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False Data Detection in CT Image

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Abstract — Artifact is an disturbances or errors or object that hides the data. An image is the collection of pixels with different intensity. The intensity of the pixel can be expressed as I(x,y), where I is the intensity value of the pixel , which is positioned or located through x-axis and y-axis. An image contains several sub-images which can be grouped through the amplitude or intensity of the pixel. The sub-images are called as regions and the sub-images alone can be processed without disturbing other regions which is meant as Region-Of-Interest. In Computed Tomography images used in medical area, there are several chances for the occurrences of false-image or false region called as artifact due to several reasons during scanning. To reduce the artifact the false region has to be segmented. In the segmentation, the artifact regions alone have to be detected and it has to be removed [3]. The removed artifact area is nothing but a missing data area in an image. But the removed area contains unwanted data that disturbs the original data. In case of medical images these unwanted or false data may lead to false diagnosis or it may lead the physician to miss some diagnosis which may be hidden inside the false or artifact regions. So the removal of these artifact regions and to find the missing data in those artifact regions is one of the most important task in medical imaging. In this paper, the artifact regions from the artifact image has been detected and pointed out in the image.

Keywords: *Artifact, Region of Interest (ROI), Cluster, Intensity, Segmentation, Image Processing.*

I. INTRODUCTION

An image is a two-dimensional pixel that records the visual perception. The picture of an object or person shown in front of the lenses gets captured and depicts in the computer as an image that gives similar appearance as in the real. The process made in the image using some statistical methods is meant as an image processing, in which, the input is the image captured through the lens and the output is the image that is produced by taking the input image which depicts the appearance of the real image, gets processed or made some changes according to the needs using some statistical methods. The processing can either be made for the whole image or to the particular region of an image. To process the region-of-interest, the region alone has to be segmented. Image segmentation is the process of dividing the image into several regions using some constraints. Segmentation can be referred as grouping the pixels, in which each pixels within the group has high similarity and the pixels outside the group has high dis-similarities. In image segmentation, each pixel will be assigned a label so that the pixel with same label shares similar characteristics or similar features.In Computed Tomography images used in medical area, there are several chances for the occurrences of false-image or false region called as artifact due to several reasons during scanning. To reduce the artifact the false region has to be segmented.In this paper, for segmentation, regions-based image segmentation has been performed [4]. After segmenting the image, the artifactregions alone has to be detected. The detected artifactregions then have to be detached from the original CT image. Finally artifact free CT images will be produced, but in that detached regions the original data will be missing. So further, those missing data has to be found out to produce complete artifact free image.

II. IMAGES EGMENTATION

Image segmentation is the process of dividing an image into multiple regions so that the region needed to be further processed alone will be taken for the image processing.. Image segmentation is used to identify a particular object or other related information in digital images. Segmentation partitions an image into separateregions, in which each region contains each pixel with similar attributes. Image segmentation is mainly needed to group pixels in homogeneous regions. To group the pixels in homogeneous regions common features has to be extracted from the image. Common features can be represented by the space of color, texture and gray levels, each representing similarities between pixel of a regions. Segmentation is used to either simplify the image or change the representation of an image into meaningful form of an image that might be easier to analyze. Image segmentation is mainly used to locate objects and boundaries in images. The result of image segmentation is the group of pixels in the set of regions and all the regions together forms an entire image or a set of contours extracted from the image. According to some characteristic or some property, such as color, intensity, or texture, the pixel gets separated as regions. The segmentation is based on the measurements taken from the image that might be grey-level, color, texture, depth or motion. Using three classes, the image segmentation can be grouped. Those three classes are:Clustering, edge detection, regions growing. There are several image segmentation algorithms such as k-means which are often used in image segmentation [1]. In this paper clustering is made based on the intensity values of the pixel.

III. AMPLITUDEBASED CLUSTERING

Clustering is the processes of grouping several sub-images from the input image using image segmentation. Image segmentation partitions the image into intersect regionsthrough the characteristics of the image such as texture of the image or the intensity value of the image.If the domain of the image is given byΩ, the segmentation problem is to determine the sets$S_{k=}$$\Omega$, whose union is the entire domain Ω, where,
$\Omega = {}^{n}\cup_{k=1} S_k$, where union of all ‘K’ segments gives the original input image.

In computed tomography scan image there might be chances for the occurrences of artifact. The most commonly occurred artifact in CT scan image is the metal artifact. Metal artifact is the artifact that occurs when the X-ray beam is passed over the metal region in the scanning area , then there occurs the streak or star artifact which blurs the image and makes it difficult to diagnose. So to either remove the artifact or to reduce the artifact , initially the regions affected by the metal artifact has to be segmented. In this paper , the segmentation is made using the intensity value of each and every pixel in which the intensity value is taken as the feature to segment the image.

$$SI = \sum_{i=0}^{m} \sum_{j=0}^{n} \begin{cases} \text{if, } k = 1, I_1 \geq a_{i,j} \leq I_2 & 2 \\ , I_2 > a_{i,j} \leq I_3 & \\ 3, I_3 > a_{i,j} \leq I_4 & \\ 4, I_4 > a_{i,j} \leq I_5 & \\ 5, a_{i,j} > I_5 & \\ = 0, \text{otherwise.} & \end{cases}$$

Where SI is the image segments which is segmented by using m, which is the number of rows and n which is the number of columns. In this paper, the image segmentation is denoted as SI(m,n). Segments or clusters which are separated by the value of the intensity are denoted by 'K'. The value of 'K', that is, the number of groups to be segmented in an image is chosen manually. Pixels which shares similar intensity will be grouped as a separate cluster. So to group the cluster certain constraints has to be used. In this paper the first cluster is separated using the first constraint, **$,I_1 \geq a_{i,j} \leq I_2$.** So the value of the pixel intensity that lies between I_1 and $I_2$are grouped as the separate region as the first cluster.Second segment is formed by using the second constraint, **$,I_2 \geq a_{i,j} \leq I_3$** . So the value of the pixel intensity that lies between $I_2$and $I_3$are grouped as the separate region as the second cluster. The next cluster is grouped in the same way as, the pixel intensity values which lies between $I_3$and I_4 , that is the constraint , **$I_3 > a_{i,j} \leq I_4$**are grouped as a third cluster.Fourth cluster is separated using the fourth constraint, **$,I_4 \geq a_{i,j} \leq I_5$.** So the value of the pixel intensity that lies between $I_4$and $I_5$are grouped as the separate region as the fourth cluster. Same as the fifth cluster is grouped with the pixel value which satisfies the fifth constraints **$,a_{i,j} > I_5$.**Here repeated execution also gives the same result which is not in the case of K-means clustering where, when the centroid value gets changed, then the order of the result gets changed [5,8,9,11].

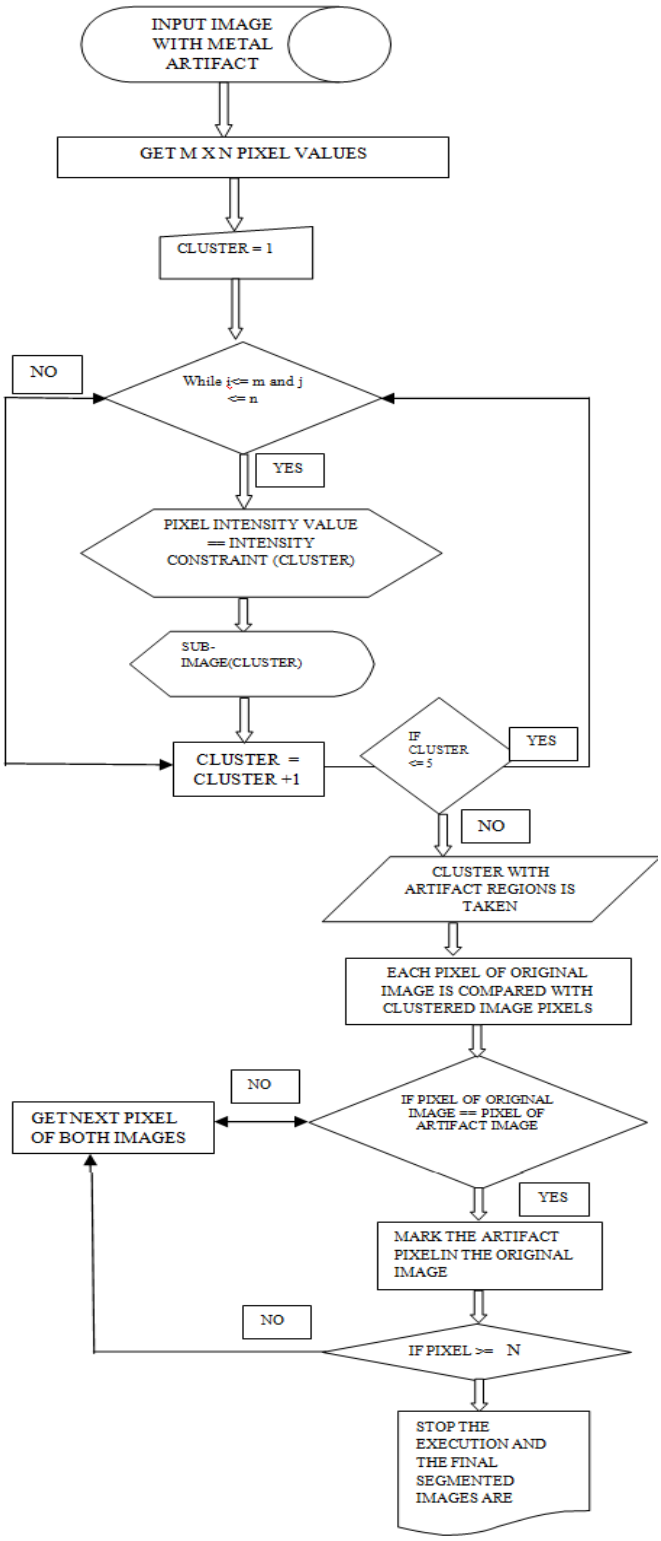
A. Processing Steps

- The input image is the image which contains the metal artifact is taken for image processing.
- As the image is two-dimensional image, the size of the image m x n has to be known.
- Knowing the size of the image , the unique intensity values of each and every pixel in the image has to be analyzed.
- Number of regions or group or clusters has to be given manually.
- Using the first intensity constraint check the whole m x n pixels and cluster the first region.
- Repeat the process 'K' number of times using its corresponding constraint so that 'K' clustered image will be obtained as an output.

IV. DETECTING THE ARTIFACT AREA

To detect the artefact area, initially the segmentation has been made above using some intensity constraints. After segmentation is completed, the segment containing artifact area alone has to be taken. In that artifact image the artifactalone has to be detected from the original image. To detect the artifact area from the original image, the segmented artefact image has to be split in to half. Splitting has to be made because , otherwise, some non-artifact regions may also be detected as artefact region. In that split image the artifact affected block has to be taken and both the segmented artifact image and the original image has to be compared. The comparison has to be performed for each and every pixel in the original image. During comparison, when the pixel of the segmented artifact image matches the original image pixel then that pixel has to be removed from the original image. This process continues until all the pixel of the image has been checked. So , after all the pixel of the original image has been checked, all pixel of the segmented artifact image might have been matched with the original image. So all the artifact pixel has to be marked.Finally, the artifactregions that is, the streaks produced by the metal area alone will be detected and marked in the original image. The histogram is a graph showing the number of pixel in an image at each different intensity value found in that image. Histogram of this CT image plots the number of pixel for each tonal value [7].

A. Overview



B. Simulation Results

Figure 1. Input image with metal artefact

Figure 2: Cluster 1.

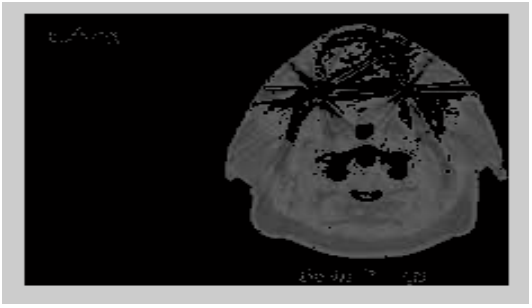


Figure 3: Cluster 2.

Figure 4: Cluster 3.

Figure 5: Cluster 4.

Figure 6: Cluster 5.

Figure 7:Artifact region split from the clustered image.

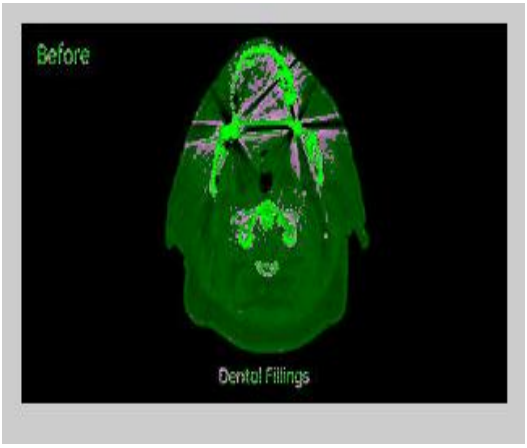


Figure 8: False data detected image.

C. Histogram

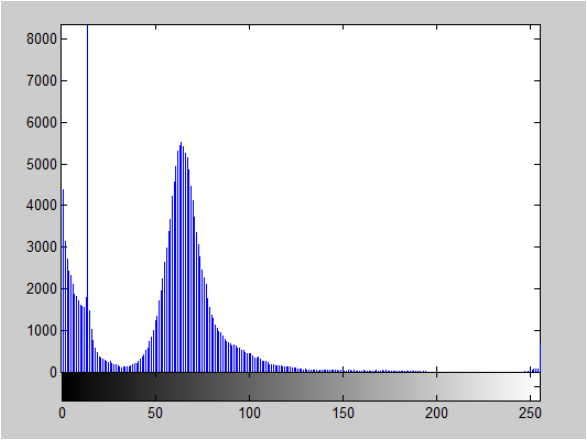


Figure 9: Histogram of originalartifact image.

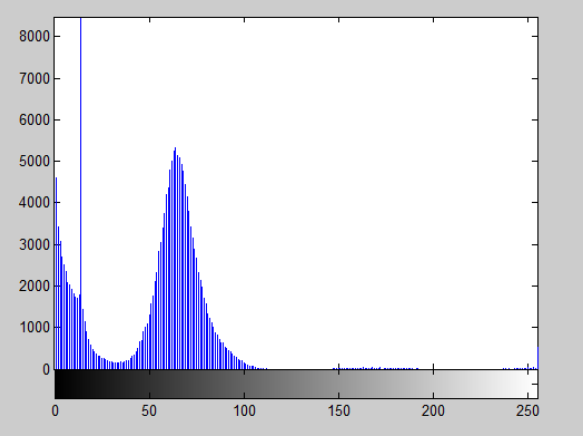


Figure 10: Histogram of artifactdetected CT image.

D. *Table*

Table 1: Resultant artifact detected Regionscolour and its description.

Colour	Description
Dark green	CT image without artifact
Light green	Metallic cap
Pink	Artifact region

V. DESCRIPTION

In the above images , the original CT image is an dental image with cap on the teeth. During CT scan, when the X-ray beam passed upon the metal cap , there appeared streak artifact. The artifact image has been segmented into several clusters. In those clustered images the artifact containing cluster alone has been taken for further process. That clustered image has been split in the basis that the streak artifact affected region alone will be appeared as a separate block. So the comparing original image and artifact block, the artifact region alone is marked. In this above result, pink color denotes artifacts, bright light green denotes metal cap and other are actual CT image.

VI. FUTURE WORK

As the metal artifactregions has been segmented and the artifactregions has been detected and marked in the CT image, now the detected regions in the image will be the unknown data or missing data. So, themarked artefact regions has to be taken into account and using some statistical methods the missing data has to be found out and filled to produce artifact free CT image.

CONCLUSION

Image with metal artefact is taken for the processing. Artifact, is an false data that is present in the image. That artefact present in the image has to be either removed or else reduced using some statistical methods. So, the artefact, that is, the false data region alone has to be segmented. The false data region is the region of interest. From the clustered image, the artifactregion has been retracted. Then the retracted artifactregions has been marked or contoured in the original artifact CT image. In future, the detected artifactregions have to be filled with the statistically estimated pixel to generate an original CT image without any artifact.

References

[1] J.A Hartigan “Clustering Algorithms”, New York Wiley 1975.

[2] S. P. Lloyd, ―”Least squares quantization in PCM,” IEEE Trans. Inf.Theory, vol. IT-28, no. 2, pp. 129–136, Mar.1982.

[3] J. Besag, “On the statistical analysis of dirty pictures,”J. Roy.Statist.Soc. B, vol. 48, pp. 259–302, 1986.

[4] S. Zhu and A. Yuille, “Regions competition: Unifying snakes, regions growing, and Bayes/MDL for multiband image segmentation,” IEEE Trans. Pattern Anal. Mach.Intell., vol. 18, no. 9, pp. 884–900, Sep.1996.

[5] S.MaryPraveena, Dr.IlaVennila,” Optimization Fusion Approach for Image Segmentation Using K-Means Algorithm”, International Journal of Computer Applications (0975 – 8887)Volume 2 – No.7, June 2010.

[6] A.M Uso,F.Pla,P.GSevila,” Unsupervised Image Segmentation using a Heirarchical Clustering Selection Process”.Structural Syntactic and Statistical Pattern Recognition Vol 4109,pp.799-807,2006.

[7] A.Z Arifin,A.Asano,”Image Segmentation by histogram thresholding using hierarchical cluster analysis”Pattern Recognition Letters,Vol.27,no.13,pp. 1515-1521,2006.

[8] J.L Marroquin,F. Girosi,,”Some Extentions of the K-Means Algorithm For Image Segmentation and Pattern Classification”, Technical Report,MIT Artificial Intelligence Laborartory,1993. International Journal of Information Technology (IJIT), Volume – 1, Issue – 1, August 2012 ISSN 2279 – 008X International Academic and Industrial Research Solutions (IAIRS) Page 17 .

[9] M.Luo, Y.F.Ma ,H.J. Zhang,”ASpecial Constrained K-Means approach to Image Segmentation”,proc. The 2003 Joint Conference of Fourth International Conference on Informations Communications and Signal Processing and the Fourth Pacific Rim Conference on Multimedia,Vol.2,pp.738-742,2003.

[10] M.Betke, N.C Makris, ”Fast Object Recognition in Noisy Images Using Simulated Annealing”, Intl.Conf on Computer Vision,pp.523,Jun.20-23,1995.

[11] T. Kanungo, D. M. Mount, N. Netanyahu, C. Piatko, R. Silverman, & A. Y.Wu (2002) “An efficient k-means clustering algorithm: Analysis and implementation” Proc. IEEE Conf. Computer Vision and Pattern Recognition, pp.881-892.

[12] J. Shi and J. Malik, ―Normalized cuts and image segmentation,‖ IEEE Trans. Pattern Anal.Mach. Intell., vol. 22, no. 8, pp. 888–905, Aug.2000.