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Multiple Color Object Recognition In Video Streams Using Parallel Processing

Mr. Girish Basole[1] , Dr. Nagaraja B. G.[2]

[1]Research Scholar Dept. of Electronics & Communication Engineering Jain Institute of Technology, Davangere.

[2]Professor & Head, Dept. of E & CE Jain Institute of Technology, Davangere.

Abstract – This research paper proposes a novel method of multiple color object recognition in video streams using parallel processing techniques. In this paper, we have used the switching and enabling circuits for the object region filling& identifying the colour objects in the video streaming images & is very much suitable for recognizing the objects in video images with a small quantity of texture or colour. The calculations of threshold values for finding boundary are obtained using some learning systems like parallel processors. In the proposed method, Here, we have used single object images. Using these techniques, we have developed multiple object recognition systems from a single image at a very high speed, which is the highlight of this proposed methodology which is developed in this research article. An example of a carrot & apple is taken into consideration for the simulation purposes. For edge detection purposes, we use differentiation technique.We can use parallel processors for getting the threshold values. For different ranges of average gray level values, the parallel processors circuit gives different threshold values.

The image formats, number of colors, number of images, number of samples, the total number of pixels, the number of colour pixels recognized & the percentage of pixels recognized is summarized in the form of a table & by observing these results, the methodology proposed seems to be better compared to any other method. Thus, the proposed method shows the efficacy of the methodology developed by us which can be verified from the simulated results, both in graphical form as well as in the form of quantitative results depicted in the form of numerical tables.

Keywords – Image, Object, Multiple, Video, Detection, Surveillance, Cluster, CNN, KNN, Identification, Tracking, Shadow, Logical Reasoning, k-means, Segmentation, Histogram, Foreground, Background.

I. Organization of the research paper

The organization of the paper is developed as follows. A brief introduction to the related work is presented in the introductory section I. The section II presents a overview of the literature related to the work done by various others in the relevant field till date along with their advantages & dis-advantages. The section III explains the proposed methodology, whereas the section IV gives a brief description of the edge detection methods. Multiple colors learning method& its effect, i.e., the development of the multiple colours learning algorithm is presented in the sections V & VI respectively. The object recognition method is briefly explained in the section VII. Finally, the results, discussions & the final summary of the paper along with the concluding remarks of the research work done is presented in the SectionsVIII& IX respectively. This is followed by a exhaustive number of references that were used in the development of this review paper.

II Introduction

The recognition of coloured objects in advanced pictures& in videos is a standout amongst the most

significant and testing errands of PC vision. The sort of articles to be distinguished can run from conceptual geometric items like lines or circles to complex genuine articles like human faces or fingerprints. Most of item acknowledgment calculations include edge discovery as a pre-processing activity to play out a basic auxiliary investigation of a computerized picture. Be that as it may, edge identification just gives a pixel-wise grouping of edges, which does not permit end on the state of complex articles present in the picture [1].

A greatly improved portrayal for the obvious state of items can be accomplished by finding the outlines of articles. As opposed to edges, outlines as of now give a theoretical portrayal of the picture substance and can be utilized to separate the picture into closer view articles and foundation. In addition, it is a fascinating inquiry of PC vision to separate the area of a picture in closer view and foundation, yet in addition in semantic portions [1]-[2].

Item identification in unconstrained pictures is a significant picture understanding issue with numerous potential applications. There has been little accomplishment in making a solitary calculation that can recognize discretionary articles in unconstrained pictures; rather, calculations commonly should be tweaked for every particular item. Therefore, it commonly requires an enormous number of models (for unbending articles) or a lot of human instinct (for nonrigid items) to build up a powerful calculation [1]-[3].

In the field of video &image processing applications, colored object tracking plays a vital role [1]. The coloured object detection and tracking are both most dynamic research area with number of applications includingcomputerized video surveillance, robotic vision, traffic detection, vehicle navigation, object identification, in defense establishments, in industrial zones and much more. It should be noted that a video signal is having both spatial as well as temporal information, whereas an image is having only spatial information as such a video is considered as a sequence of images, each is called as frame. There are both moving and static object in sequence of images. Moving object which can be a person, bird, vehicle etc. also called as foreground object and background object can be the static things. Detecting the semantically meaningful moving object is the task of moving object detection [2]. To track object, we must first detect an object. Tracking is carried out to check the presence of object in videos. Basically, there are three steps included in object tracking. Object detection, classification and tracking of an object.

It is a well-known concept that videos are always 2 dimensional in nature, whereas an image is 2 dimensional in nature. In general, video is defined as - basically the time wise collection of image frame with audio data. Frame is the unit of the video. Video processing is the image by image processing. As per the motion detection and tracking concern its deals with frames. For the motion detection frame processed one by one from video .

Identifying the moving object is the basic operation in video. As object is detected we can operate that object by using their characteristic & parameter. In any video, for the processing we have to follow the 3 important steps, viz., moving object identification, in all the frames object has to be tracked wherever that object presents in that frame& finally, the detected object has to be analyzed to take suitable action as per the requirement like behavior classification, velocity estimation & other characteristics.

Integrated Person Tracking Using Stereo, Color, and Pattern Detection was worked upon by many researchers across the world [8]. The creation of displays or environments which passively observe and react to people is an exciting challenge for computer vision. Faces and bodies are central to human communication and yet machines have been largely blind to their presence in real- time, unconstrained environments. Often, computer vision systems for person tracking explor it a single visual processing technique to locate and track user features. These systems can be non-robust to real world conditions with multiple people and/or moving backgrounds. Additionally, tracking is usually performed only over a

single, short time scale: a person model is typically based only on an unbroken sequence of user observations, and is reset when the user is occluded or leaves the scene temporarily.

II Literature Survey

A large number of researchers have worked on the chosen topic. In this research paper, some relevant ones which have been used are being cited & referenced. Colour objects in the videos & its identification with tracking plays a very important role in the modern-day surveillance mission, especially in the country's security point of view to identify the terrorists as it will be very difficult to identify fromblack & white scenes .

Conventional ways of object recognition systems use time consuming algorithms and they are not suitable for high speed object recognition. Here, we have developed a simple method based on colors present in the object. A multiple colored object may contain some surrounding colors in the image, so first we have to find the boundary of the object. There are several techniques for finding the boundary of an object. Here we have used a parallel differentiating technique, first the color image is converted into a gray level image. Then find the difference between adjacent pixels and if this difference is greater than a particular threshold value then that differentiator represents a boundary pixel of the multiple colored objects. Finding the threshold values for different images is an important task.

If we want to teach the system for recognizing a particular object, we have to teach the basic color matching devices for recognizing different colors present in that object. For teaching a single color select different points in the object boundary having almost same color. There are several basic color matching devices arranged to learn different colors and each of them should be learned according to the color information present in that object. More than one image with the same object can be used for teaching. After the learning is completed, the system can identify each color present in the object. Thus a large number of object-colors data can be taught.

When a color matching process is executed all the basic color matching devices inside the boundary become ON states using some switching and enabling circuits and remaining basic color matching devices are OFF states. Then if a particular color region is obtained inside the boundary, the system searches for the remaining colors. If all the colors are obtained in a ratio, then the system recognizes the object. If one of the colors is missed from the learned colors, the system searches for the next object.The length-breadth ratio and the shape of the object can be analyzed and those parameters can be used to recognize the object.

Visual saliency goals at identifying the maximum visually unique elements in a image, and has received increasing interest in contemporary years. Though early work in maximum cases targeted on predicting eye- fixations in snap shots, research has validated that salient object detection, which emphasizes object-degree integrity of saliency prediction effects, is greater beneficial and can function a pre-processing step for a ramification of pc imaginative and prescient and image processing obligations together with content-conscious photograph enhancing, item detection, image class, character re-identification and video summarization. Despite latest development, salient item detection stays a tough hassle that requires greater correct answers. Human visual and cognitive systems concerned within the visible interest manner are collected of layers of unified neurons

For example, the person seen gadget has layers of easy and compound cells whose activation are resolute through method of the significance of enter signals falling into their receptive fields. Visual salience is every now and then inaccurately described as physical assets of a visible stimulus. It is significant to keep in mind that salience is the end result of a communication of a incentive with one-of-a-kind stimuli, similarly to with a visible tool (organic or reproduction). As an instantly- forward case, bear in thoughts to a shade-blind individual ought to have a noticeably unique enjoy of illustration salience than someone amid regular color revelation, although each look at precisely the identical physical scene (see, e.g., the

first instance photo underneath). As an extra controversial example, it is able to be that knowledge adjustments the salience of a few stimuli for a little observer.

Yet, as the reality illustration salience arises from pretty low-level and stereotypical computations inside the early levels of visual processing (information inside the following section), the factors causal to salience are usually rather equivalent from one observer to the following, main to similar studies across various observers and of behavioral circumstances. The essence of salience lies in enhancing the neural and perceptual example of places whose restricted visual data notably variety since the widely adjacent image facts in a few behaviorally appropriate manners. This essential standard is instinctively induced as follows.

Visualize an easy seek selection as depicted underneath, where one bar pops-out because of its exceptional direction. Now recall inspecting a characteristic map that is tuned to incentive strength (luminance) evaluation: because of the reality here are numerous white bars on a black historical past, premature illustration neurons touchy to community depth evaluation will reply dynamically to every of the bars (distracters and goal alike, considering the reality that each one have identical concentration)

Based at the pattern of interest on this map, wherein basically each bar elicits a strong top of interest, one might be difficult pushed to accept one vicinity like being virtually extra exciting and worth of interest than all the others. Instinctively, in the end, one would possibly want to use a few normalization operatives which could supply a very low universal weight to this map's involvement to the very last saliency plan [1].

The scenario is pretty fantastic whilst examining a feature map in which neurons are tuned to close by vertically oriented edges. In this map, one area (wherein the unmarried extra or less vertical bar is) might strongly excite the neural characteristic detectors, as all other locations might elicit notable deal weaker responses [9]- [7].

Generally, strategies of saliency detection can be categorized as both pinnacle-down and backside-up techniques. Top-down strategies are challenge-driven and require supervised getting to know amid physically categorized ground fact. To higher distinguish salient objects from historical past, excessive-diploma facts and supervised techniques are integrated to recover the accurateness of saliency map.

Now assessment, backside of the strategies typically makes the most low-level cues which include abilities, insignia and three-dimensional detachments to bring together saliency plots. Unique of the maximum recycled ideas, evaluation previous, is to yield the shade assessment or geodesic remoteness in opposition to surrounds as an area‘s system.

In addition, numerous contemporary strategies communicate their procedures primarily created mostly on margin earlier, pretentious that areas alongside the photograph border are much more probable to be the records. Admittedly, it's far distinctly feasible aimed at the picture edge to be the ancient beyond, which consumes been proved. Though, it isn’t suitable to kind all bulges on the border into one class as most preceding strategies. If an item seems at the photograph boundary, the selected ancient beyond seeds can be difficult to understand & immediately reason the inaccuracy of consequences .

A branch & a bound clustering algo concept was developed by Koontzet.al. in [6], the same authors developed a graph based theoretic approach to the non- parametric cluster analysis in [63]. Finding the groups in the data sets of videos with an introduction to the cluster analysis was put forth by Kaufmanet.al. in [5]. Iasonas Kokkinoset.al. developed relationship between the synergy of the object recognition & image segmentation process using the concept of expectation and maximization algorithm in . Histograms of oriented gradients (HOG) for the detection of human faces was developed by Dalal et.al. in . Felzenszwalbet.al. [66] worked on the detection of objects using some novel edge detection technique and

identified majority of the objects present in the video streaming.

Ramadeviet.al. in [7] developed a new segmentation approach and used it for the recognition of objects by developing a novel edge detection algo. An efficient, high-quality image contour detection algorithm was proposed by Catanzaroet.al. in [8] which was used by majority of the video processing researchers for various types of engineering applications. A Parallel Processing Technique for High Speed Object Recognition when the videos are being run or recorded at a faster rate was developed by

From [1], Rasiq et.al., where they showed that even when videos are at high speed, the detection can be done, the novel results they published in their research paper in [9]. The same group also worked on the colour video images using the concept of parallel processing technique using high speed image segmentation process in [7], in the sense they extended their work for high speed segmentation process, further extension was also done by the same group w.r.t. the parallel processors for high speed multiple objects recognition in videos in [7].

III Proposed methodology

In the proposed methodology for the detection of coloured objects, first we have to detect the edges of the coloured objects, for this we have used the edge based segmentation technique to segment the foreground objects from the background objects, those objects which are having gray scale values varying from 1 to 254 are found out & segmented first.

Then, we use the digital logic gate circuits in parallel combination (hardware), i.e., the switching and enabling circuits for finding out the coloured neighboring pixels. Then, we use the concept of multiple colors learning method to develop the multiple colors learning algorithm, the output of which is the coloured pixel of the coloured object being identified [6].

Edge Detection Method

Edge detection method is the method of detecting the edges of objects in a image or in a video. For this, the main concept is the change in the intensity level or the change in the gradient occurs at the edges of the objects in a image or in a video. This concept is made use of in detecting the edges using one type of operators called as the gradient operators. The edge detection includes a variety of mathematical methods that aim at identifying points in a digital image at which the image brightness changes sharply.

The first step in an image recognition system is the edges sensibility in a digital image. Edge detection for object observation in image processing is the important part. This will give us a good understanding of edge detection algorithms. An edge is useful because it marks the boundaries and divides of plane, object or appearance from other places things. For pattern recognition it is also an intermediate step in the digital images. An edge consists of pixels with the intensity variations of gray tones which are different from their neighbour pixels .

This paper introduces the standard edge detection methods which are widely used in image processing such as Prewitt, Laplacian of Gaussian, Canny, Sobel, Robert and also the new approach are discussed in this known as Fuzzy logic.Edge based segmentation technique solves issues via element detection in unique areas. Gray charge scheduled the border of dissimilar areas is frequently quite massive, plus it is individual of the primary assumptions of the brink revealing technique could live realized.

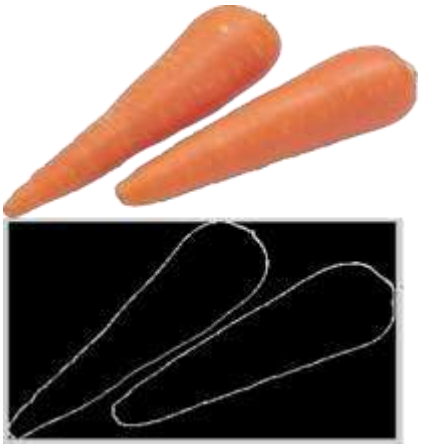


Fig.1 : Edge detection

The Fig. no. 1 shows how the edges of the coloured object (i.e., the carrot vegetable) is being segmented, and the edges of the carrot vegetable is found out because at the borders of the carrot, the colour is changing from orange to white. These points are detected where there is a change in the intensity levels & found out, segregated to form the borders [9] Its number one concept is to stumble on the representation element factors, which can be subsequently associated with an outline regular through a fine method. Its problem deception in the contradiction among the clatter protection scheduled the threshold recognition and the revealing precision. If enhance the exposure accuracy, awkward report may be generated through the noise. If improve noise protection will purpose detection lost and role departure

For edge detection, first we convert the color image to gray level image using parallel summation technique. Each primary colors of a pixel is summed to represent a gray value. Thus the entire pixels in the color image are converted to a gray level image using a large number of parallel summation circuits. Then we use parallel differentiation method for boundary detection by finding the gray level intensity differences between the adjacent pixels using op-amp array. If the intensity difference between adjacent pixels is greater than a particular threshold value then that is considered as a 1 and it is the boundary element of an object.

If we consider an image as a matrix with m number of rows and n number of columns we need (m*n) number of op-amps for horizontal differentiation. These differentiated outputs of each op-amp is compared with the threshold value for getting a binary image represented as A and similarly we create an (m*n) element matrix using vertical differentiation and it is represented as B. Both A and B matrices are binary images having the same size. We can use logical OR operation for each elements in the matrices. Thus,we get boundary image .

C = A+B…… (A OR B)

V Multiple Colors Learning Method

For teaching the systemabout different colors present in the object, we want to find the boundary of the object. Because some colors in the object region may present in the background of it. Using parallel differentiation method, we get a binary image having “m” rows and “n” columns denoted as C. Then, we use region filling method for isolating the object region in the image. Each pixel in the image matrix C is connected to switching and enabling circuit with four X-OR gates and one NAND gate as shown in the figure 4.2(a) in one side, the same circuit in the opposite side, both are symmetrical and the NAND gates outputs are given to a two input NOR gate. The X- OR gates are connected in the four directions-horizontal, vertical and both the diagonals.

A value 0 flows through these X-OR gates if not a high value pixel or boundary pixel is detected. If a high value pixel is detected or C(i ,j)=1, then the corresponding p becomes 1 and all the X-OR gates

outputs connected to this pixel become 1,then the flows of 0 are blocked through the X-OR gates and flows of 1 are started as shown in the Figs.2 & 3 respectively. If the boundary detection is perfect or a closed boundary, the above pixel is a boundary pixel and these flows of "1" continue until the next boundary pixel of the object. If any one of the inputs become 0 then the NOR gate output becomes low and the corresponding basic color matching device can be enabled if we want to teach the color.By using this NOR gate circuit, probability of error pixels can be reduced. Since each pixel is connected with the switching and enabling circuit the object region in the image becomes isolated .

Now, we can teach the system about the different colors containing in the object. For teaching a single color, select different points in the object boundary having almost same color . Now, this system can learn different colors in the various locations in the object region and each of them should be learned according to the color information present in that object. A basic color matching device can learn and recognize more than one color by using more memory locations. After the learning is completed, the system can identify each color present in the object. Thus, a large number of object-colors data can be taught. More than one image with the same object can be used for perfect learning. The basic color matching devices store the learned colors as color 1, color2, etc .

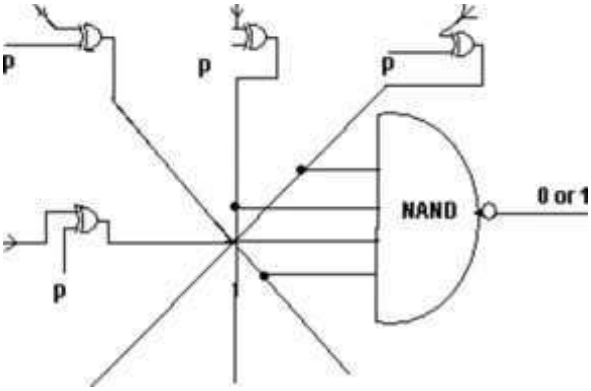


Fig. 2 : Switching and enabling circuit

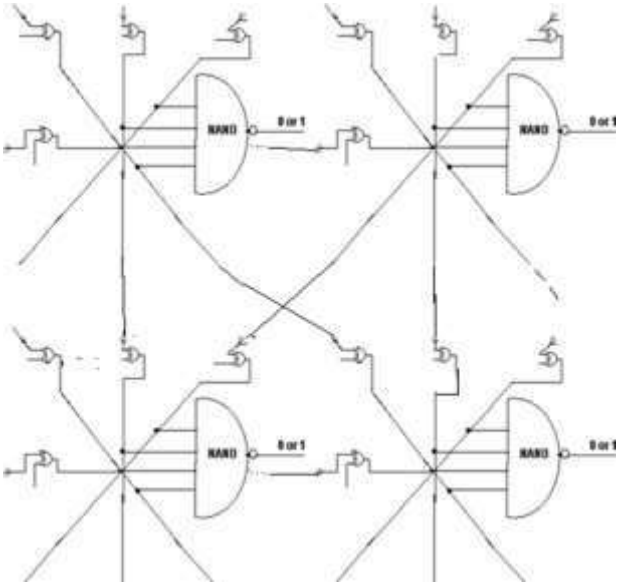


Fig. 3: Switching and enabling circuit for four adjacent pixels

VI Multiple Colours Learning Algorithm

The multiple colours learning algorithm is designed in such a way that the colours in the video images are detected using the concept of multiple colours learning theory with the help of the switching cirucuits. The developed algorithm is a 10-step algorithm & is as follows .

1. Start
2. Load image
3. Determine number of colors, number of samples
4. Convert the equivalent gray level image
5. Find the boundary using parallel differentiation method horizontally and vertically (A and B)
6. Find boundary matrix C=A+B, where A for horizontal and B for vertical
7. Isolate object regions in the image using switching and enabling circuits in the matrix,
8. Learn all the colors in the isolated region one by one [71].
9. If learning is not completed go to step 1.
10. Stop

VII Object Recognition Method

Since our research work is focused on the color based object recognition technique, we need (m×n) number of basic color matching devices for pixel level processing. First we have to isolate the object region as described above, Figs. 5 & 6) are examples of object isolations. Then all the basic color matching devices are loaded with the first color of the object. Now the system checks for the first color in the object region and if that first color is present, it is represented as a sub-region in the object region as shown in Fig. 6(c). Similarly, all the colors are checked and created sub-regions; Figs. 6 (d) & (e) are examples of sub-regions.

In order to calculate the ratio of color 1, divide the number of high value pixels in color 1 sub-region by number of pixels in the isolated object region. Similarly, ratios of color 2, color 3 etc. are calculated. If one of the colors is found missing from the learned colors then search for next object using the above procedure. Then the sub- regions are formed to a single object region within the object boundary with number of high value pixels S. Finally, for getting percentage of recognition, divide the total number of high value pixels in the formed object region (S) by the total number of pixels in the isolated region (I) and multiply this result by 100.

Percentage of recognition= (S/I)×100

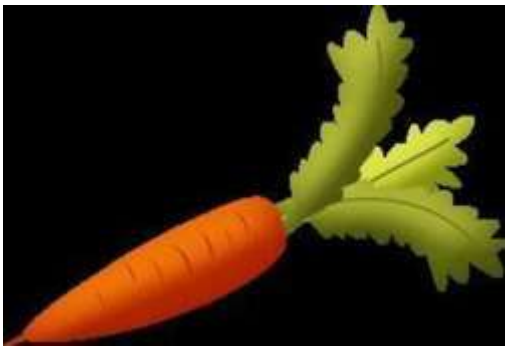
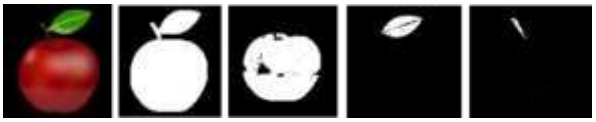


Fig. 4 : Input image

Fig. 5 : Segmented images

Identifying different colors present in the object is a powerful tool to recognize the object. Moreover, length- breadth ratio and the shape of the object boundary are also used for recognizing the object.

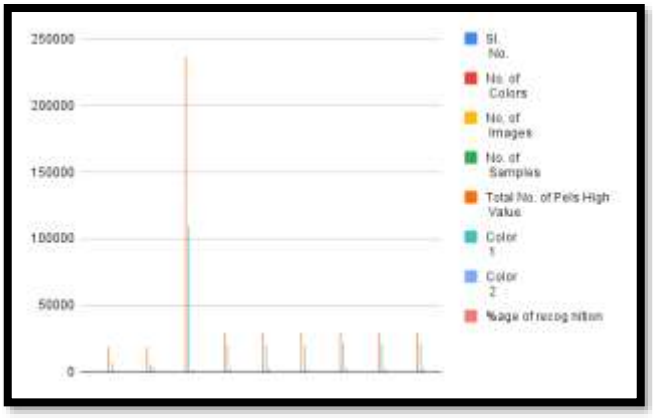


(a) (b) (c) (d) (e)

Fig. 6 : Recognition of different color regions

Results and Discussions

For edge detection purposes, we use differentiation technique. It is an easy way for edge detection. The threshold value for edge detection is an important factor. We can use parallel processors for getting the threshold values. For different ranges of average gray level values,

1. When we use jpeg images the recognition is poor.
2. It is due to the blocking artifacts in the jpeg format [8] (compare Row No.1 and 2 with others)
3. When number of learning samples increases, we get better results (compare Row No.2 and 5 with others)
4. When we use a large sized image, we need morenumber of learning samples for better results (compare Row No.3 with others)
5. When number of colors increases, we get more accurate results (compare Row Nos.8 and 9 with others)
6. When number of learning image increases, we get better results (compare Row Nos.7, 8 and 9 with others)
7. 

Sl. No.	Image Format	No. of Colors	No. of Images	No. of Samples	Total No. of Pels High Value	Number of Colour Pixels Recognized				%age of recognition
						Color 1	Color 2	Color 3	Color 4	
1	jpeg	3	1	4	19394	7446	2261	233	-	51.25
2	jpeg	3	1	8	19394	6897	4419	286	-	59.82
3	png	2	1	4	236357	110130	2480	-	-	47.64
4	png	2	1	4	29984	20674	2857	-	-	78.48
5	png	2	1	8	29984	20711	3484	-	-	80.69
6	png	2	2	4	29984	20260	3027	-	-	77.66
7	png	2	5	2	29984	22418	3184	-	-	85.15
8	png	3	5	2	29984	21797	3263	415	-	84.96
9	png	3	5	4	29984	22298	3292	436	-	86.80

Table 1 : The Simulated Results

Summary& Conclusions

In this paper, a novel method of multiple color object recognition in video streams using parallel processing technique is being proposed. Here, we have used switching and enabling circuits for the object region filling. This method is suitable for recognizing objects in images with a small quantity of texture. We can use some other method for the object region filling in an image with large quantity of texture. The calculations of threshold values for finding boundary can be learned using some learning systems like parallel processors. Here, we have used single object images, if we use image with more than one objects then perfect boundary detection is required. Using these techniques, we can develop multiple object recognition systems from a single image at a very high speed.The quantitative results presented shows the power & efficacy of the methodology developed by us. The recognition rate is increased compared to the work done by others mentioned in the survey.

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