity is more potent than that of different regions because of the movement of the coronary heart and the blood within it. The LMIC model introduces motion intensity into the LIC version as a brand new picture electricity function and the trouble of the vulnerable boundary can be addressed by making complete use of the motion depth statistics. Manual interaction with the LMIC model is easy and the user best wishes to pick one factor to find the LV. a few critical parameters in comparing the RV feature, inclusive of ejection fraction (EF) and cardiac output are computed based at the endocardium. Consequently, in this observe we propose the segmentation algorithm of the endocardium.

II. RELATED WORK

However, most of these algorithms do not pay enough attention to image noise interference and intensity inhomogeneity in the MRI images, which certainly have an influence on the accuracy of segmentation results. To avoid such complicated user interaction the current methodology is efficient to use. These shape based approaches need prior anatomical information which is studied from finite training set.

The region-based totally segmentation set of rules is generally used for homogeneity of the photo intensities. As opposed to this vicinity based totally approach often fails to offer correct segmentation results because of the intensity inhomogeneity. Within the method of stage set, this criterion defines energy in terms of the level set functions partition of the image area and a bias subject that money owed for the depth inhomogeneity of the image. therefore, with the aid of minimizing this power, our technique is able to concurrently segment the image and estimate the bias discipline, and the expected bias area may be used for intensity inhomogeneity correction (or bias correction) [7]. For complex segmentation project, prior knowledge is needed. As a result proposed an authentic categorization for cardiac segmentation methods, with a unique emphasis on what stage of external statistics is needed (weak or robust) and how it is used to constrain segmentation. Here quick-axis view might be used to study computerized and semi-automated segmentation strategies of cine MR pictures of the cardiac ventricles, the maximum commonplace imaging plane to evaluate the cardiac function. Fuzziness may be determined on some parts of the pictures, usually because of blood go with the flow and partial extent consequences, made extra critical by way of circumstance of respiratory movement. In phrases of shape, the ventricle varies in sufferers, over the years and over the lengthy axis and because of this variability it needs to account for segmentation algorithms. Segmentation based totally on no or susceptible earlier, that includes image primarily based and pixel classification based totally methods, as well as deformable fashions. Segmentation primarily based on sturdy previous, that consist of form previous primarily based deformable fashions, energetic shape and appearance fashions, and atlas based methods [9]. Deformable models are used for delineating the region boundaries, atlas guided models uses the anatomy to form the atlas or LUT and the atlases are used as reference frame for segmentation of new image, threshold base models are used in separating pixels dependent on intensity value, Region based approach is based on the principle of homogeneity of pixels with similar properties are clustered together, Statistical models are used to match predefined geometry of shape to extracted image.

III. PROPOSED METHODOLOGY

Proposed system requires cardiac MRI images, LIC model and LMIC model. The required cardiac MR data contains Test images from database MRI_DB. Each test data set consists of 18 patients. Only the Training set includes ground truth manual segmentations. In case of MR images contiguous cine short axis slices from the base to the apex of the ventricles and per cardiac cycle are taken. Cardiac examinations were performed at 1.5T using an MRI scanner. The proposed method was evaluated by using the Test datasets. Fig. 1 shows the basic overview of the system. After collection of MR data, the dataset is segmented with the help of LIC and LMIC models. Hence to improve the accuracy, methods which are focusing on the noise interference and intensity inhomogeneity produced because of hearts motion and blood flow are implemented with clustering methods.

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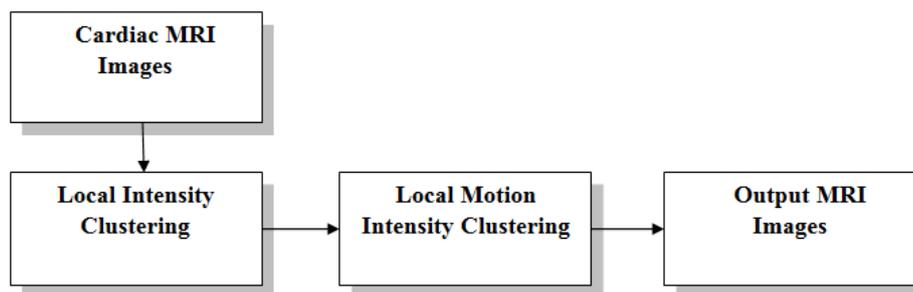


Fig.1. Overview of System

The Local Intensity Clustering Model is mainly used to deal with noise interference and intensity inhomogeneity produced in the cardiac MRI image. The LIC model is the first step in segmentation and it used instead of other segmentation method because it does not need prior shape based information of images. To address ill-defined borders and to get the information of motion intensity LIC further converted in Local Motion Intensity Clustering (LMIC). To calculate the motion intensity the optical flow method of Lucas Kanade (LK) is used. Finally after segmentation important parameter of RV segmentation like Ejection Fraction (EF) is computed with Hausdroff Distance (HD) and Dice Metric (DM).

A. Local Intensity Clustering Model

The Local Intensity Clustering Model (LIC) is mainly used to deal with noise interference and intensity inhomogeneity produced in the cardiac MRI image because it does not need prior shape based information of images. Due to this it will be used to address the challenges of ill-defined borders and the information related to motion instead of shape is improved. Maximum widely used area based totally picture segmentation set of rules is based at the homogeneity of photo intensities in the particular area of interest, which frequently fail to offer correct segmentation end result due to intensity inhomogeneity within the segmentation.

Furthermore, intensity inhomogeneities often result in overlap between the distributions of the intensities in the areas. Consequently, it isn't viable to section these regions immediately primarily based at the pixel intensities. Local intensities, that can effectively exploited in the method of our technique for image segmentation with simultaneous estimation of the bias subject Field. Local intensities are referred as local intensity clustering property. This [7] will allow using standard K-means clustering to classify the local intensities on the basis of this clustering criterion function.

In level set formation this clustering criterion defines energy in terms of level set function which is used to represents the partitions of the image area and bias area that accounts for depth inhomogeneity of photograph. Therefore with the aid of minimizing the energy, technique is able to segment the picture and estimate the bias subject and the envisioned values are used for the correction of inhomogeneity [7].

B. Local Motion Intensity Clustering Model

The LIC model handles the image noise and intensity inhomogeneity with by minimizing energy in level set formation in particular region of interest [7]. Therefore, LIC model is unable to clearly distinguish the boundary between LV and the surrounding tissues. However, the motion intensity of the LV region is different from the surrounding areas due to cardiac motion and blood flow. To estimate motion intensity optical flow method is used here the Lukas Kanade (LK) optical flow method is used.

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Motion estimation is used to compute the independent motion at each pixel and to determine the motion vector that describes transformation from one form of image to another. The motion intensity image which blurred image and in that difficult to identify the boundary and shape. In LIC model clustering criteria is minimized to make the cluster centre similar to image to get the same result and classification results are corrected by motion intensity image. Fig.2. shows that Overview of LMIC Model.

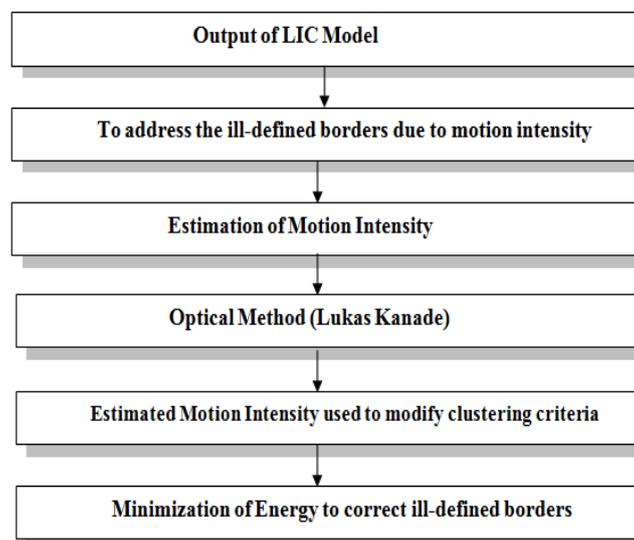


Fig.2. Overview of LMIC Model

The modified clustering criterion function is, used to avoid over segmentation and limit the inaccurate motion intensity data. Further this clustering criterion function of motion intensity image can be formulated in level set function [7] to minimize the energy function. Due to this energy minimization better result for motion intensities can be obtained. Therefore LMIC address ill-defined borders and to get the information of motion intensity effectively.

IV. EXPERIMENTAL RESULTS

The analysis of proposed methodology can be done using the accuracy of segmentation result is compared to gold standard by using two criteria.

Dice Metric (DM) is used to measures the similarity of the two regions by computing the ratio of the overlap as the sum of manual and automatic segmentations. DM varies between 0 and 1, where 0 and 1 means total mismatch and perfect match, respectively.

Hausdorff Distance (HD) is used to computes the average value of maximal discrepancy from point to curve between the manual and automatic contours to measure the distance between the two contours. The units of HD are mm. The lower the HD, the more effective the method is.

Therefore, for proposed methodology the Fig.3. Shows the output after segmentation of patient's cardiac images which gives the effective output for left ventricle segmentation and here the Dice Metric is calculated for every patient in database.

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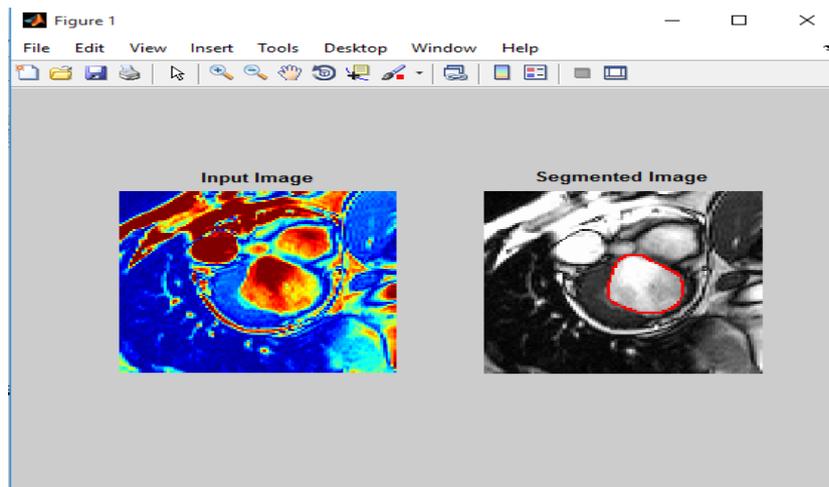


Fig.3. Patients cardiac Segmented Image from LMIC Model

Table.1: DM values for patients cardiac images for particular systole number

Paitent Number	Systole Number	Dice Metric(DM)
Paitent1	7	0.9202
Paitent2	8	0.8793
Paitent3	5	0.8090
Paitent4	6	0.9229
Paitent5	9	0.8598
Paitent6	5	0.9165
Paitent7	5	0.9146
Paitent8	9	0.9311
Paitent9	8	0.8164
Paitent10	7	0.9100

Table.1 shows DM values for patient's cardiac images for particular systole number and the DM values obtained gives better result. The LMIC model has some advantages that it does not need any manual segmentation of training dataset which can be help to save the time. This model does not require any shape based information and require only one point to locate the LV which helps to reduce the complexity of semi automated algorithm. The LIC and LMIC both models are not able to segment apical images due to gray scale information and low motion intensity give unsatisfactory result.

V. CONCLUSION

In this paper we proposed model for LV Segmentation in cardiac MR short-axis images. Most of the algorithms are based on Atlas data or geometric properties use shape related information for segmentation. However, it is quite difficult to obtain the shape information. Instead of this motion intensity information is easy and not requires training. Experimental result shows that the ill-defined borders for segmentation can be effectively addressed by using the LMIC model. Quantitative analysis shows that the segmentation accuracy of our algorithm is better than other existing methods and it can give more precise value of EF.

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