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ADVANCED TRENDS IN LOGO MATCHING AND RECOGNITION

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Abstract—Graphic logos are a special class of visual objects extremely important to determine the identity of something or someone. The main aim of this project is to present a highly effective and scalable framework for matching and recognizing logos from real environment. Given a query image and a large logo database and the goal is to recognize the logo contained in the query, if any. Efficient method presented which is better the existing method in terms of FRR and FAR. In this project we are extending the same method for improved scalability of logo detection and recognition. The recent method of logo detection and recognition is based on the definition of a "Context-Dependent Similarity" kernel that directly incorporates the spatial context of local features is under investigation. Formally, the Context Dependent Similarity Kernel function is defined as the fixed-point of three terms 1) an energy function which balances a fidelity term, 2) a context criterion, 3) an entropy term. In this project we are extending this method further for scalability as well as other rigid, non-rigid logo transformations. The analysis of proposed approach will be developed using MATLAB. During the simulation we will first do comparative analysis proposed Context dependent similarity matching and detection procedure against nearest neighbor SIFT matching, nearest neighbor matching with RANSAC verification so that we can claim the proposed method is best as compared existing once. Second we will evaluate the performance of proposed by considering the scalability factor and compute its precision and recall rate.
Keywords— logo recognition, CDS, SIFT, RANSAC.

I. INTRODUCTION

The intensifying and the massive production of visual data from companies and institutions, and the increasing popularity of social systems for diffusion and sharing of images and video have more recommended research in effective solutions for object detection, recognition to support automatic group of images and video and content-based recovery of visual data. Graphic logo is a special class of visual objects to assess the identity of something. In the industry they have essential role to recall the customer's expectations associated with particular product and service. The economical relevance has motivated the active involvement of companies to scrutinize logo archives to find facts of similar already existing logos, discover the improper 'p0ior non-authorized use of the logos, that have small variations with respect to the originals to deceive customers, analyze videos to get the idea about how long time their logo has been displayed.

Logos are graphic production that either recall some real world objects, emphasize a name, and display some abstract sign that have strong perceptual appeal. Color may have some significance to evaluate the logo identity. But the distinctiveness of logos are studied by semiologists, graphic designers and experts of social communication.

Different logo may have similar layout with slightly different disposition of the graphic elements and localized differences in the orientation, size, shape, or in the case of malicious tampering differ by the presence or the absence of one or few traits. However logos often appear in images or videos of real world indoor and outdoor scenes superimposed on objects of any geometry and shirts of persons or jerseys of players, billboards, boards of shops and posters in sports playfields. Sometimes they are subjected to perspective transformation and deformation, often ruined by noise, lighting effects and partially occluded. Such images and logos thereafter have often comparatively low declaration and quality. Regions that include logos might be small, contain few information. Logo detection and identification in these scenarios has become important for a number of applications.

Several examples have been published in the literature, such as the automatic identification of product on the web to advance commercial search engines, the certification of the visibility of advertising logos in sport events, the recognition of near duplicate logos and unofficial uses. Special applications of social utility have also been reported as the recognition of groceries in shops to help the blind people. A generic systems for logo detection, recognition in images taken in real world environments must obey with contrasting requirements. On one hand, invariance to a large range of geometric, photometric conversion is required to comply with all the possible conditions of images or the video recording. Since in real world logos images are not detained in isolation, logo detection and recognition should be robust to partial occlusions and at the same time, particularly if we would like to realize malicious tampering, retrieve logos with local peculiarities.

II. PROPOSED APPROACH

The main aim of this project is to present a highly effective and scalable framework for matching and recognizing logos from real environment. Given the query image and a large logo database, the goal is to recognize the logo contained in the query, if any. Previously efficient method presented which outperform the existing method in terms of FRR and FAR. In the project we will extend the same method for improved scalability of logo detection and recognition. The recent method of logo detection and recognition which is based on the definition of a "Context-Dependent Similarity" kernal directly incorporates the spatial context of local features is under investigation.

Formally, the Context Dependent Similarity function is the fixed-point of three terms:1)an energy function which balances a fidelity term; 2) a context criterion; 3) an entropy term. In this project we are extending this method further for scalability as well as rigid and non-rigid logo transformation. The practical analysis of this proposed approach will be done using MATLAB. During the simulation we will first do comparative analysis proposed CDS matching and detection procedure against the nearest neighbor SIFT matching, nearest neighbor matching with RANSAC verification so that we can claim the proposed method is best as compared existing once. Second we will evaluate the performance of proposed by considering the scalability factor, compute its precision and recall rate.

Figure 1. MICC logo dataset

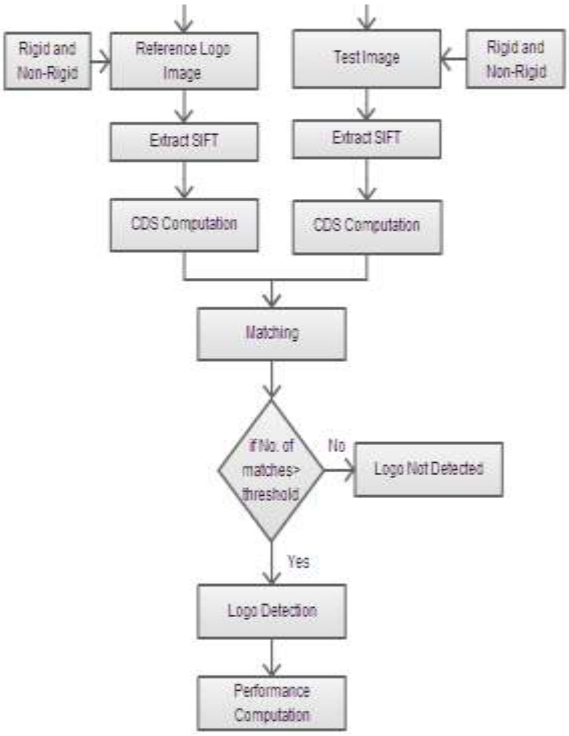


Figure 2. Architecture

III. SYSTEM SPECIFICATION AND ALGORITHM

3.1. Theorotical Foundation of Matching Algorithm

The user inputs the reference image and test image detection, First we find out that you want to process both images, all the features of their key points out of both finding images, and we will remove image using SIFT features, using the features we will explore the images we object descriptors that match, logo image to detect the CDS algorithm applied.

3.1.1. Algorithm

Logo Detection and Recognition(CDS)
Input: Reference logo image: IX, Test image: IY, CDS
Parameters: ε, Na, Nr, α, β, τ.
Output: A Boolean value determining whether the reference logo in IX is detected in the IY.
Extract the SIFT from IX, IY and let SX: = {x1. . . xn}, SY := {y1, . . . , ym} be respectively the list of interest points of both images;
for i ← 1 **to** n **do**
Compute the context of xi, given ε, Na, Nr;
for j ←1 **to** m **do**
Compute the context of y j, given ε, Na, Nr ;
Set t ←1, maxt ←30;
repeat
    for i ←1 **to** n **do**
        for j ←1 **to** m **do**
Compute the Context Dependent Similarity matrix entry **K**(t)xi ,y j, given α, β;
Set t ←t + 1;
Until the convergence (i.e., ││**K**(t) − **K**(t−1)││2 → 0) OR
t > maxt;
K ← **K**(t);
for i ← 1 **to** n **do**

for j ← 1 **to** m **do**

Compute the $\mathbf{K}_{y_j|x_i} \leftarrow \frac{\mathbf{K}_{x_i, y_j}}{\sum_m \mathbf{K}_{x_j, y_s}}$

A match between xi and y j is declared iff $\mathbf{K}_{y_j|x_i} \geq \sum \mathbf{K}_{y_s|x_i}$;

if number of matches in $S_Y > \tau|S_X|$ **then**
return true i.e. the logo detection
else
return false;

Provided that τ ›› 1/q

$$\nu \overset{n\to+\infty}{\longrightarrow} 0 \quad \text{and} \quad P\left(\mathbf{K}_{Y_J|X} \geq \sum_{j \neq J}^{m} \mathbf{K}_{Y_j|X}\right) \overset{n\to+\infty}{\longrightarrow} 1.$$

Output: A Boolean value shows whether the reference logo in Ix is detected in Ir

IV. SIMULATION ENVORNMENT AND RESULTS

4.1 MATLAB

MATLAB is process oriented fourth generation programming language in which plotting the graph, matrix manipulation, creation of user interface & interfacing with program written in other language is allowed.

Matlab is invented from two words i.e. matrix laboratory. Matlab developed in 1970 by Cleve Molar, who is Chairman of computer science department of New Mexico.

MATLAB having five main components.

1. Development Environment.
2. Mathematical Function Library.
3. LAB Language.
4. Graphics.
5. The MATLAB application Programming Interface.

There are some features of MATLAB good for computation then platform independent, Understanding easier, device independent plotting, graphical user interface. In the data mining, embedded system, Animation, Graphics, Bio informatics, Life Sciences then control systems, networking and communication the MATLAB is used. Also in DSP based applications that is in image processing also MATLAB is used.

MATLAB have some disadvantages like the cost of this software is more than other simulation tool. The advantages are that it is used for math applications like equation, matrix calculations, plot equations calculations.

4.2 Software Requirements:

In this project we used the MATLAB 2012 version. By using this simulation environment result are actually analyzed and collected for proof study.

Table I. Software Specifications

Software Tools	Software Name
Operating System	windows 7/8
Development tool	MATLAB 2012.

4.3 Hardware Requirements:

Table II. Hardware Specifications

Hardware	Minimum Requirement
Microprocessor	PENTIUM IV 2.6 GHZ
Random Access Memory	512 MB DD RAM
Monitor	15”color
Hard disk(HDD)	20 GB

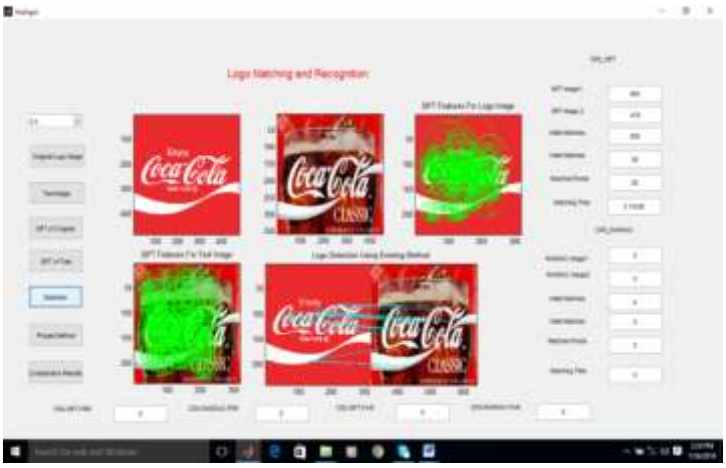


Fig. 3. Console output using CDS SIFT algorithm

In the above diagram for Coca Cola logo two images have taken that are original logo image and test image. From this CDS SIFT features of each image are obtained.

In the above diagram for CDS SIFT we filtered those interest points from both the images having nearly same orientation means that are initial matching points.

The interest points of original image = 460

The interest points of test image = 479

Initial matches = 208

Then take valid matches between these two images means those interest points which are included in logo only.

Valid matches = 36

So out of 36 we have to take those interest points which exactly detect that logo.

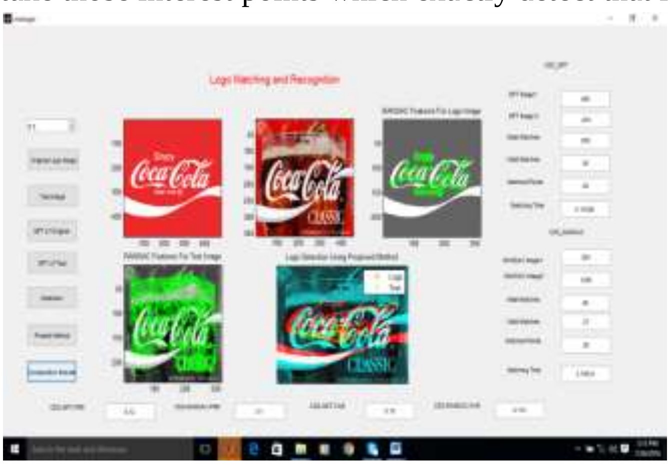


Fig. 4. Console output using CDS RANSAC algorithm

The above image shows the output using proposed algorithm that is CDS RANSAC and compared between these two algorithms.
Above diagram shows CDS RANSAC algorithm for that
Interest points of original image = 263
Interest points of test image = 1206
Initial matches = 46
Valid matches = 27
Matched points = 26
Matching time = 2.76

And also for this logo we have taken the parameters accuracy, false acceptance rate and false rejection rate and compared between these two algorithms.The last step is to compute the parameters like
Time : It is the time required to evaluate the corresponding algorithm.

$$\text{Accuracy} : \frac{\text{No. of correct images}}{\text{Total no. of images}}$$

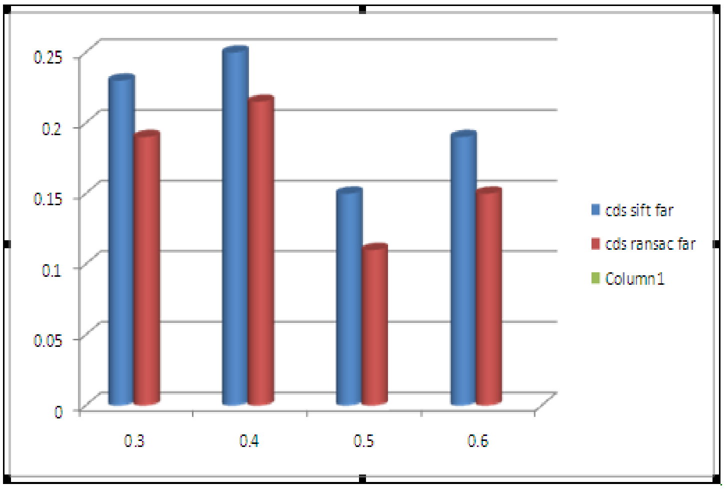
$$\text{FAR} = \frac{\text{No. of incorrect logo detection}}{\text{No. of logo detections}}$$

$$\text{FRR} = \frac{\text{No. of unrecognized logo appearance}}{\text{No. of logo appearances}}$$

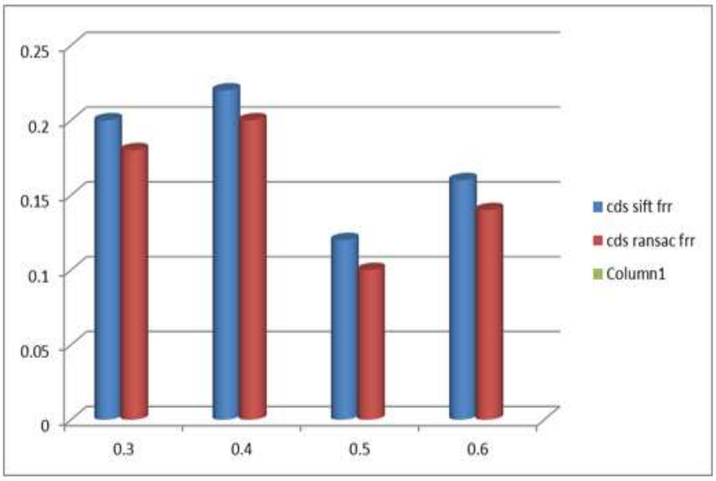
FAR(False Acceptance Rate) ,FRR(False Rejection Rate)

Table III. Comparison Of Parameters

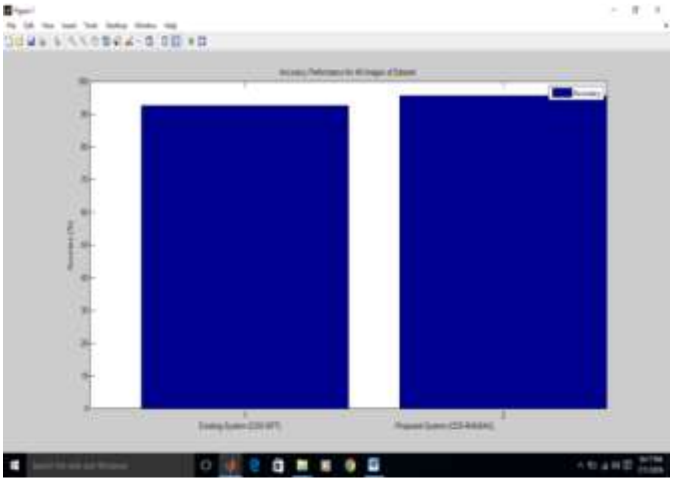
LOGO	THRESHOLD	FAR(%) Cds sift	FAR(%) Cds ransac	FRR(%) Cds sift	FRR(%) Cds ransac
Coca cola	0.3	0.23	0.19	0.20	0.18
	0.4	0.25	0.215	0.22	0.20
	0.5	0.15	0.11	0.12	0.10
	0.6	0.19	0.15	0.16	0.14



Graph 1.Graph of FAR (False Acceptance Rate)



Graph 2. Graph of FRR (False Rejection Rate)



Graph 3. Graph of Accuracy

V. CONCLUSION

In this paper we introduced the new class of similarity that is Context Dependent Similarity. From above comparison of tables and graphs we concluded that accuracy of proposed RANSAC method is more than existing CDS SIFT method and FAR and FRR is less. So proposed method is more accurate and less time consuming so that it is the best method than other.

The future work include application of this method to recovery of logo in video.

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BIOGRAPHIES

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