International Journal of Computer Engineering & Technology (IJCET)
Volume 9, Issue 4, July-Aug 2018, pp. 238-246, Article IJCET_09_04_026
Available online at http://www.iaeme.com/IJCET/issues.asp?JType=IJCET&VType=9&IType=4
Journal Impact Factor (2016): 9.3590(Calculated by GISI) www.jifactor.com
ISSN Print: 0976-6367 and ISSN Online: 0976–6375

ANALYSIS OF TEMPLATES MATCHING FOR HUMAN BODY PARTS RECOGNITION

S.Gomathi
Assistant Professor, Department of Computer Science,
SDNB Vaishnav College for Women, Chennai, India

D.Murugan
Professor & Head, Department of Computer Science and Engineering,
Manonmaniam Sundaranar University, Tirunelveli, India

ABSTRACT

An object recognition system finds objects in the real world from an image of the world. Object recognition is a process for identifying a specific object in a digital image or video. Template matching is a technique in digital image processing for finding small parts of an image which match a template image. A template is nothing but a sub image which is small. The goal is to find occurrences of this template in a larger image that is to find matches of this template in the image. In this present work object recognition of human body parts using a template matching technique.

Keywords: Template, Object recognition, Template matching, Human body parts, Digital image processing.

Cite this Article: S.Gomathi and D.Murugan, Analysis of Templates Matching For Human Body Parts Recognition. *International Journal of Computer Engineering & Technology*, 9(4), 2018, pp. 238-246.
http://www.iaeme.com/IJCET/issues.asp?JType=IJCET&VType=9&IType=4

1. INTRODUCTION

Object recognition in computer vision is the task of finding a given object in an image or video sequence. Object recognition is fundamental component of artificial intelligence and computer vision. Object recognition methods are used in various areas such as science, engineering, medical applications, etc. Humans recognize a large amount of objects in images with little effort, regardless of the fact that the image of the objects may differ somewhat in different viewpoints, in several different sizes /scale or even when they are translated or rotated [1]. Objects can even be recognized when they are partially obstructed from view. This task is still a challenge for computer vision systems in general.

Template Matching is a high-level machine vision technique that allows to identify the parts of an image that match the given image pattern. Cross Correlation is the basic statistical approach to image registration. It is used for template matching or pattern recognition.

Template can be considered a sub-image from the reference image, and the image can be considered as a sensed image. [2]

2. REVIEW OF LITERATURE

C. Saravanan et al.[2] proposed a face matching algorithm that allows a template called extracted face of person which is the Region of Interest from one image and start search for matching with the different image of same person taken at different times, from different viewpoints, or by different sensors using Normalized Cross-Correlation (NCC). In [3] the author proposed a procedure for digital image correlation is described which is based on least squares window matching. J. P. Lewis [4] proposed the method for fast normalized crosscorrelation. This article shows that unnormalized cross correlation can be efficiently normalized using precomputed tables containing the integral of the image of the search window. Nadir Nourain Dawoud et al. [5] proposed a fast template matching technique based on Optimized similarity measurement metrics namely: Sum of Absolute Difference (OSAD) and Sum of Square Difference (SSD) to overcome the drawback of NCC. Wiedo Hu et al.[6] proposed template match object detection for inertial navigation systems (INS). The proposed method is an image processing technique to improve the precision of the INS for detecting and tracking the ground objects from flying vehicles. Reinders [7] present an eye tracking algorithm which is robust against variations in scale, orientation and changes of eye appearances, such as eye blinking. The locations of the eye regions in the different frames are found using template matching. Gavrila et al. [8] proposed the clustered full body human templates into a hierarchical structure where the similarity between two templates was defined by the Chamfer distance. For each sliding detection window, the best matching template is found by traversing the tree from root to leaf in depth-first search strategy.

3. PROPOSED METHOD

This article present the framework of finding a given object in an image. Template matching finds all the points inside an image which match a template. One of the sub problems that occur in the specification above is calculating the similarity measure of the aligned pattern image and the overlapped segment of the input image, which is equivalent to calculating a similarity measure of two images of equal dimensions. This is a classical task, and a numeric measure of image similarity is usually called image correlation.

3.1. ALGORITHM FOR PROPOSED METHOD

- Read the original image.
- Read the template image.
- Calculate the correlation.
- Finding the most likely region.
- Perform the Hypothesis test.
- Detect the area.

3.2. CORRELATION

Correlation is a measure of the degree to which two variables agree, not necessary in actual value but in general behaviour. The two variables are the corresponding pixel values in two images, template and source. The correlation coefficient is a measure that determines the degree to which two variables' movements are associated. The range of values for the correlation coefficient is -1.0 to 1.0. If a calculated correlation is greater than 1.0 or less than -1.0, a mistake has been made. A correlation of -1.0 indicates a perfect negative correlation, while a correlation of 1.0 indicates a perfect positive correlation.

3.3. TEMPLATE MATCHING

A template is a small image (sub-image). The goal is to find occurrences of this template in a larger image. That is, you want to find matches of this template in the image. General classifications of template or image matching approaches are: Template or Area based approaches and Feature-based approaches [9].

Featured-based approach:

Featured-based approach is well suited when both reference and template images had more correspondence with respect to features and control points. Features include points, curves, or a surface model that have to be matched. Here, the aim is to locate the pair wise connection between reference and template using their spatial relations or descriptors of features. Subcategories of the above approach are spatial relations, invariant descriptors, pyramids and wavelets and relaxation methods.

*** Area-based approach:***

Area-based methods are sometimes called as correlation-like methods or template matching methods. For the templates which may not provide a direct match, then Eigen spaces are used, which gives the detail of matching image under various conditions, as illumination, color contrast or acceptable matching poses.

4. APROCHES OF TEMPLATE MATCHING

4.1. CROSS-CORRELATION COEFFICIENT

One of the sub problems that occur in the specification above is calculating the similarity measure of the aligned pattern image and the overlapped segment of the input image, which is equivalent to calculating a similarity measure of two images of equal dimensions. This is a classical task, and a numeric measure of image similarity is usually called image correlation.

The fundamental method of calculating the image correlation is so called crosscorrelation, which essentially is a simple sum of pairwise multiplications of corresponding pixel values of the images. Correlation is an important tool in image processing, pattern recognition, and other fields. The cross correlation coefficient [2,10] is defined as

$$\gamma(x,y)=\frac{\sum_s\sum_t \delta_{I(x+s,y+t)}\,\delta_{T(s,t)}}{\sum_s\sum_t \delta^2_{I(x+s,y+t)}\,\delta^2_{T(s,t)}} \qquad (1)$$

Where

$$\delta_{I(x+s,y+t)} = I(x+s,y+t) - \bar{I}(x,y)$$

$$\delta_{T(s,t)} = T(s,t) - \bar{T}$$

$$s \in \{1,2,3,\text{---------},p\}$$
$$t \in \{1,2,3,\text{---------},q\}$$
$$x \in \{1,2,3,\text{---------},m-p+1\}$$
$$y \in \{1,2,3,\text{---------},n-q+1\}$$

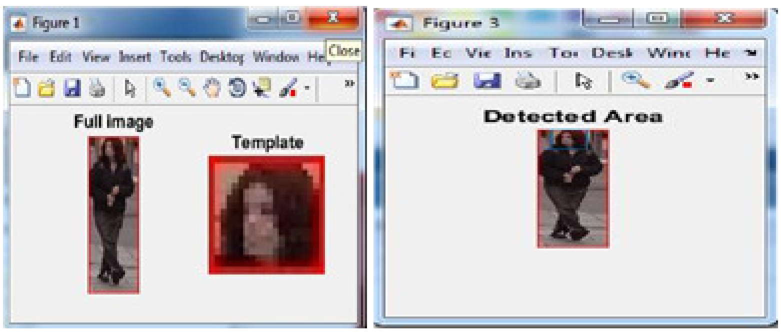
$$\bar{I}(x,y) = \frac{1}{pq}\sum_s\sum_t I(x+s,y+t)$$

$$\bar{T} = \frac{1}{pq}\sum_s\sum_t T(s,t)$$

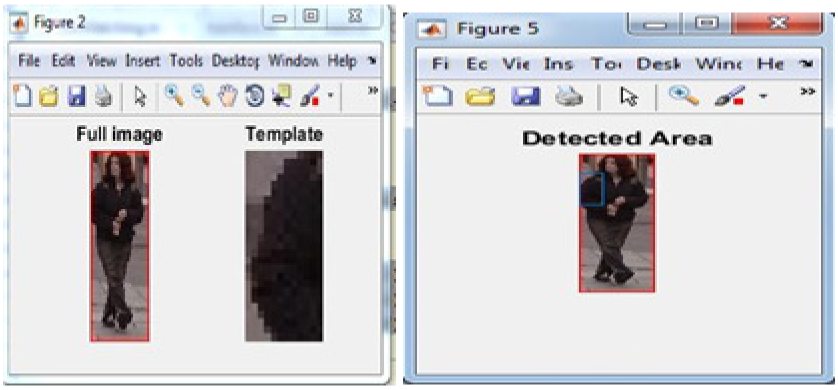
The value of cross-correlation coefficient □□ ranges from –1 to +1 corresponds to completely not matched and completely matched respectively. For template matching the template, T slides over I and □□ is calculated for each coordinate (x,y). After calculation, the point which exhibits maximum □□ is referred to as the match point.

4.2. TEMPLATE MATCHING OF HUMAN BODY PARTS

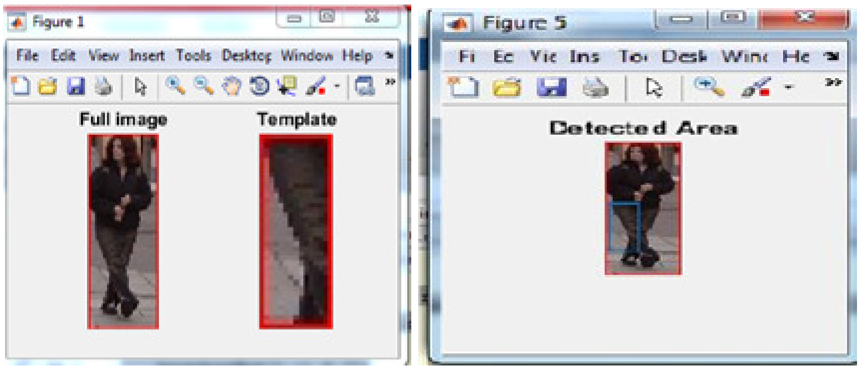
Template matching technique is one of the methods used for ground object detection and tracking. . A template matching algorithm works by computing a fit score for each pixel in the image and then looking for local maximums. The tested images for various characteristic for sample real time image1,2 and 3 are given below. The fig. 1 shows the template matching of Image 1 which contains the and template image of face(a), left hand(c), left leg(e) and right leg(g).



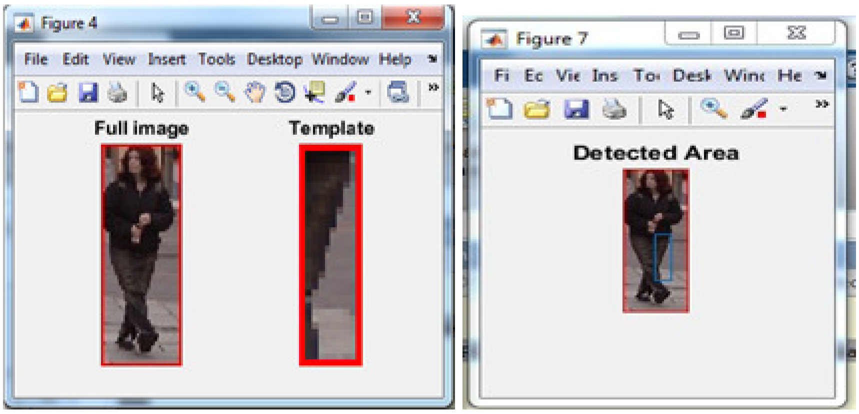
(a) Face Template (b) Template Matching of Face



(c) Left hand Template (d) Template Matching of Left hand



(e)Left leg Template (f) Template Matching of Left leg

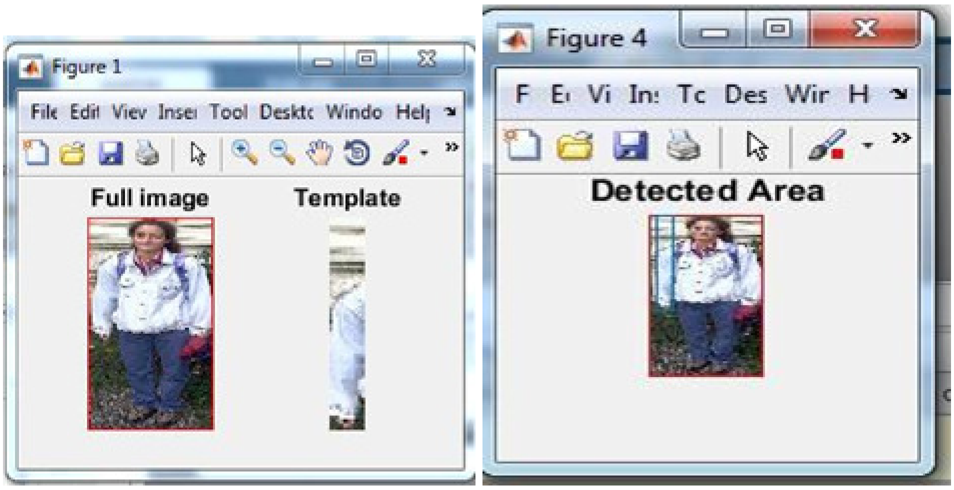


(g) Right leg Template (h) Template Matching of Right leg

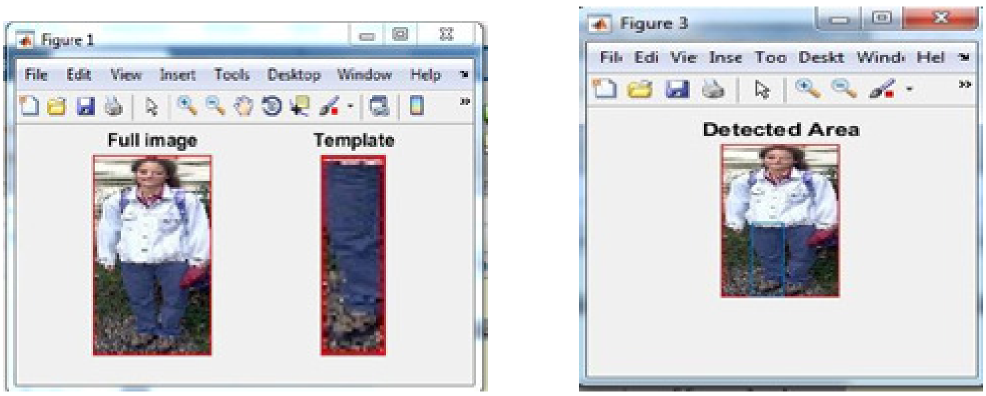
Figure 1 Template Matching of Human Body Parts in Image 1

The below fig. 2 shows the template matching of Image 2 which contains template image of face(a), left hand(c), left leg(e) and right leg(g) in image 2.

(a) Face Template (b) Template Matching of Face



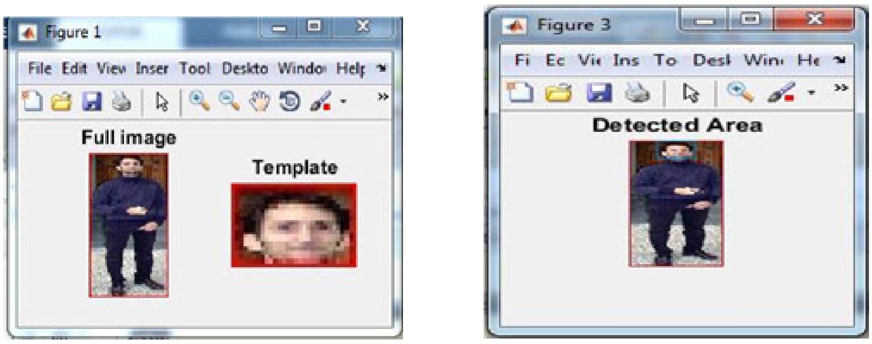
(c) Left hand Template (d) Template Matching of Left hand



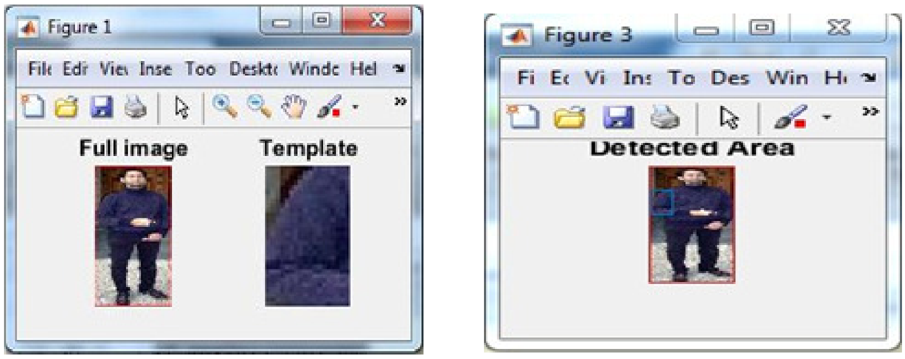
(e)Left leg Template (f) Template Matching of Left leg

Figure 2 Template Matching of Human Body Parts in Image 2

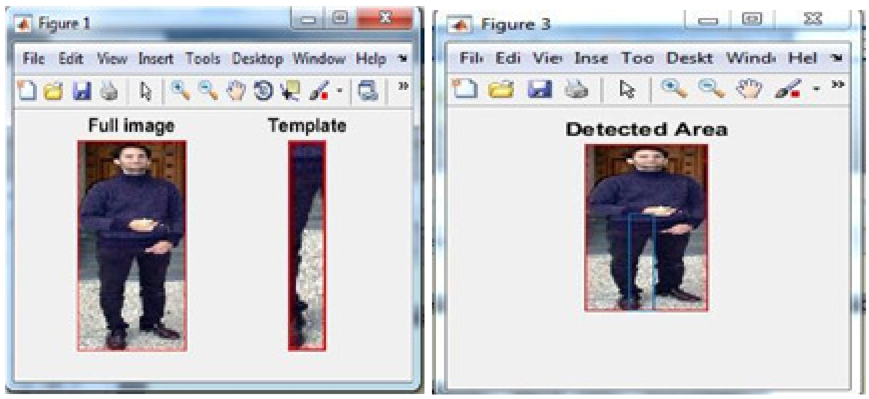
The below fig. 3 shows the the template matching of Image 3 which contains template image of face(a), left hand(c), left leg(e) and right leg(g) in image 3.



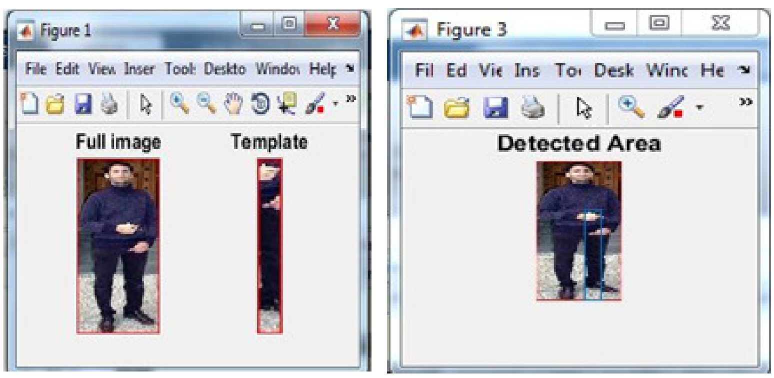
(a) Face Template (b) Template Matching of Face



(c) Left hand Template (d) Template Matching of Left hand



(e)Left leg Template (f) Template Matching of Left leg



(g) Right leg Template (h) Template Matching of Right leg

Figure 3 Template Matching of Human Body Parts in Image 3

5. RESULTS AND CONCLUSION

The cross-correlation coefficient algorithm is applied for solving object recognition problem. In this research work the performance has been studied for number of human images with templates. The work was tested images from the database of 200 images for each and every parts of human body .In this article investigate the effect of several training parameters on recognition accuracy. The trends are highly correlated the real test sets appears consistently 'easier', probably due to the less varied poses present.

Accuracy:

Accuracy refers to the closeness of a measured value to a standard or known value. In other words, accuracy describes the difference between the measurement and parts actual value.

Fig 4 Accuracy for Human Body Parts Recognition of Dataset

Table 1 Accuracy for Dataset

Data Set		Face	Left Hand	Right Hand	Left Leg	Right Leg
IndriaPerson dataset	Image 1	0.8118	0.7766	0.7368	0.8780	0.8587
	Image 2	0.8235	0.7348	0.7817	0.7013	0.8932
	Image 3	0.8137	0.6676	0.5373	0.7145	0.5853
Accuracy		**81.63%**	**72.63%**	**68.52%**	**76.46%**	**77.90%**
Benchmark dataset	Image 1	0.7353	0.6843	0.6156	0.7453	0.4875
	Image 2	0.4357	0.3524	0.5125	0.2369	0.4367
	Image 3	0.5874	0.3412	0.4521	0.5471	0.2463
Accuracy		**58.61%**	**45.93%**	**52.67%**	**50.97%**	**39.01%**

It is evident from the table 1 Indria Person Dataset gives the higher accuracy than the Benchmark dataset.

Precision and Recall:

Precision describe the variation in measure the same part repeatedly with the same system. Precision and Recall are defined as follows:

$$\text{Precision} = \frac{TP}{TP + FP} \quad (2)$$

$$\text{Recall} = \frac{TP}{TP + FN} \quad (3)$$

Table 2 Performance of Dataset

Dataset	Precision	Recall
Indria Person Dataset	98.4%	94.5%
Benchmark Dataset	80.0%	32.4%

The proposed algorithm successfully employed the cross-correlation method to solve the object recognition problem. The simple template matching algorithm presented here has achieved promising results of recognition high accuracy rates gives the Indria Person Dataset.

The maximum cross-correlation coefficient value indicate the perfect matching of extracted object with the target image. The system successfully recognized the various objects.

REFERENCES

[1] Sreejith C, Sreeshma K, Suhanna C HA , "Study on Pattern Matching using Eigen Algorithm" Dept. of CSE, MEA, Engg. College, Vengoor, Kerala, India.

[2] C. Saravanan, M. Surender, "Algorithm for Face Matching Using Normalized CrossCorrelation", International Journal of Engineering and Advanced Technology (IJEAT), Vol. 2(4), 2013, pp.930-934.

[3] ACKERMANN, F. "Digital image correlation: Performance and potential application in photogrammetry". Photogrammetric Record 11 (64), 1984, pp.429-439.

[4] J. P. Lewis, "Fast normalized cross-correlation", Canadian Image Processing and Pattern Recognition Society, Quebec City, Canada, May 15-19, 1995.

[5] Nadir Nourain Dawoud, Brahim Belhaouari Samir, Josefina Janier,"Fast Template Matching

[6] Method Based on Optimized Metrics for Face Localization", Proceedings of the International Multi Conference of Engineers and Computer Scientists, 2012.

[7] Wiedo Hu, Ahmed Mohamed Gharuib, Alaa El-Din Sayed Hafez," Template Match Object Detection for Inertial Navigation Systems", Positioning, Vol. 2, 2011.pp.78-83.

[8] Reinders M., "Eye tracking by template matching using an automatic codebook generation scheme", Third annual conference of the Advanced School for Computing and Imaging, Heijen, The Netherlands, 1997, pp. 85-91.

[9] Gavrila.D.M and Philomin.V ,"Real-time object detection for smart vehicles," in Proc IEEE International on Computer Vision, Vol. 1,1999, pp. 87–93.

[10] Nazil Perveen, Darshan Kumar and Ishan Bhardwaj," An Overview on Template Matching Methodologies and its Applications", International Journal of Research in Computer and Communication Technology, Vol 2(10), 2013, pp.988-994.

[11] Kavita Ahuja, Preeti Tuli," Object Recognition by Template Matching Using Correlations and Phase Angle Method", International Journal of Advanced Research in Computer and Communication Engineering ,Vol. 2(3),2013, pp.1368-1373.