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# Moving Object Segmentation using Fuzzy $C$-Means Clustering Technique

Vivek Bhandari[a], B R Kapuriya[b] and M M Kuber[c]

[a]Department of Aerospace Engineering, Defence Institute of Advanced Technology (Deemed University), Pune, India, Contact: v.bhandu@gmail.com

[b]Department of Applied Mathematics, Defence Institute of Advanced Technology (Deemed University), Pune, India, Contact: kapuriyabr@gmail.com,

[c]Department of Computer Engineering, Defence Institute of Advanced Technology (Deemed University), Pune, India.

Affine motion model is widely used in motion segmentation. This paper gives an approach for moving object segmentation by using Fuzzy $C$-Means (FCM) clustering on Affine parameters. Here this algorithm has been simulated in Matlab. Fuzzy $C$-Means clustering has been applied on the affine parameters of the pixels. Affine parameters have been calculated from Optical Flow data. Here Lucas Kanade method has been used for Optical flow Velocity calculation. Comparison of proposed method with respect to $K$-Means clustering segmentation method has been presented. By proposed method reduction in segmentation computation time has been achieved to almost half of the time compared to K-Means clustering segmentation. Segmentation output of the proposed method on the test video 'flower.yuv' and othertest videos has produced good results.

**Keywords :** Affine parameters, Fuzzy $C$-Means Clustering, Optical Flow, Lucas Kanade, $K$-Means Clustering.

## 1. INTRODUCTION

Moving object segmentation is carried out mainly by detecting the motion. This motion detection is mainly carried out either by Optical flow method or Block subtraction method between two frames. In this paper Lucas Kanade Optical Flow method has been used for motion detection. With the help of Optical Flow data Affine parameters have been computed. Similarly modelling can be done for projective and prospective parameters too.

In this paper we have confined our domain to affine parameters. These affine parameters have been used by Fuzzy $C$-Means clustering for Moving Object Segmentation. Moving object segmentation has large area of Application in the field varying from civil application to military application. It can be used for detecting certain task specific events.

## 2. OPTICAL FLOW

The most common method used for computing Optical flow are Lucas Kanade method and Horn and Schunck method [1]-[2]. In our work we have used Lucas Kanade method for Optical flow computation. The expression for image velocity/ Optical flow is given by equation(1)

$$\vec{v} = [A^T W^2 A]^{-1} A^T W^2 \vec{b} \quad (1)$$

where, $A=[\nabla I(x_1, y_1), ...\nabla I(x_N, y_N)]$ for neighbourhood $N$ comprising $n \times n$ pixels
$W = diag[W(x_1, y_1), ...W(x_N, y_N))]$
$\vec{b} = -(I_t(x_1, y_1), ...I_t(x_N, y_N))$

In order to compute optical flow, Intensity gradient with respect to $x, y$ and $t$ is computed. Neighbourhood window size is decided so as to calculate Optical Flow corresponding to any pixel. In the experiment two consecutive frames of test video have been taken as shown

Figure 6. Segmentation using Fuzzy $C$-Means clustering

Figure 7. Segmentation using $K$-Means Clustering

## 5. RESULTS

The simulation for both method i.e., the Fuzzy $C$-Means clustering method (proposed method) and the $K$-Means clustering method has been performed on the test video (flower.yuv) in Matlab. The test environment under which simulation was carried out is intel core 2 Duo, 2.26 G.Hz CPU with 32 bit Operating system. The picture size of the test video 'flower.yuv' is $288 \times 352$ pixels. The moving object segmentation has been carried out by considering frame no. 200 and frame no. 201 of the test video 'flower.yuv'.The results of segmentation by both methods are shown in Figure 4, Figure 5, Figure 6 and Figure 7 where Figure 4 and Figure 6 are segmented by Fuzzy $C$-Means clustering on Affine Parameters and the Figure 5 and Figure 7 are segmented by $K$-Means clustering on Affine Parameters. The comparison of both methods is shown in Table 1.

Table 1
Optical Flow and Segmentation Computation Time for Output Figures as shown in Figure 4 to Figure 7

| **Segmentation Method/ Test Video** | **K-Means clustering time(Sec)** | **Fuzzy C-Means clustering time(Sec)** |
|---|---|---|
| Hallchif | 309.1917 | 102.9050 |
| Salesman | 74.5605 | 30.6322 |
| Motherchild | 229.8306 | 101.6932 |
| Garden | 331.8732 | 160.9266 |

## 6. CONCLUSIONS

The proposed Fuzzy $C$-Means clustering algorithm for moving object segmentation is able to produce encouraging result with reduction in processing time as shown in Table 1. The segmented images can further be improved by applying pre-processing and post-processing on the subject video.

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**Vivek Bhandari** has been working in the field of aerospace operation and system maintenance for the last fourteen years. He is B.E in Electrical Engineering from Government Engineering College Ujjain and MTech in Aerospace Engineering from Defence Institute of Advanced Technology Pune. He has research interest in the field of Image and video processing. He has carried out extensive study and research in the field of moving object segmentation.

**B R Kapuriya** is currently Scientist at DIAT, DRDO. He obtained his BSc degree from Saurashtra University. He received his MSc degree in Mathematics from MS University of Baroda. His research interest includes Image and Video Processing.

**Madhav M Kuber** received his MSc and MTech degrees from Pune University. He has worked in CAIR, Bangalore from 1989 to 1995. Currently he is working as a faculty in the Department of Computer Engineering at DIAT, Pune. His research interest include Image Processing, VLSI Design, Information Security and Real time and Embedded Systems.