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LABVIEW BASED TARGET RECOGNITION AND TRACKING SYSTEM

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Abstract

In this study, the shape which gives a fine estimation about what may the object be is handled by Generalized Hough Transform via LABVIEW Graphical Interface Program. The template of any object with a distinguishable shape is learned first and then tracked via LABVIEW. The templates are searched in the video of a webcam which has the capability of 30 frames in a second. The matches taking a score over defined level are considered as real matches and bounded by a bounding box. In this way the target recognized and tracked real time.

LABVIEW TABANLI HEDEF TANIMA VE TAKİP SİSTEMİ

Özetçe

Bu çalışmada esas olarak nesnelerin ne olduğu hakkında iyi bir tahmin imkânı sunan nesne şeklinin temel alındığı Genelleştirilmiş Hough Dönüşümü LABVIEW Grafiksel Arayüz Programı vasıtasıyla kullanılmıştır. Fark edilebilir herhangi bir şekli olan bir nesne öncelikle program tarafından tanınmış ve müteakiben LABVIEW vasıtasıyla takibi yapılmıştır. Nesne şablonları saniyede 30 imgeye kadar imge yakalama kapasitesine sahip bir web kameranın görüntü akışı içerisinde tespit edilmeye çalışılmıştır. Belirlenen benzerlik yüzdesini aşan hedefler için imge üzerinde sınırlayıcı bir çerçeve çıkarılmıştır. Bu şekilde hedef nesne gerçek zamanlı olarak tanınmış ve takip edilmiştir.

Keywords: *Image processing, object recognition, target tracking, geometric matching, generalized hough transform.*
Anahtar Kelimeler: *Görüntü işleme, nesne tanıma, hedef izleme, geometrik eşleştirme, genelleştirilmiş hough dönüşümü.*

1. INTRODUCTION

Different from the thermal image, image based target tracking is accomplished using the intensity of light in the environment. On the other hand in a thermal image target tracking system the process is based on the propagation of an object warmer than the absolute temperature. In both systems the common property is the systems not propagating. So the key concept of these kinds of systems is to distinguish the targets passively and try not to lose. Image-based target tracking systems are attached to the values of the lightening indoors and to the sunlight outdoors. A fine algorithm is recognized as its operating well both in an over-lit environment and in a dim environment. The over-lit environment can cause the actual color values of objects to saturate while a dim environment can cause the color values to be seen in a lower grade and both of these can lead to undesired drastic results especially for an algorithm using pre-learning. When designing a target tracking algorithm, these factors should be considered to find the best technique. Operating environment sometimes recommends a probability-based, a contour-based or a tracking kernel-based method. In Chan-Hong Chao et al.'s study, a stereo-camera system which is avoiding the obstacles, approaching a certain distance and standing in front of the target, detects the target based on the color information [1]. In Fabrizio Lamberti et al.'s study, over a thermal camera light intensity of the objects is tracked by the template matching method using a probability-based method for constructing a region of interest around the target [2]. In Yong Rui and Yunqiang Chen's study, a probabilistic method resulting better for an object moving at a linear speed but not in the case of a non-linear movement, Kalman Filter and Unscented Particle Filter methods are compared and using UPF a face recognition system is developed [3]. In Mustafa ÖZDEN and Ediz POLAT's study, by using both Mean Shift and Kernel Density Estimation methods, a target tracking system is constructed [4]. Mean Shift algorithm's estimation for the next position of the target is made more stable by Kernel Density Estimation.

When target tracking methods are inspected, there could be encountered three main titles [5]. These titles are point tracking, kernel

tracking and silhouette tracking methods. LABVIEW-Based Target Recognition and Tracking System has used the silhouette tracking method which is based on the shape of the objects. In section 2 silhouette tracking is explained. Section 3 and 4 respectively introduces the target recognition and target tracking algorithm. Conclusions and assessments are drawn in section 5.

2. SILHOUETTE TRACKING

Silhouette tracking is a tracking method which handles the template of the target. In silhouette tracking there are two kind of information used for the process. First of these is the contour of the object and the second one is the inside of that contour. Tracking algorithms should monitor the frame sequences to find continually the template of the object in every frame. Because the silhouette tracking algorithm uses the contour information, there has to be an edge detection step in the beginning. After that a contour analyze is needed to draw the shape of the object from the edge points correctly. For a contour tracking algorithm the key point is to find the closed contour of the object. On the other hand, called as shape matching, inside of the contour could be tracked mainly handling with the histogram or non-parametric transformation for overall curves of the template.

Shape Matching

In shape matching both the contour and all other curves of the object inside the contour are employed for the matching process. In the first step the shape matching algorithm should utilize edge detection. After changing the image into a binary form constructed by the edge points, curves must be found by connecting the edge points according to threshold levels. LABVIEW Based Target Recognition and Tracking System uses Generalized Hough Transform to make a non-parametric transformation of any arbitrary object after finding the binary image of the target template.

3. TARGET RECOGNITION

Target recognition begins with freezing the image frame which includes the object to be tracked. After that to make a template of the target a cut out process is necessary because the template is designated in this way. The template is taken into a learning phase after being designated. An edge detection algorithm is used to find the edge points in the frame of the template. If the threshold level of the edge strength defined by the user is exceeded, the program records the position as an edge point. After all pixels are inspected, the edge points are searched for a relationship. For example if two edge points are near enough or the gradients of the points are about the same angle, these points are considered to be the part of the same curve. When all curves are found the program employs the Generalized Hough Transform to find the R tables. R tables are constructed by relating the gradients of the edge points and these edge points' distance (r) to a reference point and the angle (β) between the line from the reference point to the edge point and horizontal axis. So that the learning phase of the program is completed. Figure III.1 shows an R Table.

$\phi_1 = 0$	$(r,\beta)_{1_1}$	$(r,\beta)_{1_2}$	$\cdots$	$(r,\beta)_{1_{m_1}}$
$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$
ϕ_j	$(r,\beta)_{j_1}$	$(r,\beta)_{j_2}$	$\cdots$	$(r,\beta)_{j_{m_1}}$
$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$
$\phi_k = \pi$	$(r,\beta)_{k_1}$	$(r,\beta)_{k_2}$	$\cdots$	$(r,\beta)_{k_{m_1}}$

Figure 1 R Table [6].

4. TARGET TRACKING

After learning the template, the camera continues to take the frame sequences. In every frame algorithm do the same as in the beginning of the learning phase. The first step is again to find the edge points in the whole image. Then the edge points should be analyzed according to the parameters

defined by the user to find the curve points. From that point on the algorithm moves in the opposite way as of learning phase. The angle between the gradients of the edge points and the horizontal axis is computed and utilized in R Table as the angle of Φ. By using r and β found in the table, the real reference point is reached from the edge points if the curves are alike the curves found in the template. For every edge point when that process is over there is going to be an accumulation in the reference point. But if a different curve is employed there will not be an accumulation in any reference point. For about every edge point there is going to be a different reference point.

Targets found in the image are designated by a yellow rectangle. In Figure IV.1 an empty tea glass is taken as the template and tracked although there has been another tea glass same in the shape filled with tea.

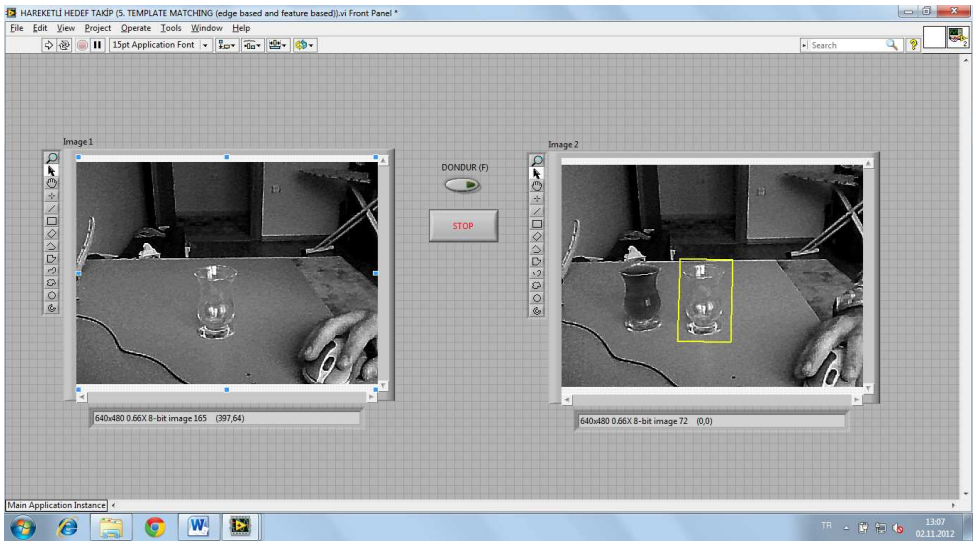

Figure 2 Target Recognition and Tracking Interface

5. CONCLUSION

Windows 7 operating system and LABVIEW 2011 sp1 version are utilized to generate the algorithm based on Generalized Hough Transform. With the current state of the program it is possible to track an object while it is in the same appearance. But if the object appearance is changed because of the object's movement around its own axis then it is not possible to track the template. On the other hand rotation from 0 to 360 degree is easily responded by the algorithm and the target is designated as rotated. Meanwhile the program demonstrates a real time operation.

In the following studies we will try to track the target from any angle view and will try to find the distant matches by employing scaled templates. Apart from that with the upgraded version of operating system, processor and the interface program, it is believed that the algorithm can give better results.

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