HSI Color Component Ratio for Compact Object Representation

Tin Tin Yu[1], Zin Mar Win[2]

[1] *University of Computer Studies, Mandalay,*
[2] *University of Computer Studies, Mandalay,*

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Abstract- A feature extraction method is proposed for discriminative features on segmented moving objects and these compact set of color feature for object representation tend to handle the large amount of local features in feature correspondence and high accuracy in object classification in challenging sequences. Test sequences from the Caviar Test case scenario dataset and online benchmark tracking dataset are used in experiment to prove the robustness of proposed method.

***Index Terms*-** Caviar Test Case scenario, Online Benchmark tracking dataset

I. Introduction

The research trend of Object tracking and Identification still remains as the most interested field in visual application systems. Identified objects in moving object is very difficult task because a number of challenges comes in practical condition that demand to be concerned with, by the robust feature representation approach. Challenges in moving video sequences may be containing change in illumination, shadows, partial occlusion, Scale Variation, Occlusion, Deformation, Fast Motion, and Background Clutters etc. Object Representation become critical factors and how one defines the object highly impact to the difficulty level of this challenging factors.

The development of vigorous vision is still a general concern for industry and service area applications in real time. Industrial vision sensors are commonly exposed to significant noise and yield a prosperity of data. Hence, a select number of features are has been chosen to measure a number of properties of the mission, for example, the corner portion, edge length. Feature extractors are historically linked pattern recognition and refer to plotting to reduce and condense the dimensions of the patterns. And also feature extraction increase generalization capability and computational requirements for classification and recognition. Thus feature extraction got a lot of awareness in the recent two decades. Important changes in spatial, temporary conditions in real-time situation tends to the task robust and reliable feature extraction very challenging. The most important requirements for robust visual measurements that is speed, accuracy and reliability in the study [9].

Classification and recognizing objects is the process of tracing the interested objects in video sequences. Its research trend still remains as the most interested field in visual application systems. To accomplish in handling all challenging scenarios with one single approach will not be possible. If a robust target representation can be developed that can be adaptive with variations, the accuracy of classification and tracking result can improve significantly. The most important requirement for visual extraction is that the image quality parameters are reliable, accurate and rapid measurement, despite the relatively important factor and image position changes due to the relative motion in reality.

II. Related Works

S. Kim et al. [4] introduced a method of classifying objects focused on surface labeling in the real world background. They could reduce the outcome of entropy based codebook surface marks. Furthermore, the identification codebook is selected from a codebook specific to that category controlled by the entropy of the field codebook. High entropy books are deleted first because they give ambiguous class labels. Finally, they evaluated those codebooks using multiple classifier namely NNC (Nearest Neighbor Classifier) and SVM (Support Vector Machine) classifiers in order to different distance measurement. They could get better performance with visual word frame bags with the best set of features, codebooks, and classifiers. This work are useful for the selecting and classifying codebooks with other complex classification methods. P. Chang et. al [1] describes the general occurrence of color in detail The histogram (CH) is a valid way to embody objects for image recognition. By tracking pairs of pixels you can add a variable amount of geometry to a common color histogram. They also analysed the algorithm to approximate false alarm values and used some of them to set some algorithm parameters. These results show that the algorithm works despite confusion background disruption and clogging and bending of a small amount of objects.

A. F. Otoom et. al [6] evaluated the performance of the various function sets to determine the optimal set of elements that seemed more useful in accurately classifying abandoned objects. By the experimental result, this approach to classification based on statistics of geometric element elements is higher than the approaches based on the other two scale invariant image transformation (SIFT) using different classification and evaluation methodology they concluded. Classification based on statistical geometric primitives that performs ten-fold cross validations gave an average 22% higher recognition accuracy with 7% lower false alarm associated to the second best access based on SIFT key histogram. The experimental analysis showed that geometric primitive statistics maximizes separation between classes and then it make simpler the classification process.

R. Rean et. al [7] introduced a shape context, a color histogram, and a completed local binary pattern (CLBP) approach to classify various object category classes . Shape context provides 93% accuracy with ETH - 80 database. They proved this approach is better than the other approaches. The result found can be further enhanced by using a better function extraction and using a combination of shape and color descriptions, shapes, and structure descriptors. Mokjiet. al [5] details the new gray level co-occurrence matrix (GLCM) based on the Haar wavelet transform. GLCM based on Haar wavelet transform has the function of reducing the computational load of pixel input by 62.5% at maximum. As far as performance measurement is concerned, Haar wave transformation not only reduces the computational load and also improve the accuracy of classification of Brodatz texture images equalled to the original calculation. L. Yang et. al [8] proposed a new structure to unify visual codebook generation with classifier training for object category recognition. Two important features performed this task from existing object recognition methods. First, unlike the cluster approach where individual image functions are combined with a single visual word, each image function is encoded using a visual bit vector. Second, unlike the standard practice of separating visual codec generation process and classifier training, the proposed approach uses these two processes with a single optimization framework under one objective function Integrate. Iterative algorithms are introduced that effectively identify optimal visual bits and associated weights. Experiments in the PASCAL 2006 data file showed that their proposed approach was an important step in the classification of object categories compared to the latest approaches.

III. PROPOSED FEATURE EXTRACTION

The HSI color space represents a color similar to the scan color of the human eye, so this type of color representation is a very important and attractive color model for recent image processing applications [3]. The HSI color model stands for each color with three color components: Shade (H), Saturation (S), Intensity (I) [2]. The following figure describes how HIS color model symbolizes the corresponding color value.

HSI color component ratio for target recognition of moving objects from the challenging tracking sequences. Figure3 shows the basic structure of the proposed architecture using in the work.

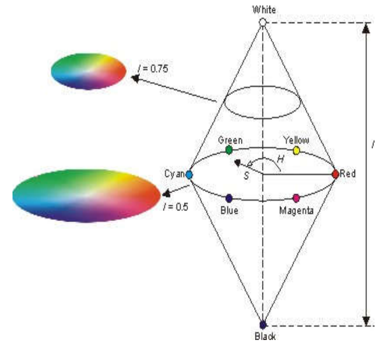


Fig. 1 HSI Color Model Representation

The work contains three processing steps for the moving object tracking and identification system as in figure2. Object segmentation is the pre-processing step for the detection moving object in video sequences. In the pre-processing stage, segmenting the moving object from video scene of each frame with the help of Gaussian Mixture Model.

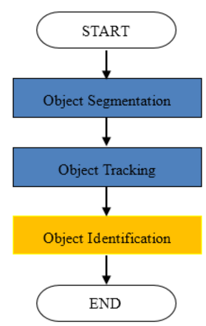


Fig 2: Processing Steps of the Object Tracking and Identification System

The next step is the object tracking. Object tracking is the process of tracing the interested objects in video sequences. In this work, these segmented object will be used in object tracking method to visualize the usability of proposed feature and to get the more accurate tracking results.To tracking the object, Kalman Filter was used in this work. The visualization of tracked object and growth truth portion can be seen in figure4.

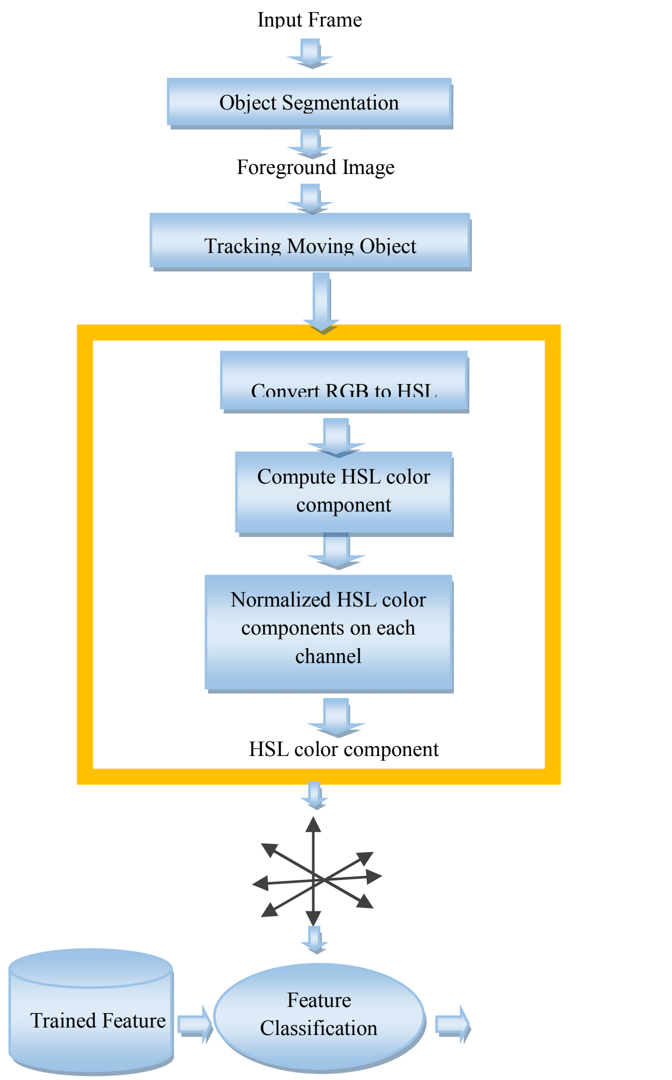


Fig 3: Architecture of the Proposed Feature Extraction Method

Fig 4: Visualization of Overlap Ratio on the Tracking Result for Walking Sequences

To classify and identify the moving object as labelling object in the video frame, normatlization of HIS color feature on segmented moving object is used. These features are extracted from separated channel namely hue, saturation and normalize them to get the compact structure. Firstly compute the HIS Color Component from the segmented RGB objects by eq (1), (2) and (3).

$$H(Hue)=\begin{cases} \theta & if\ B \leq G \\ 360-\theta & if\ B > G \end{cases} \quad (1)$$

$$S(Saturation)=1-\frac{3}{(R+G+B)}[\min(R,G,B)] \quad (2)$$

$$I\ (Intensity)=\frac{1}{3}(R,G,B) \quad (3)$$

Then the three color moment are applying on the extracted color channels separately by this ways (4), (5) and (6).

$$\mu = \frac{1}{N}\sum_{i-1}^{N} A_i \quad (4)$$

The variance deviation is one kind of normal distribution of the particular color channel.

$$V = \frac{1}{N-1}\sum_{i=1}^{N}|A_i - \mu|^2 \quad (5)$$

Where,

μ= Mean of distribution

N= number of observations

A_i= current color channel value

V= variance of distribution

Skewness can be understood as a measure of the degree of asymmetry of distribution.

$$S=\frac{E(A-\mu)^3}{\sigma^3} \quad (6)$$

Where,

μ = the mean of x

S= skewness of normal distribution

E(t)=the expected value of the quantity t.

σ= the standard deviation of x

The compact feature length in this work is only 9 features.

Feature 1 to 3: mean to HSI color channels

Feature 4 to 6: Variance to HSI color channels

Feature 7 to 9: Skewness to HSI color channels

IV. EXPERIMENTAL RESULT

The image pre-processing or image segmentation stage is performed before other processes. The original image, ground truth and segmentation result (foreground image) of three video sequences namely walking2, crossing from Online Benchmark dataset and also two video sequences namely wallk1 and walk2 from CAVIAR Test Case Scenario dataset are shown in Table 1 respectively. Segmentation result for detecting moving part is evaluated on the pixel level common segmentation criteria. The result for the object segmentation result are shown in Table2.

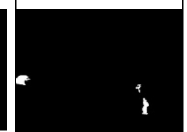
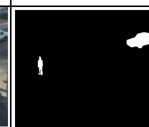
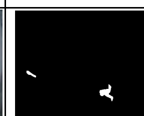
TABLE I

Attributes of Challenges and Relative Sequences

Dataset	Sequences	Resolution	Challenges	Number of Frames
Online Bench Tracking	Walking 2	576*768	Scale Variation, Occlusion, Deformation	412
	Crossing	240*360	Scale Variation, Deformation, Fast Motion, Background Clutters	120
CAVIAR Test Case Scenario	Walk1	288*384	Scale Variation, Illumination Variations	541

TABLE II

Detection Result of Moving Parts from Sequences

Sequences	Original Frame	Growth Truth	Segmentation Result
Walking			
Crossing			
Walk1			

Tracking result with the overlap ratio concerned with bounding box of the three challenging test sequences are shown in Table3.

TABLE III

Overlap Ratio of the Tracking Sequences

No.	Sequence	Overlap Ratio
1.	Walking	0.67813
2.	Crossing	0.61662
3.	Walk1	0.78540

Object Classifcation result on three different challenging sequences are described in Table4. To be avoid the data bais, ten fold crosss validation is used with three classifier namely support vector machine (SVM), k-nearest neighbor (KNN) and Boosted Tree . Accuary and time of the proposed feature extraction of HIS color component portion on challenging sequecnes can be seen in Figure 5 and Figure6.

TABLE IV

Classification Result with HSI Color Component on Three Challenging Sequences

Sequence	SVM		KNN		Boosted Tree	
	Accuracy (%)	Predict Time %(s)	Accuracy()	Predict Time	Accuracy (%)	Predict Time
Walking	91.3	4.8576	90.7	0.92825	89.0	5.500
Crossing	92.1	2.1384	93.3	0.98408	41.6	1.0194
Walk1	94.9	2.2821	89.1	1.0475	91.7	12.428

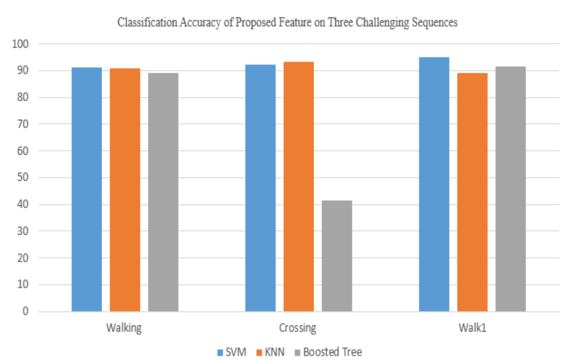


Fig5: Classification Accuracy of Proposed Feature on Three Challenging Sequences

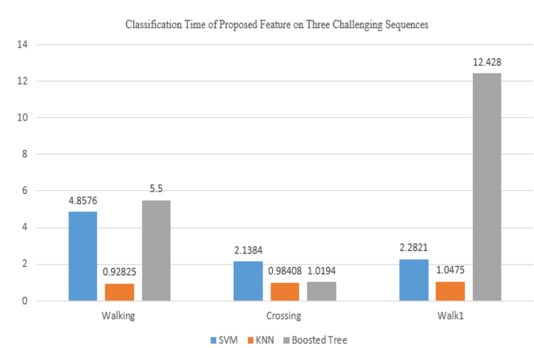


Fig6: Classification Time of Proposed Feature on Three Challenging Sequences

V. CONCLUSION

This work presents the overview design and step by step implementation of the identification and detection of tracked moving objects from the video sequences. The accuracy and time of the proposed feature extraction methods was tested by using multiple classifier and these the identification results were reported. Intensive experimental shows the proposed feature extraction are compact and effectiveness on challenging sequences for object tracking and identification.

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AUTHORS

First Author – Tin Tin Yu, Ph.D candidate , University of Computer Studies, Mandalay , baybayyu@gmail.com

Correspondence Author – Zin Mar Win, Lecturer, University of Computer Studies, Mandalay zmwucsy@gmail.com