A Phenomenal Task of Segmentation and Extraction of Blood Sample Color Features from the Cardiac Frames Sequence Using Fuzzy C-Means Algorithm

D. Napoleon and K.Ragul

Abstract--- *In the modern digital world the extraction of valid information from videos has been a phenomenal task in the hands of video processing technology. The rapid process of video technology, video has quickly become an essential component in the present applications of multimedia. In the modern times, the color extraction with the process of video segmentation has emerged as one of the most imperative and challenging area. Where the segmentation is highly dependent on the model and criteria for grouping pixels into region where color is the key point in the partitioning. The prime objective of video object segmentation is to facilitate content based representation by extracting objects of interest from a series of consecutive video frames. The main aim of this paper is to segment the particular color with the process of segmentation by using a clustering algorithm in order to detect objects. Conversion is one the traditional task which is performed as color space in the name of L*a*b for the color extraction which enables to quantify the visual difference. At this juncture the clustering algorithm is used to extract the blood sample color features from the video frames where the regions are partitioned. In which the clustering algorithm performs glowing for the color segmentation by segmenting the heart to detect the red color region in the name of thick blood regions.*

Keywords--- *Digital Video, Video Processing, L*a*b Color Space, Video Segmentation, Clustering Algorithm*

I. INTRODUCTION

ADVENT of video is a rich information source which is commonly used for capturing and sharing knowledge in learning systems. In the informative society everyone access various information in which 80% of the information's perceived by human is visual information [1]. With the rapid progress in video technology, the revolution of video has hastily become an essential component of today's multimedia applications. This consists of various things such as video cassette recorder, video-on-demand, virtual walkthrough and more with the quick development in video technology. In order to reduce the transfer stress in network and invalid information transmission, the transmission storage and management techniques of video information become more and more significant. A colossal quantity of video data is now extensively available owing to the technology's revolution in multimedia and also with the digital TV and information systems. Due to the rapid escalation in the digital video content, an efficient way to access and manipulate the information in a hefty video database has become pretty complex and timely issues [2]. On such a process the process of video segmentation and extraction triggered for the video analysis and content based retrieval.

The visual signal processing leads the video processing applications in which the video segmentation is particularly directed to carry out the color characteristic in segmentation [3]. In which the amount of data in video processing is significantly reduced by using video segmentation and feature extraction with color space characteristic. Video segmentation aims to segment moving objects in video sequence with the time varying process [13]. The video segmentation refers to the division of the video sequence according to a certain standards for the purpose of defining some meaningful and relatively independent sets of space or time and then organizing the elements of these sets. The inherent problem about the formation of video segmentation is that the interesting video object is not about the low-level similarity of some items, such as color, brightness, and light flow. In fact, the division of the video object contains the higher levels of semantic concepts [5]. In such a process using the L*a*b color space the particular region color is extracted from the samples. In this paper the function of the heart video is considered in order to segment the veins and other parts with the color attributes. Where the blood region of the layer with the red color is detect by using the FCM clustering algorithm along with the color space technique.

II. NOISE MODELS

The digital videos are often degraded by some random errors – this degradation is usually called noise. Noise can occur during capturing, transmission, or processing, and may be dependent on, or independent of, the video frames content. Noise can be viewed in numerous ways. Some of the frequent noises that are encountered in visual processing are categorized based on the criteria of distributions, correlation, nature and source. There are various types of noise in image

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that can corrupt the frames [8]. Some of the noises are Gaussian noise, speckle noise and salt and pepper. In this sample the traditional salt and pepper noise is introduced for the experimental process.

2.1 Salt & Pepper Noise

It represents itself as randomly occurring white and black pixels. An effective noise reduction method for this type of noise involves the usage of a median filter. Salt and pepper noise creeps into images in situations where quick transients, such as faulty switching, take place. The image after distortion from salt and pepper noise looks like the image attached. This type of noise contains random occurrences of both black & white intensity values, and often caused by threshold of noise image. Salt & Pepper distribution noise can be expressed by

$$\mathbf{P(x)} = \begin{cases} p1, & x = A \\ p2, & x = B \\ 0, & otherwise \end{cases}$$

Where P1, P2 are the Probabilities Density Function (PDF) p(x) is distribution salt and pepper noise in image and A, B are the array size image. In this paper salt & pepper noise in image is randomly occurred in white and black pixels of an image [6]. The main challenge in removing salt & pepper noise from image is due to the fact that image data as well as the noise, share the same small set of values, which complicates the process of detecting and removing the noise.

III. METHODOLOGY

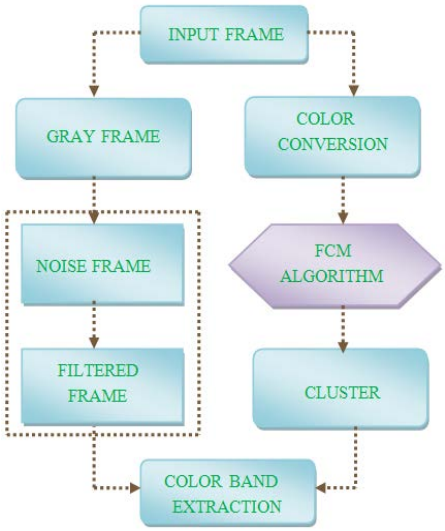

Fig. 1: System Architecture

The goal of color segmentation is to divide the video frames into homogeneous regions. Here, the system architecture of our proposed work shown in the fig-1.

IV. MEDIAN FILTER

The median filter sorts the surrounding pixels value in the window to an orderly set and replaces the center pixel within the define window with the middle value in the set.

$$\hat{f}(x,y) = \underset{(s,t) \in s_{xy}}{median}\{g(s,t)\}$$

Median filtering is a non-linear technique that works best with impulse noise (salt & pepper noise) whilst retaining sharp edges in the image [9]. The main disadvantage is the extra computation time needed to sort the intensity value of each set.

V. VIDEO SEGMENTATION

The objective of the segmentation is to partition the region into parts that have a strong correlation with objects or areas of the real world contained in the sample [4]. In the recent years, interest in video segmentation has increased with advance in visual processing technology and processing capabilities [6]. In the development of video segmentation technology, it is necessary to build video objects model before the video segmentation [15].

However, there is not an accurate and generally accepted video object model nowadays, only a fuzzy definition which describes as the meaningful entity that is linked together by each of the area. Video segmentation generated by objects is an important application domain in digital video processing technology, and the technology of digital video processing not only covers nearly every aspect of digital video processing and digital image processing and analysis but relates to computer vision, statistical signal processing, stochastic process and pattern recognition and other domains [7]. In such aspects the FCM clustering algorithm is used to extract the features from the video frames and detect the particular color.

VI. CLUSTERING ALGORITHM

Clustering is the process of partitioning or grouping a given set of patterns into disjoint clusters in which it is a way to separate groups of objects. This is done such that patterns in the same cluster are alike and patterns belonging to two different clusters are different. Clustering has been a widely studied problem in a variety of application where the clustering algorithm actively works well for the video based segmentation [10]. Many algorithms are been proposed for clustering where the FCM algorithm method has been shown to be effective in producing good clustering results for the video frames with the color space [14].

6.1 Fuzzy C-Means Clustering

The fuzzy C-means clustering do the fuzzy partition rather than the hard partition, by using the objective function. This algorithm is proposed as an improvement to the fuzzy k-means clustering [11]. The FCM partition the collection of 'n' vector into C groups and finds a cluster center in each group such that a cost function of dissimilarity measure is minimized. The FCM algorithm assigns pixels to each category using fuzzy membership functions. Let $\hat{f}_{aj}$ be the frame which is to be clustered into 'C' clusters. The algorithm is an iterative optimization that minimizes the cost function defined as follows.

$$M' = \sum_{k=1}^{m*n} \sum_{i=1}^{c} \mu_{ik}^{m} \left|\left| f_{aj_{tk}} - v_i \right|\right| \quad 1 \le m < \infty$$

Where 'm 'is the any real number greater than '1', μ_{ik}^{m} is the degree of membership of $f_{aj_{tk}}$ in cluster 'I, v_i is the i[th] cluster center , ||.||| is a norm metric. The parameter 'm'

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controls the fuzziness of the resulting partition [12]. The cost function is minimized when pixels close to the centroid of their clusters are assigned high membership values and low membership values are assigned to pixels far from the centroid. The membership function represents the probability that a pixel belong to a specific cluster. In the FCM algorithm, the probability is dependent on the distance between the pixel and each individual cluster center in the feature domain.

Algorithm: Fuzzy c-means (FCM)

Given the data set Z, choose the number of clusters 1 < c < N, the weighting exponent m > 1, the termination tolerance $\in > 0$ and the norm-inducing matrix A. Initialize the partition matrix randomly, such that $U^{(0)} \in M_{fc}$.

Repeat for l=1, 2…

Step 1: compute the cluster prototypes (means):

$$v_i^{(l)} = \frac{\sum_{k=1}^{N} (\mu_{ik}^{(l-1)})^m Z_k}{\sum_{k=1}^{N} (\mu_{ik}^{(l-1)})^m}, \qquad 1 \le i \le c.$$

Step 2: compute the distances:

$$D^2_{ikA} = (Z_k - V_i^{(l)})^T A((Z_k - V_i^{(l)}), \ 1 \le i \le c, \quad 1 \le k \le N.$$

Step 3: update the partition matrix:

For $1 \le k \le N$

If $D_{ikA} > 0$ for all i = 1, 2…, c

$$\mu_{ik}^{(l)} = \frac{1}{\sum_{j=1}^{c} (D_{ikA} / D_{jkA})^{2/(m-1)}},$$

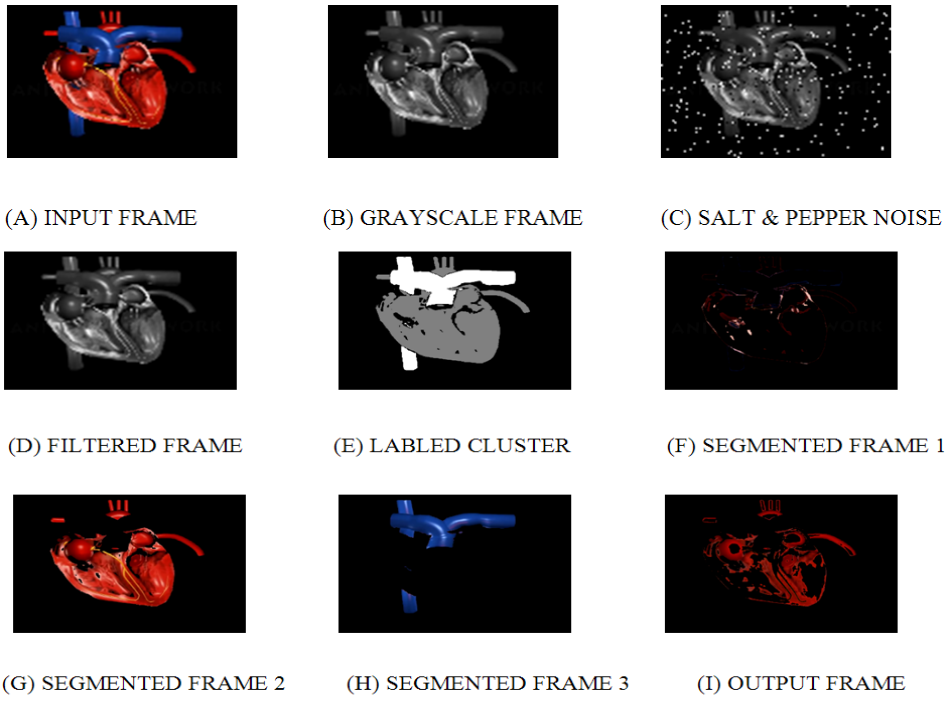
Otherwise

$\mu_{ik}^{(l)} = 0$ if $D_{ikA} > 0$, and $\mu_{ik}^{(l)} \in [0, 1]$ with $\sum_{j=1}^{c} \mu_{ik}^{(l)} = 1$.

until $\| U^{(l)} - U^{(l-1)} \| < \in$.

VII. Result

The following figure shows the experimental results of the proposed work. The digital video frames are taken as the input for the work. This proposed work is done using MATLAB.2010 version.



(A) INPUT FRAME (B) GRAYSCALE FRAME (C) SALT & PEPPER NOISE

(D) FILTERED FRAME (E) LABLED CLUSTER (F) SEGMENTED FRAME 1

(G) SEGMENTED FRAME 2 (H) SEGMENTED FRAME 3 (I) OUTPUT FRAME

VIII. Conclusion

The sequence of visual frames which is well organized in a manner is basically named as videos which give valid visual information's. On the hands of such a process the visual processing is enriched his own trend in the video technology applications. The feature extraction emphases its revolution in the visual processing, by extracting valid information's from the video frames in the name of segmentation. In this paper Fuzzy C-Means clustering algorithm is used for segmenting and detecting the particular color from the sample. Fuzzy clustering is a powerful unsupervised method for the analysis of data and construction of models which works well for the video color segmentation and detection.

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