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Segmenting video frame images using genetic algorithms

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ABSTRACT

Image segmentation plays an important role in computer vision. It is a process that partitions a digital image into several meaningful regions, by identifying regions of an image that have common properties while separating regions that are dissimilar. The image segmentation problem is posed as an optimization procedure. In this thesis, an optimization approach based on genetic algorithm is introduced for finding optimal image segmentation. The design and implementation of genetic algorithm image segment or (GSAI) system are described. GSAI system employs finds optimal value using genetic operators "crossover operator and mutation operator". The different proposed / implementation segmentation methods of the GSAI system were tested using Gray image are taken from one films and with size 352x240 pixels for video frames images of In this is work focused on genetic algorithm coefficients which affect in direct and active way in the work of GA to study and analysis dependable video images which are taken from video clips after partitioning to multiple frames.

Key words: Image segmentation**,** GSAI**,** Generating

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1 Introduction

Fragmentation of the image is necessary in many applications of computer vision and control industrial,[1] the basic goal of operating segmentation of a frame from the sequence of grayscale frames of video clip is to isolate images segmentation to regions with properties homogeneous highlight important objects in the image that can analyse image through knowledge of the area and the size of each object in the picture extracting statistical information important goals in the picture. Segmentation algorithms depend directly on the two concepts, namely homogeneity and contrast the characteristics of areas in the picture such as (gray level, color, construction). The goal of image segmentation is to find regions that represent objects or meaningful parts of objects. Division of the image into regions corresponding to objects of interest is necessary before any processing can be done at a level higher than that of the pixel. Identifying real objects, pseudo-objects, and shadows or actually finding anything of interest within the image which requires some form of segmentation [Gon, 97]. [2] Segmentation algorithms for gray-level images generally are based on one of two basic properties of gray-level values: discontinuity and similarity. In the first category, the approach is to partition an image based on abrupt changes in gray level. The principle areas of interest within this category are detection lines and edges in an image. The principle approaches in the second category are based on thresholding, region growing, and region splitting and merging. The problem of segmentation is inherently hard and NP-complete problem, the formulation and implementation of a randomized search approach to segment an image, using genetic algorithms [Gan, 99].

1.1 Image segmentation techniques

In image segmentation techniques there are two main categories [Gon, 92][3].

- Region based methods.
- Edge based methods.

Region based methods: which assign each image point into particular region or target, the region growing and

shrinking methods use the row and column (rc) based image space, whereas the clustering techniques can be applied to any domain (spatial domain, color space, etc). A region-based method usually proceeds as follows: the image is partitioned into connected regions by grouping neighboring pixels of similar intensity levels, adjacent regions are then merged under some criterion involving perhaps homogeneity or sharpness of region boundaries; over stringent criteria create fragmentation [Asa, 96]. Boundary based methods locate the edge lines existed between different adjacent image regions, the boundary detection methods are extensions of the edge detection techniques, this technique.

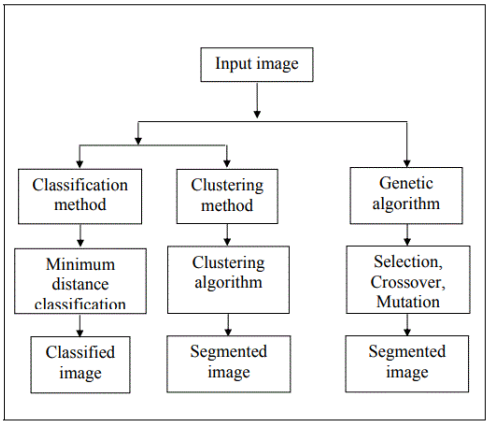


Figure 1. General block diagram for segmentation

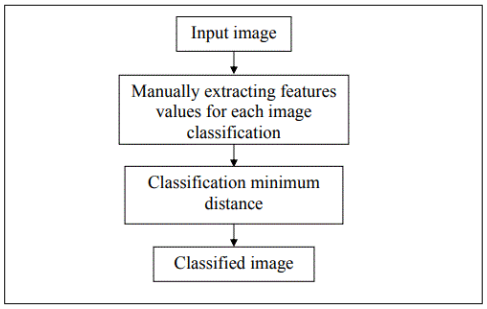


Figure 2. Block diagram for image classification using Minimum distance algorithm

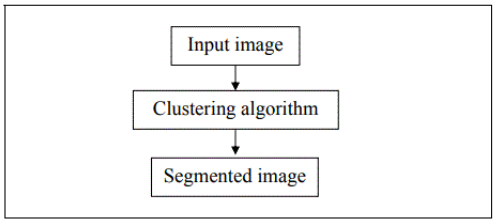


Figure 3. Block diagram for image segmentation using clustering algorithm

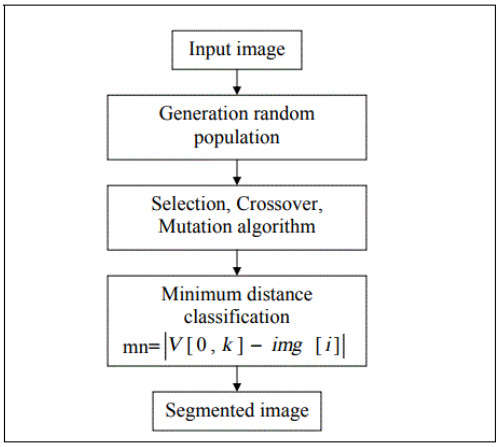


Figure 4. Block diagram for image segmentation using genetic algorithm

2 Results and Discussion

2.1 Image frame segmentation results

Toshiba film: type file mpg with size 9.02 MB, 30 frames per seconds are stored in files bmp through time periods two seconds 2/30 sec between frames, then video clip partitioned to 15 frames for one second and taken only the even sequence frames save as bmp files. By using adobe program Photoshop version 6.0 dependable characteristics for frames was save as size (352x240) pixels and with gray level (0-255) 8-bits. The video is divided into 15 frame Kamal shown in Figure 4.

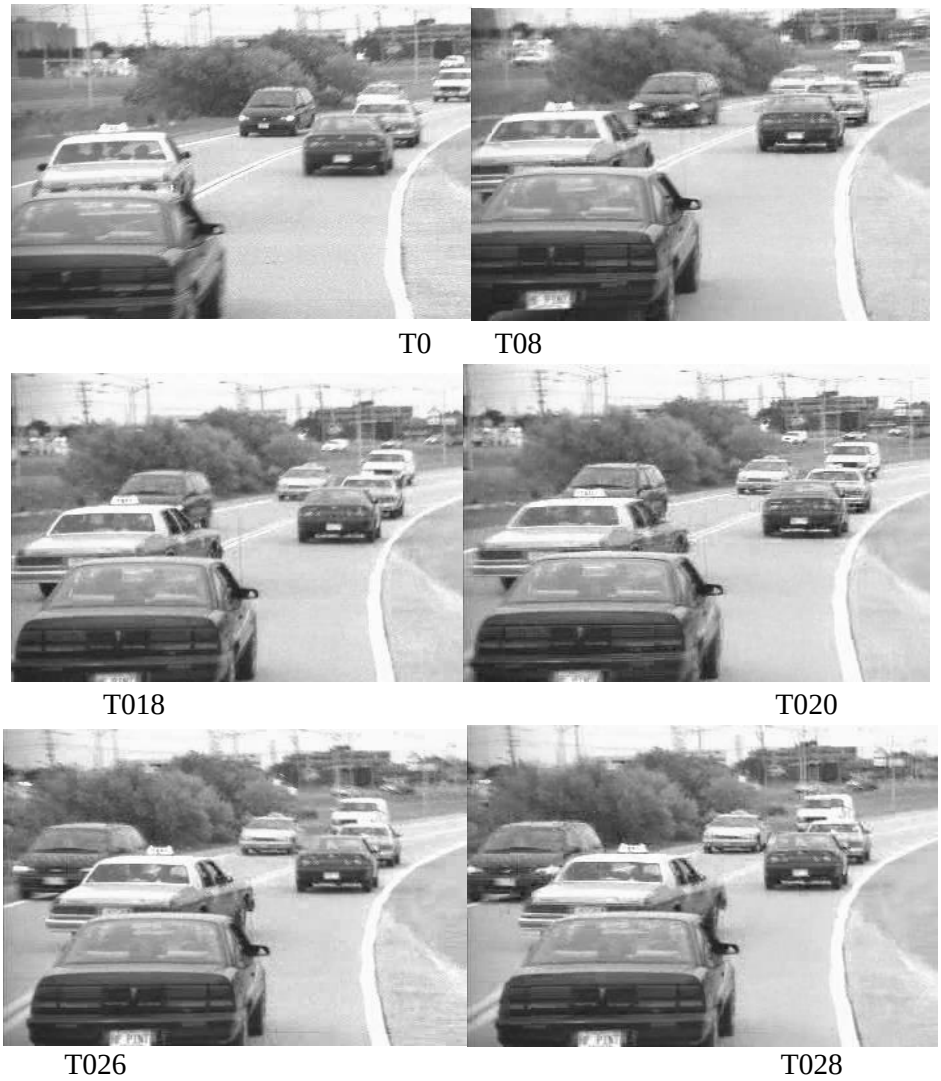


Figure 4. Original frames for cars

2.2 Segmentation by clustering results

Depending on film regions segmentation of the gray to group for grouping small regions to gray aggregations for all pixels elements belonging to the same intensity grey.[9] This operation results obtained by image segmentation to the totals different according to used image and calculation, image features (μi), compare with averages. This method was applied on film for four cutting regions from each frame (image), where note of segmentation accuracy for film images by using this method, The results were illustrated in Table (4.1 a), (4.1 b), (4.1 c), in Table 4.1 a, mean (M) the image without clustering (averages before checking).Table (4.1 b), film features (average M) after procedure at first test (Ld1) and in Table (4.1 c), film features (average M) after procedure at last test (Ld2), M it represent average by the clustering method .The images partative are illustrated in Figure 6, finally, obtaining of best clustering are includes number of new elements and new averages those

existed in each partitive region. The average after proceeding represents the differences values between the two successive iterations.

Table 4.1 a. Image features (Ri, M) for different regions

(Ri) cutting region	**Average by the clustering (M)**
R1	31
R2	94
R3	157
R4	220

Table 4.1 b. Film characteristics where the average after proceeding the first test

Region no.	**M(first test)**	**Frame name**					
		T0	**T08**	**T018**	**T020**	**T026**	**T028**
R1	M1	0	0	0	0	0	0
R2	M2	31	3	0	0	0	0
R3	M3	94	1	0	1	4	2
R4	M4	157	0	0	0	2	0

Table 4.1 c. Film characteristics where the average after proceeding the last test

Region no.	**M(last test)**	**Frame name**					
		T0	**T08**	**T018**	**T020**	**T026**	**T028**
R1	M1	0	0	0	0	0	0
R2	M2	0	5	0	0	0	0
R3	M3	0	1	0	0	1	6
R4	M4	0	0	0	0	2	0

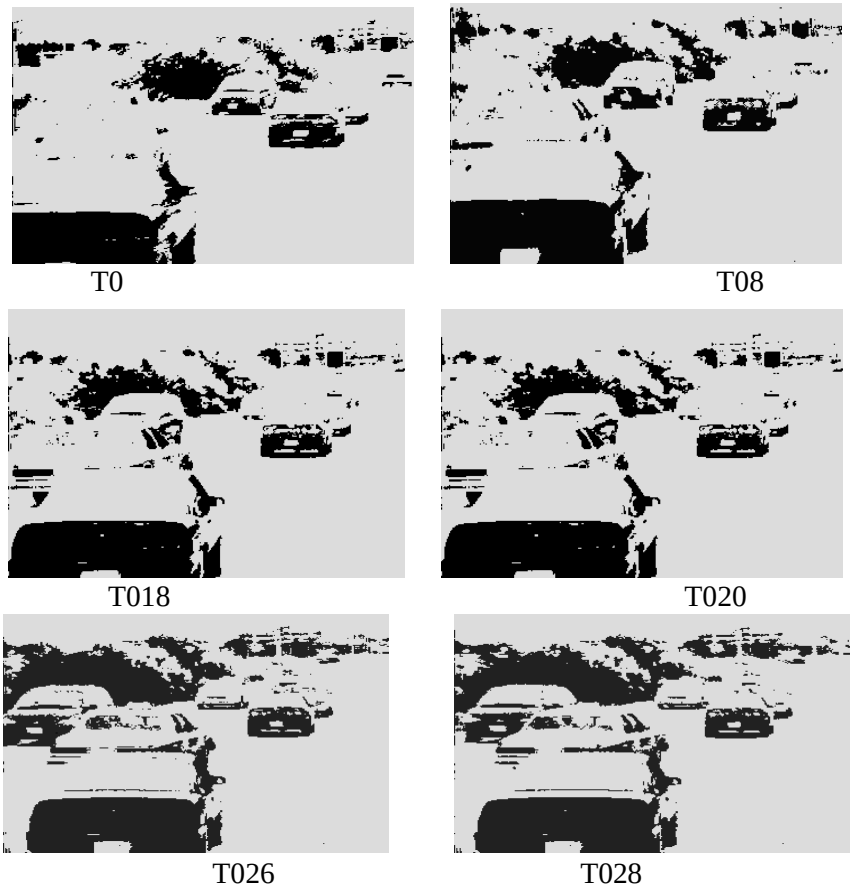


Figure 5. Cars frames by clustering method

2.3 Classification results

Object selection is specified from each region and classified by using MD (minimum distance classification) and regions homogenous cut-back from each object then specify features of these objects for segmentation purpose,[10] implemented on film, gray levels images (8bits).Toshiba film: consist of several video clips by selecting six frames from film, cutting four homogenous regions for each image or frame(R1,R2,R3,R4), then calculation mean (μi) of each region(μi) for calculation and dependence these values for purpose segmentation, classification method results are illustrate as follows :In table (5), represent image features (Ri, μi) for homogenous region and cutting these regions from all images of film Figure 6, it illustrate images of film after classification. Cutting regions from any image gray and using minimum distance method on those images and then obtaining on four averages (μi) for calculation and depending these values for segmentation purpose.

Table 4. Image features (Ri, μi) for homogenous and cutting regions for all first film images

(Ri) cutting region	**(*μi*) average for each cutting region**					
	T0	**T08**	**T018**	**T020**	**T026**	**T028**
R1	50	53	51	105	62	83
R2	111	77	79	171	78	151
R3	172	198	164	202	181	173
R4	250	239	187	216	215	182

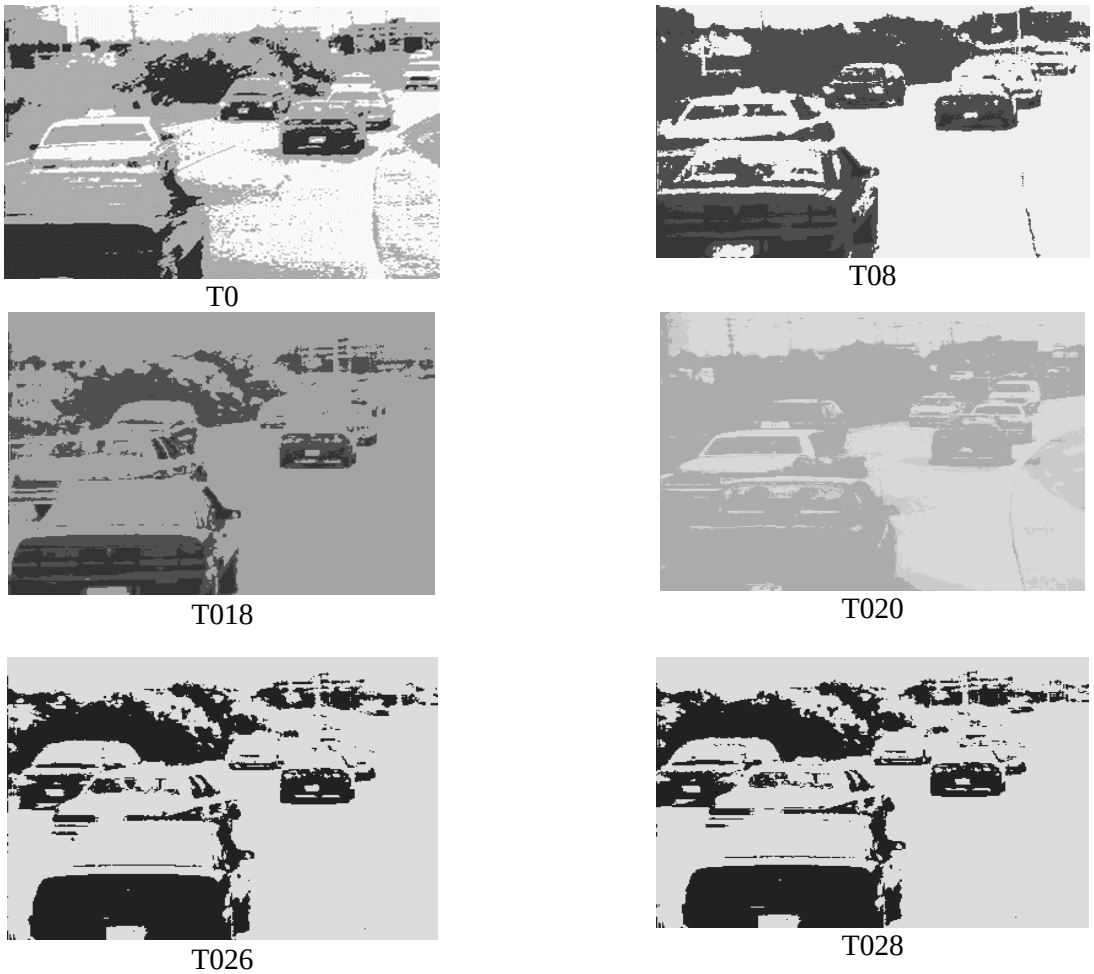
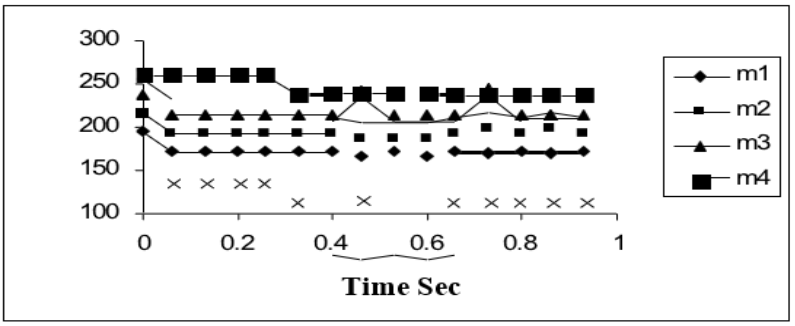


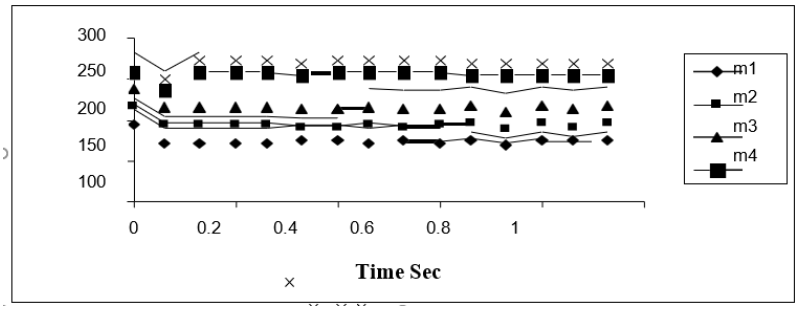
Figure 6. Cars frames by clustering method

2.4 Genetic algorithm results

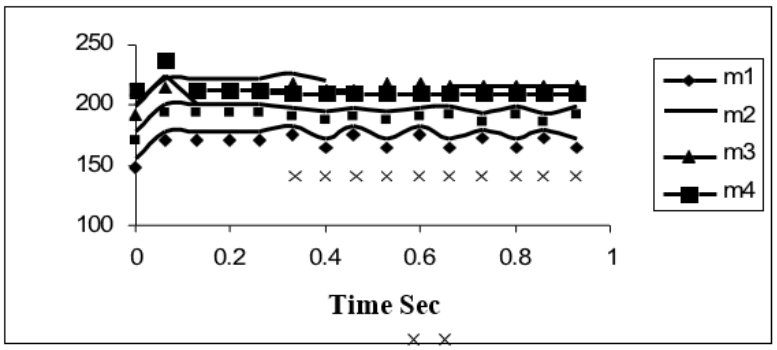
The work algorithm depended on population size is fixed =50 individuals in each generation and the length of each (chromosomes) individual is limiting according to the used image and the number of different regions, where implemented genetic algorithms on images of film,[11,12] genetic algorithm techniques are implemented in images segmentation which given us the optimal solution for best segmentation of image.The population to consist of groups of individuals (chromosomes) can be randomly generated and implementing (crossover operator, mutation operator) for genetic algorithms on the film results was as follow: [13,14] The optimal population is obtained for images where gray levels are represented in figure (7), (8), when values of fitness function become fixed. Film images (Toshiba film) were the cases of stability for film images, begin at iteration (itr=4) for image T0 and the value of fitness function for herself (f=51), T08 begin at iteration (itr=5) and the value of fitness function (f=51) whichever stability in value of fitness function for image T0, T08. In image T018,T020 there was mutation in the value of fitness function (f=52) at iteration (itr=6)for image T018 and (itr=5) for image T020 In image T026, T028 there was mutation in the value of fitness function (f=51) at iteration (itr=5) for image T018 and image T020.in figure (10), after applying genetic algorithm on these images by using crossover and mutation factor. Relation between time (t) and averages of stability for regions (μi) are illustrated in figure (7), (8) for film. The relationship between the time for each frame (image) and cases of stability in the values of the averages (μi), illustrated in figure (9), for all frame. We note that the state of stability in the averages of values begin after (itr=4) for all frames of film and after (itr=10) for all frames.



Tm0

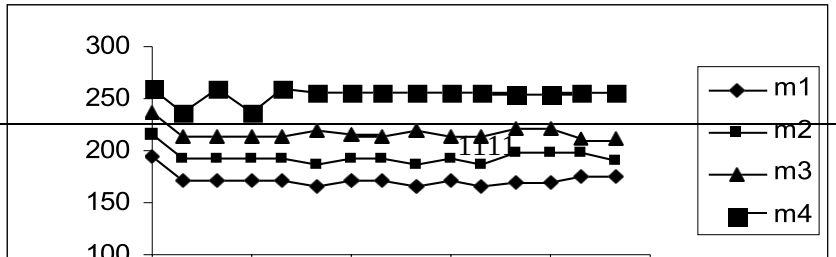


Tm8



Tm18

Figure 7. Relation between time (t) and averages of stability for regions (μi)



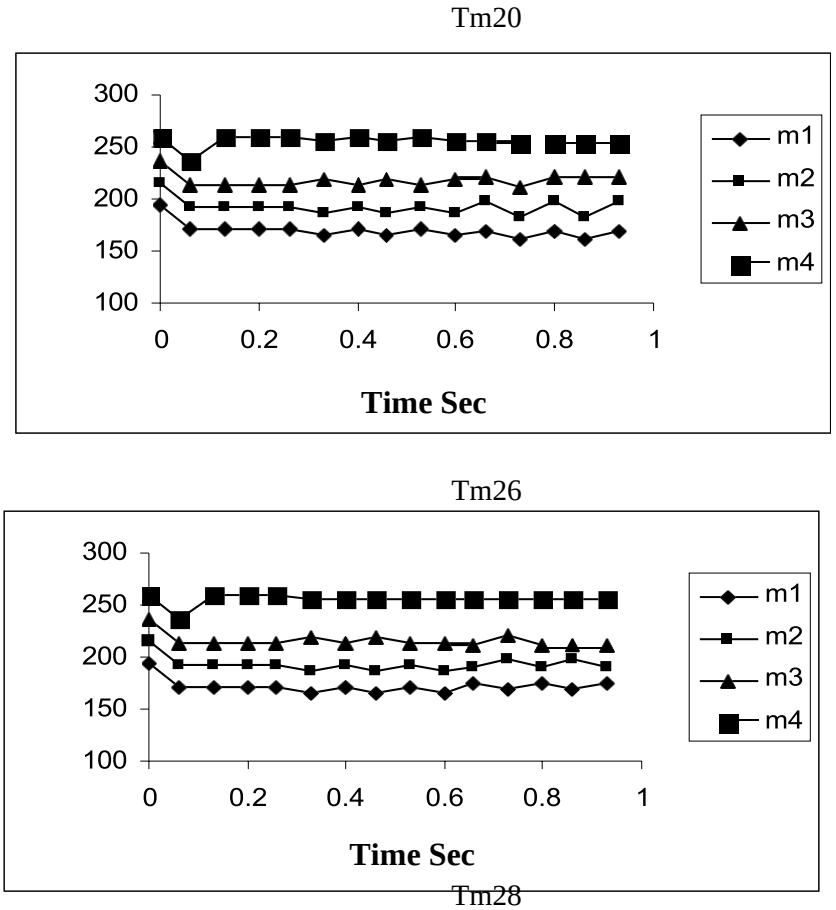


Figure 8. Relation between time (t) and averages of stability for regions (μi)

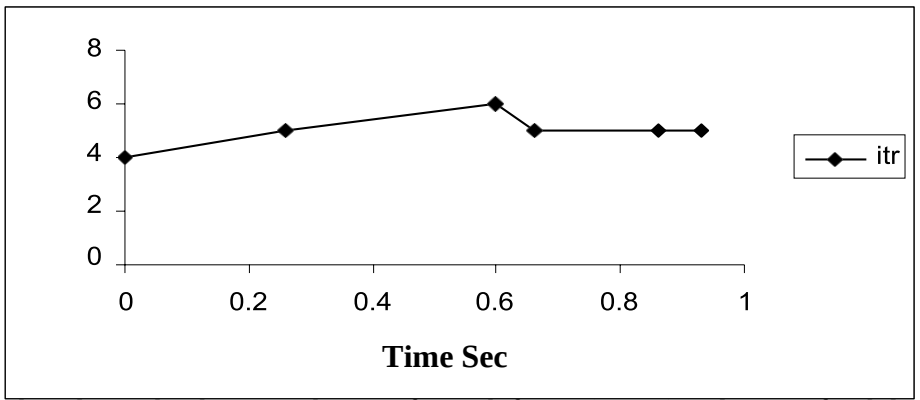


Figure 9. The relationship between the time for each frame (image) and cases of stability in the values of the averages (μi)

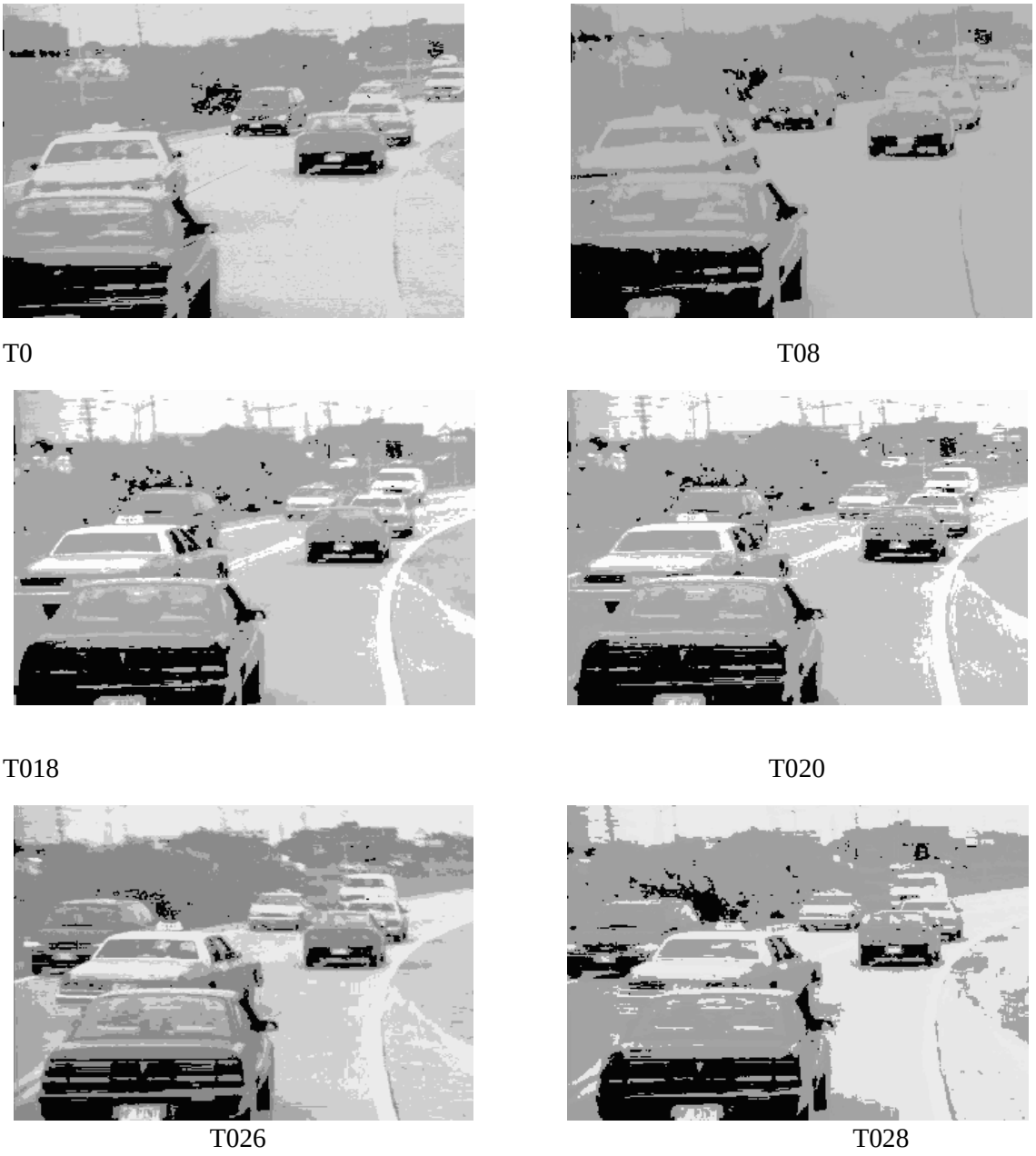


Figure 10. The images of first film are segmented by the genetic algorithm

3 Conclusion

1. The genetic algorithms are considers from best methods, because it highlights image regions by the clearer, and by using two factors (crossover and mutation) which have improved considerably segmentation results of images gray, as they observed decrease in the value of fitness function by using two factors together, whenever were the fitness function is small, whenever were the accuracy is best.
2. Results of classification methods by using minimum distance method (MD) were efficiency is very high in image regions classification and by specifying individual pixels for image to many classes
3. Method of Clustering from important methods for partitioning the pixels of image to groups, show us clustering of elements of the similar image returning to the same color we observe this on images of gray level, where by clustering of gray and we concludes the images of the second film are less efficiency than from images of first film and that, for gray intensity levels convergence for different regions in image.
4. In images the same gray level were genetic algorithms is simple and implementation is quickly because represent by one function only.

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