Journal of AL-Qadisiyah for computer science and mathematics Vol.11 No.2 Year 2019
ISSN (Print): 2074 – 0204 ISSN (Online): 2521 – 3504

Anemia Blood Cell localization Using Modified K- Means Algorithm

Loay E.George[1] Huda M.Rada[2] Mela.G.Abdul-Haleem[3]

University of Baghdad , College of Science , Department of Computer Science

Loayedwar57@scbaghdad.edu.iq[1]

Huda.Rada@sc.uobaghdad.edu.iq[2]

a.mayla@yahoo.com[3]

Recived : 23\12\2018 **Revised : 13 \ 1 \ 2019** **Accepted : 5\2\2019**

Available online : 17 /4/2019

Abstract:

In this project segmentation of image strategy based on K-means clustering calculation is displayed. The proposed strategy utilizes clustering to allocate the dominant colors in medical tissue images for purpose of segmentation with high performance. The initialization step of the system is the selection of suitable color model used for segmentation. A set of inter and intra-class measures are used to evaluate the degree of model suitability. The method is able to make segmentation at different classification resolutions. For purpose of performance evaluation the comes about of the proposed strategy, standard K-Means and as of late altered K-Means are compared. The exploratory comes about appeared that the proposed strategy gives superior result.

***Keyword*:** *K-Means clustering algorithm, Modify K_ Means, Segmentation, Medical Images*

I. Introduction

Segmentation of image and localization are considered essential steps in many applications of medical imaging for computerizing or encouraging the assurance of anatomical structures. Since all ensuing translation assignments, such as include extraction, protest acknowledgment, and classification depend to a great extent on the quality of the sectioned yield, compelling division has gotten to be a basic step for robotized examination in restorative imaging. Division and localization of anatomical structures is troublesome in hone, particularly when managing with inalienably boisterous, low spatial determination pictures such as those created utilizing useful imaging (J.M.Spiller and T. Marwala).

Clustering is a process which separates a given dataset into homogeneous groups based on specific requirements. The objects that are similar to each other are kept in the same group. While, the objects are which are dissimilar are kept in different groups. Clustering is considered a powerful tool in various fields including image processing, mobile communication, computational biology, medicine and economics. Image segmentation can be used as an effective method for image classification (Balas and Seldev, 2012).

In this paper, we describe an approach for anemia blood cell localization that work with following steps (1) compute histogram of the RGB color spaces, (2) modified k-mean algorithm to draw image in 12,4 color respectively, (3) normalize image using mean and standard deviation, (4) binarization image, (5) apply seed filling algorithm to fill objects, (6) segmented original image using segmented color equation to use for matching and localization.

In section II a brief review for some of related work in medical image analysis and localization. In section III, an illustration for the localization model is presented. Experiment results are reported in section IV. Some conclusions are outline in V.

II. Related Work

Nameirakpam Dhanachandra and Yambem Jina Chanu (Nameirakpam and Yambem, 2017) in this inquire about work creators briefly portrayed a few of the clustering procedures and examined a few of the later works by analysts on these methods like (Clustering procedures, K-means, Fuzzy c-means, Subtractive, Desire Maximization, and DBSCAN).

Sandeep and Simarpreet (Sandeep, Simarpreet, 2017) proposed Strategy to improve the K-mean clustering algorithm. With the assistance of this strategy proficiency, exactness, execution and computational time are moved forward. In this investigate work Normalization is being connected which is able decrease the complexity of huge dataset. Normalized comes about make the information appropriate for particular examination and forecast to be performed.

Nameirakpam Dhanachand, Khumanthem Manglem and Yambem Jina Chanu (Nameirakpam et al.,2015) proposed strategy to segmented image by utilizing k-clustering calculation, and subtractive cluster to create the starting centroid and at the same time we utilized partial contrast stretching to improve the quality of the original image and median filter to make strides segmented image. In this investigate work we utilized RMSE and PSNR measurements to check and watch the image segmentation quality.

Farah H. A. Jabar, Waidah Ismail, Rosalina A.Salam, Rosline Hassan (Farah H. A. Jabar et al.,2015) In this investigate work we utilized three clustering procedures which are (Fluffy C-Means (FCM), classic K-Means (CKM) and Enhanced K-

Means (EKM) at that point we performed filtering strategies which are Mean shift Filtering(MSF) and seeded region Growing (SRG). Test comes about appears way better execution of segmentation images utilizing the proposed Improved K-Means algorithm.

Masood,saleha;Sharif,Muhammad;Masood,Afifa;Yamin,Mussarat,Raza,Mudassar(Masood,saleha et.al.,2015) in this paper diverse approaches of Medical image segmentation will be classified at the side their sub areas and sub strategies. Recent strategies proposed in each category will too be talked about taken after by a comparison of these strategies.

Monika Mogra, Arun Bansel and Vivek Srivastava (Monika et al., 2014) proposed an versatile approach for extricating, identifying and checking the WBCs in microscoping blood test images. In this investigate work we utilized two distinctive approaches to perform their task one is k-means clustering procedure and second is Hough Transform.

Ms.Chinki Chandhok, Mrs.Soni Chaturvedi and Dr.A.A Khurshid (Ms.Chinki et al., 2012) proposed a color-based division strategy that employments K-means clustering strategy. The accurate segmentation results were obtained by using standard K-Means algorithm only when applied to images with homogeneous regions for texture and color because no nearby limitations are connected to force spatial coherence. They try to merged clustered blocks to a specific number of regions after clustered based on their color and spatial features are accomplished.

Napoleon, M.SivaSubramanian, M.Praneesh and S.Sathya (Napoléon et al., 2012) were comparing SOM (Self-Organization Map) Based Fuzzy C-Means clustering algorithm to taken different types of Remote Sensing data to test the performance. We compare the quality measures standard deviation, variance and also we can detect the images based on various Edge Detection techniques for efficient segmentation.

III. The Proposed Localization For Anemia Blood Cell Model

The general structure of the proposed localization for Anemia Blood Cell Model is shown in Fig. (1). It consists of six major stages: (i) Compute Histogram of RGB color spaces, (ii) Apply Modified K-mean algorithm to clustering image into 12 and 4 color spaces respectively, (iii) Normalize image by using mean and standard deviation, (iv) Binariztion, (v) Fill objects using seed function, (vi) Segmented original image using segmented color equation to use for matching and localization.

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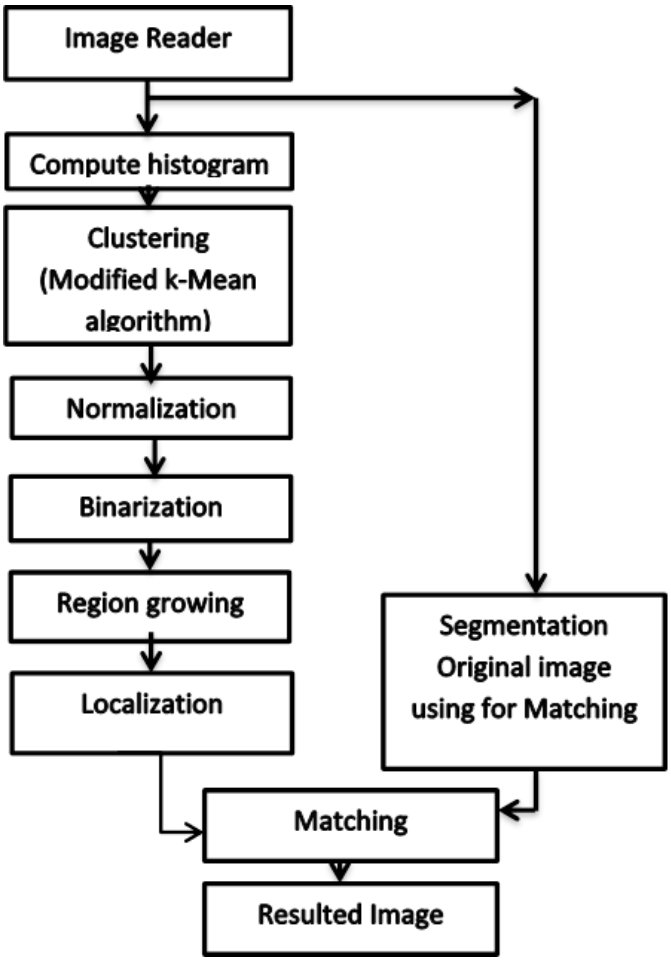

Figure (1) Proposed Model

A. Compute Histogram

- **Color Model**

One of the additive color models is RGB. In this model there are three colors combined to reproduce a wide array of colors. There are some purposes in which RGB color model is used **(**P.Tamije and S.Sam 2014).

Colors in RGB model can be represented as a tuple of three base colors. For example, according to RGB (Red, Green, Blue), dark color is spoken to by the tuple (0, 0, 0) and the white color is spoken to by (255,255,255). The reason of a color show is to encourage the detail of colors in a certain way and common standard [histogram and color model]. Models of colors adds themselves to (in principle) increasingly representations of color, especially in digital representations, like digital electronic display or digital printing.

- **Histogram of color**

The histogram of color is a procedure for report the contents of the colors in the image, it calculate the number of each color appearances in the image.

B. K-means Clustering Algorithm

The K-Means calculation, to begin with created four decades prior, is one of the foremost prevalent Centre-based calculations that endeavors to discover K clusters which minimize the mean squared quantization error (MSQE). The algorithm tries to find K models (centroids) all through a data set in such a way these K models donate best representation to the data (Monika et al 2014). The K-Means calculation is summarized through the taking after steps:

1. Initialization process
   a) Determine the number of models (K).
   b) Appoint a model (a vector of amount that's the data of the same dimensionality for each cluster.
2. Allocate each point of data to the closest model. The point of data we have identified is now a member of the defined group.
3. Compute the modern area for each initial demonstrate (by checking the mean of all Individuals of that class).
4. Screen modern locales of model. In case these values are not essentially diverse over their number of cycles at that point exit the algorithm. In case they are essentially different, return back to Step 2.

The most issue of the K-Means algorithm is its reliance on the prototypes initialization. The false

chosen of the initial prototypes leads to run the probability of convergence to the local least instead of the global least. In this way starting models can have a significant impact on K-Means. The K-Means work can be written as follows:

$$JKm = \sum_{i=1}^{N} min_{j=1}^{K} \|xi - mj\|\text{^}2 \ldots\ldots (1)$$

- **Modified K-Means Clustering Algorithm**

A characteristic expansion of the K-Means problem permits us to utilize another strategy, specifically, a set of adjust associated with the data points. These might as well represent importance scale, a recurrence number, or a few other data. The aim is that to sort data point Descending order and select first (twelfth, fourth) importance data points respectively, Observe the new prototype positions and then relegate each data point to the closest model. The point of data we have recognized is presently a part of the defined group. This gives rise to the execution evaluation of the proposed strategy.

C. Normalization

The process of eliminating the variations in image (such as noise, occlusion, or illumination) caused by conditions of image acquisition is called normalization. The image variations described above severely interfere with object recognition task. Normalization aims to obtain a standard image without any artifacts related to specific conditions in which a particular image was taken (i.e., the image must be free from noise and has neutral illumination). Image normalization is used to facilitate human object perception (for example, to assist recognition) and to standardize the escalated values in an image by altering the run of gray-level values so that it lies inside a wanted range of value (S.C.Ellerbusch 2008).

Hong *et al.* (Hong *et al.* 1998) proposed the taking after algorithm. Let N (i, j) indicate the normalized gray-level value at pixel (i, j). The normalized image is characterized as follow:

$$N(i,j) = \begin{cases} \mu 0 + \sqrt{\frac{VAR0(V(i,j)-\mu e)^2}{VAR}}, if\ V(i,j) > \mu e \ldots (2) \\ \mu 0 - \sqrt{\frac{VAR0(V(i,j)-\mu e)^2}{VAR}}, otherwise \ldots\ldots (3) \end{cases}$$

Where $\mu 0$ and $VAR0$ are the required mean and variance values, individually.

Although the main reason of the normalization is to decrease the varieties in gray – level values, the algorithm alters the pixel levels utilizing as it were the statistical parameters μe and VAR (Z.Shi, and V. Govindaraju 2006).

D. Binarization

The method of dividing a digital image into different fragments (sets of pixels) is image segmentation. The objective of division is to rearrange the representation of an image into more significant one and simpler to analyze. Image division is regularly utilized to determine the location of objects and boundaries (lines, curves, etc.) in images. The best strategy of image division is thresholding which is used to create binary images from a gray scale image.

$$G_B(x,y) = \begin{cases} 1, if\ \ G(x,y) > T & \ldots..(4) \\ 0, if\ \ G(x,y) \le T & \ldots..(5) \end{cases}$$

G(x, y) represents the concentrated value of pixel at (x, y) location within the grey image G, where, $G\epsilon\ R$. G_B represents the obtained segmentation result such that$G_B \epsilon R^{\geq 0}$. If G_B(x, y) = 1, at that point pixel location (x, y) within the bimodal image G is classified as a frontal area pixel, something else it is classified as a foundation pixel (Aroop Mukherjee and Soumen Kanrar, 2010).

E. Region Growing Algorithm

In thresholding (binarization) and normalization approach every pixel is treated independently. However, region growing approach checks connectivity among pixels, in order to decide whether these pixels belong to same region (object) or not. Mainly these algorithms use predefined similarity criteria to group pixel in to large region, known as homogeneity criteria. It starts from randomly selecting a single pixel (seed pixel) and region is grown around it, until resulting region satisfy a homogeneity criteria.

Local color similarity and global spatial cohesion combine used as criteria of homogeneity to aggregate the pixels [Jagmeet Singh and Lovnish Bansal, 2014].

F. Segmentation Original Image Using For Matching:

Image segmentation is the foremost critical portion of image preparing of medical images. It may be a strategy for extricating the region of interest (ROI) through an programmed or semi-automatic handle. In medical investigate, division can be utilized in separating diverse tissues from each other, through extricating and classifying features. One of the endeavors is classifying image pixels into anatomical locales which may be valuable in extricating bones, muscles, and blood vessels.

A wide variety of division procedures have been proposed; in any case, there's no one standard division procedure that can produce palatable comes about for all imaging applications.

The definition of the objective of division changes concurring to the goal of the study and the type of image information. Diverse suspicions around the nature of the analyzed images lead to the utilize of distinctive algorithms (Kantilla P. Rane et al., 2014).

Matching is another approach to division that can be utilized to find known objects within the image, to explore for particular object, etc. For the most part talking, one image can be used to extricate objects or patterns, and coordinated image is utilized to explore for the same (or comparative) patterns on the remaining images. The match approach which depends on a few compatibility criteria that depend on object properties and object relationships is the best.

Matched pattern can be exceptionally small, or they can be representing entire question of interest. Whereas matching is frequently based on specifically comparing gray-level properties of image sub-regions, it can be similarly well performed utilizing image –derived features or higher- level descriptors. Coordinate based division would be very simple in case a duplicate the same as original of the design might be expect intrigued within the prepared image; while, a few portion of the design is ordinarily corrupted in real image by noise, geometric mutilation, occlusion, etc. Hence, it isn't possible to explore for an outright match, and a explore for locations of greatest match is more fitting (Milan Sonka et al., 2008). Figure (2) shows

the result of applying the segmented color equation on original image.

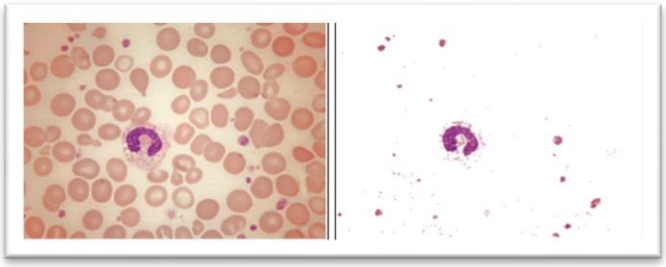

Figure (2):
(a) Original image
(b) Result image after applying segmented color equation

IV. The Results of the Proposed Localization for Anemia Blood Cell Model

The proposed algorithm is applied on tested Anemia microscopic blood smear images. The evaluation was made in terms of statistical measures Localization and Matching. The evaluation of the results of image matching for localization is performed by using object error criterion MAE (mean absolute error) as showing in the following equation: (S.C.Ellerbusch, 2008).

$$MAE = \frac{1}{n}\sum_{i=1}^{n}|xi - x| \quad \ldots. (6)$$

Where:

• n = the number of errors.

• Σ = summation image.

• |xi – x| = the outright errors.

It has digital images of microscopic slides blood disease anemia treatment has been used two types of pigments Al microscope experiments were carried out on the model of the 25 samples. It is taken. In conformity process it has been taken, including benchmarks for calculating the percentages and ratios identical percentages of ratios mismatches wrong ... on digital images drawn by 12 color and 4 colors sequentially the results have been, according to Table 1.

Table (1): The comes about of the error measurement as an average of runs.

Pic. No.	Correct in 12 color	False in 12 color	Correct in 4 color	False in 4 color
1	98.651	1.348	95.582	4.417
2	96.831	3.168	95.714	4.285
3	99.068	0.931	98.942	1.057
4	96.712	3.287	96.553	3.446

The results in tables (1) reflect the following behaviors:-

1- The digital image processing and investigation to localization by drawing the picture with 12 and 4 colors respectively have achieved high results in percentages.
2- We note that this model works on two types of pigments, (pink, and orange) and achieved the percentage ratios of slides for matching and localization in orange color are the highest proportions from pink color in simple differences.

Figures (3) shows the original tested images and the results after implemented the suggested localization model. While figure (4) shows the detailed stages implementation suggested proposed project.

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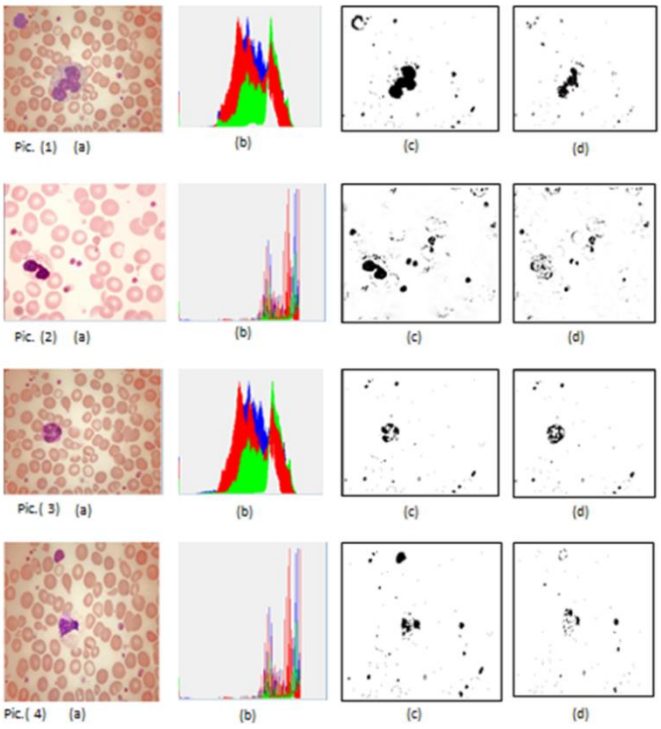

Figure (3): the original tested images and the results after implemented the suggested localization model

(a) Original image.

(b) Resulted of histogram of image.

(c) Final resulted image for 12 colors,

(d) Final resulted image for 4 colors.

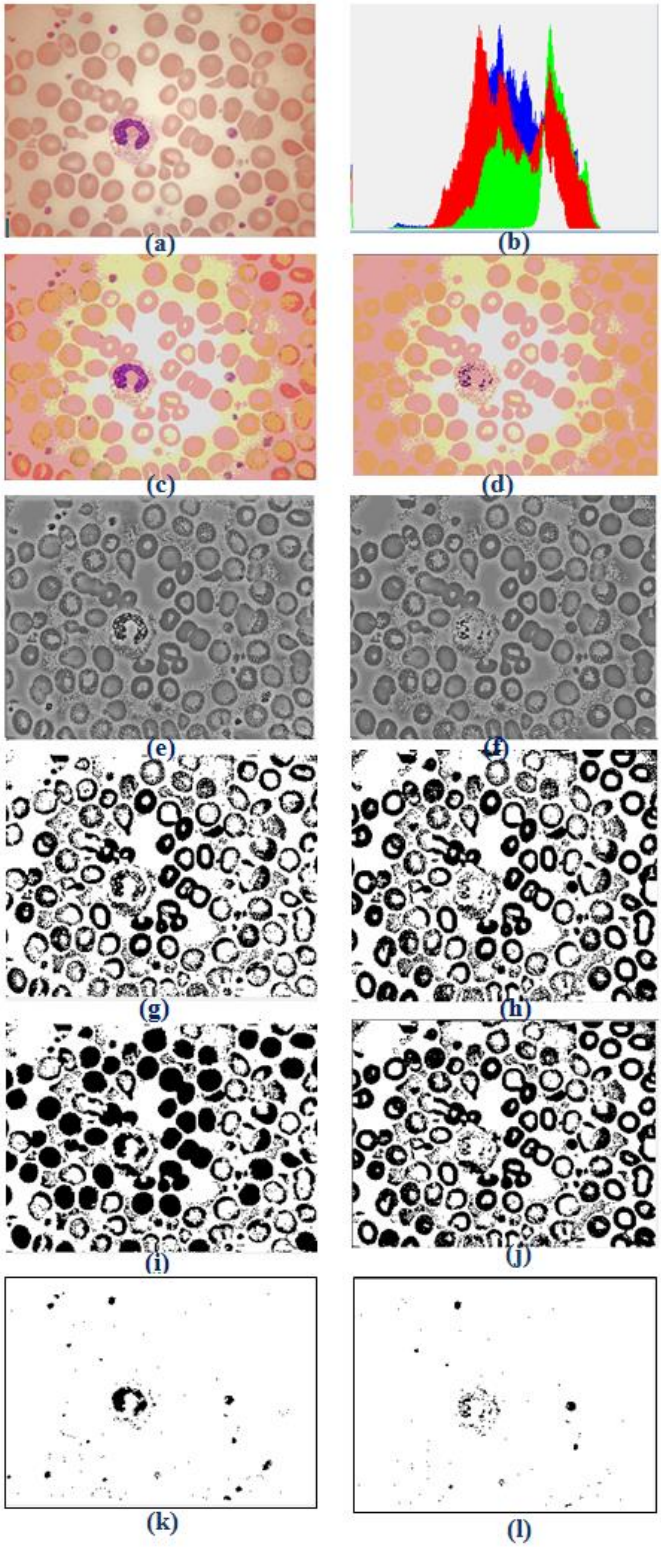

Figure (4): the detailed implemented stages in the proposed model.

(a) Original image,
(b) Histogram of image,
(c) Resulted image after segmentation using modified k-mean algorithm for 12 colors,
(d) Resulted image after segmentation using modified k-mean algorithm for 4 colors,
(e) Resulted image after applying normalizing on (c) image,
(f) Resulted image after applying normalizing on (d) image,
(g) Resulted image after Binarizaion on image (e),
(h) Resulted image after Binarizaion on image (f),
(i) Resulted image after applying region growing on (g) image,
(j) Resulted image after applying region growing on (h) image,
(k) Final resulted image (i),
(l) Final resulted image (j).

The quality of the segmented image is analyzed utilizing the estimation value of Root Mean Square Error (RMSE) and Peak to Signal Noise Ration (PSNR).

1. Root Mean Square Error: It has been utilized as a standard execution estimation of the yield image. It gives how much yield image is digressed from the input image.

$$RMSE = \sqrt{\frac{1}{nx\,ny}\frac{\sum_0^{nx-1}\sum_0^{ny-1}[(r(x,y))]\text{^}2}{\sum_0^{nx-1}\sum_0^{ny-1}[r(x,y)-t(x,y)]\text{^}2}} \quad \ldots\ldots (7)$$

2. Peak to Signal Noise Ratio: The peak to signal noise ratio is the extent between most extreme feasible powers and the corrupting clamor that impact likeness of image. It is utilized to degree the quality of the yield image.(Jaskirat et.al.,2012)

PSNR=

$$10\,log\,0\left[\frac{max(r(x,y))\text{^}2}{=\sqrt{\frac{1}{nx\,ny}\frac{\sum_0^{nx-1}\sum_0^{ny-1}[(r(x,y))]\text{^}2}{\sum_0^{nx-1}\sum_0^{ny-1}[r(x,y)-t(x,y)]\text{^}2}}}\right]. \quad \ldots\ldots\ldots (8)$$

where r (x, y) is the input image and t (x, y) is the sectioned image. And the littler value of RMSE implies the image is of great quality and littler value of PSNR means the image of destitute quality. The value of RMSE and PSNR of the sectioned image is given below within the Table 2.

Table (2): RMSE and PSNR values.

Pic. No.	RMSE (proposed algorithm 12 color)	PSNR (proposed algorithm 12 color)	RMSE (proposed algorithm 4 color)	PSNR (proposed algorithm 4 color)
1	0.0049	61.80	0.0084	60.80
2	0.0065	89.34	0.0066	89.28
3	0.0077	57.80	0.0088	57.51
4	0.0010	74.86	0.0011	74.72

The RMSE and PSNR value are calculated for proposed K-means Algorithm in (12, 4) color. The values of RMSE are getting very low and the esteem of PSNR is getting over and we are able conclude that the yield image come about from the proposed algorithm are of good quality.

So we are able compared the comes about of the proposed algorithm with other literature like (Nameirakpam et.al. 2015) which get the common results illustrate within the below table:

Table (3): RMSE and PSNR values of (Nameirakpam et.al. 2015)

Pic. No.	RMSE (k-mean algorithm)	PSNR (k-mean algorithm)	RMSE (proposed algorithm)	PSNR (proposed algorithm)
Lena sample	0.0036	32.94	0.0017	38.235
1st blood cell	0.0081	34.63	0.0077	34.80
2nd blood cell	0.0144	32.44	0.0084	34.79
3rd blood cell	0.0079	33.99	0.0073	34.43

In spite of the fact that the set of images employments from (Nameirakpam et.al. 2015) are

diverse set of images we utilized in our proposed algorithm, so ready to conclude that the proposed strategy gives superior result

. V. Conclusion

Medical imaging is one of the key areas of biomedical designing, which points to apply designing standards in field of medicine and science. Evaluation advancement for medical imaging gives seriously improvement in, Diagnosis and treatment. Precise examination of medical image information is vital within the reliability of the information acquisition prepare. Investigation of medical imaging information requires application of methods including image processing, which is one of the foremost diligent topics of designing and computer science. In the future, it is possible to apply our approach on other medical images or implement other clustering methods and make a comparison between them for getting better results. Lastly, it is possible to implement and analyze in different areas of image segmentation.

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Journal of AL-Qadisiyah for computer science and mathematics Vol.11 No.2 Year 2019
ISSN (Print): 2074 – 0204 ISSN (Online): 2521 – 3504

تجزئة خلايا فقر الدم محلياً بأستخدام خوارزمية K-Mean المعدلة

أ.م.د لؤي أدور جورج[١]
م.م هدى مصطفى رضا[٢]
م.م ميلا غازي عبد الحليم[٣]

علوم الحاسوب / كلية العلوم/ جامعة بغداد

المستخلص:

في هذا البحث يتم تقديم طريقة لتجزئة الصورة تستند الى خوارزمية التجميع (K-Mean) المعدلة تستخدم هذة الطريقة المقترحة التجميع لتخصيص الألوان السائدة في صور الانسجة الطبية لغرض التجزئة وبكفاءة عالية. تتمثل خطوة التهيئة في النظام في أختيار نموذج أولي مناسب يستخدم للتقطيع ،يتم أستخدام مجموعة من المقاييس منها(inter and intra class) لتقييم درجة ملا ئمة النموذج. الطريقة هذة كانت قادرة على جعل التجزئة في قرارات تصنيف مختلفة ، ولغرض تقييم الاداء تتم مقارنة نتائج الطريقة المقترحة و طريقة (K-Mean) القياسية ، فقد أظهرت النتائج أن الطريقة المقترحة توفر نتائج أفضل.