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Review of Logo Matching & Recognition System Based On Context Dependency

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ABSTRACT: In this paper we present a framework for logo retrieval in images and videos. The wide range application of visual data from Companies, Institution, Individuals and Social system like Flickr, YouTube is for diffusion and sharing of images and Video. There are several issues in processing visual data from an image which was corrupted by noise or subjected to any transformation and also its accuracy in matching Logos are some of the emerging research issues currently. To overcome these problem we have proposed a new class of similarities based on Context Dependent algorithm which enhances the performance in terms of accuracy in logo matching and computation time.

Through this paper, the design of Logo matching and recognition which is important for brand advertising and surveillance applications is proposed. It discovers either improper or non-authorized use of logos. Reference logos and test images are seen as constellations of local features (interest points, regions, etc.) and matched by minimizing an energy function mixing:

1) a fidelity term that measures the quality of feature matching
2) a neighborhood criterion that captures feature co-occurrence/geometry
3) a regularization term that controls the smoothness of the matching solution.
Context is a collection of interest points and Context Dependent Similarity Matrix is created to find interest point correspondences between two images in order to tackle logo detection.

KEYWORDS: Logo Matching, logo recognition, Content dependant similarities, logo images, context accuracy

I. INTRODUCTION

Logos—we see hundreds of them every day. We see them so much that we often don't even think about them. But years of work and millions of dollars go into even the simplest logos, and sometimes the layers of hidden meanings can be hard to believe. Logo retrieval from images is a challenging problem with potentially wide commercial applications. Most of such applications require real-time indexing and retrieval of logo images with high accuracy.Graphic logos are a special class of visual objects extremely important to assess the identity of something or someone. In industry and commerce, they have the essential role to recall in the customer the expectations associated with a particular product or service. This economical relevance has motivated the active involvement of companies in soliciting smart image analysis solutions to scan logo archives to find evidence of similar already existing logos, discover either improper or non-authorized use of their logo, unveil the malicious use of logos that have small variations with respect to the originals so to deceive customers, analyze videos to get statistics about how long time their logo has been displayed.

Logos are graphic productions that either recall some real world objects, or emphasize a name, or simply display some abstract signs that have strong perceptual appeal [see Figure. 1(a)]. The proposed method uses context dependent similarity algorithm which involves preprocessing the test image followed by interest point extraction, context computation and similarity design. This overcomes the limitation of processing an unclear or corrupted image which contain logo and check its genunity. Different logos may have similar layout with slightly different spatial disposition of the graphic elements, localized differences in the orientation, size and shape or in the case of malicious tampering differ by the presence or absence of one or few traits.
A generic system for logo detection and recognition in images taken in real world environments must comply with contrasting requirements. On the one hand, invariance to a large range of geometric and photometric transformations is

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required to comply with all the possible conditions of image or video recording. Since in real world images logos are not captured in isolation, logo detection and recognition should also be robust to partial occlusions.

Figure 1. (a) Examples of popular logos depicting real world objects, text, graphic signs, and complex layouts with graphic details. (b) Pairs of logos with malicious small changes in details or spatial arrangements. (c) Examples of logos displayed in real world images in bad light conditions, with partial occlusions and deformations.

II. RELATED WORK

Till now work on logo detection and recognition was concerned with providing some automatic support to the logo registration process. The system check whether other registered logos in archives of millions, exist that have similar appearance to the new coming logo image, in order to ensure that it is sufficiently distinctive and avoid confusion [3], [7]. Kato's system [9] was among the earliest ones. It converts a normalized logo image to a 64 pixel grid, and calculated a global feature vector from the frequency distributions of edge pixels. Recently, Wei *et al.* [10] proposed a different solution, where logos were described by global Zernike moments, local curvature and distance to centroid. Other methods have used different global descriptors of the full logo image either accounting for logo contours or exploiting shape descriptors such as shape context. This method assume that a logo picture is fully visible in the image, is not corrupted by noise and is not subjected to transformations. According to this, they cannot be applied to real world images. Hichem Sahbi, Lamberto Ballan, in their paper they presented the validity of method through extensive experiments on the challenging MICC-Logos dataset.This method overtakes, by 20%, baseline as well as the state of the art matching /recognition procedures. [11].Sami M. Halawani1 and Ibrahim A. Albidewi in their research work concerned with the specific class of complicated objects, i.e. logo. The progress, particularly in this field, is still at extensive research work level, due to infinite varieties of shapes and classes which are used. Essentially, the algorithm proposed is based on Principle Component Analysis (PCA) approach. In this technique, the PCA is used to extract the features, kept inherent in the normalized pattern for later matching process. The experiment had shown that, the minimum number of weights needed to perform a correct recognition is seventeen. However, for the purpose of image reconstruction, this number is not enough to build a visible image [12].

Suma R1, Anita George introduced a method in their work is a novel logo detection and localization approach based on a new class of similarities referred to as context dependent The strength of the proposed method resides in several aspects: (i) the inclusion of the information about the spatial configuration in similarity design as well as visual features, (ii) the ability to control th influence of the context and the regularization of the solution via our energy function, (iii) the tolerance to different aspects including partial occlusion, makes it suitable to detect both near-

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duplicate logos as well as logos with some variability in their appearance[13].J.Matas et al , introduced a Novel rotation invariant detector. It was coined as SURF. A new robust similarity measure for establishing tentative correspondences is proposed. The robustness ensures that invariants from multiple measurement regions (regions obtained by invariant constructions from external regions), some that are significantly larger than the MSERs [6]. Guangyu Zhu:Doermann D. in their work aimed at Graphics detection and recognition are of fundamental research problems in document image analysis and retrieval. In this work, they developed an automatic logo-based document image retrieval system that handles: Logo detection and segmentation by boosting a cascade of classifiers across multiple image [9].David S. Doermann, Ehud Rivlin and Isaac Weiss In their work, they present a multi-level staged approach to logo recognition which uses global invariants to prune the database and local a fine invariants to obtain a more refined match. They obtain an invariant signature which can be used for matching under a variety of transformations.Their work provide a method of computing Euclidean invariants, and show how to extend them to capture similarity, a fine and projective invariants when necessary. They implement feature detection, feature extraction and local invara'ant algorithms and successfully demonstrate the approach on a small database[6].

Suda,P.Bridoux,C. Kammerer,B. in their research work presents work in the field of logo and word recognition. The approach is based on a general theory for signal registration and is thus applicable to a broad variety of signal processing domains. It has been fruitfully applied to solve speech and handwriting recognition as well as tasks in the field of document analysis [1].S.Shamini1, Dr.N.Jaisankar approaches a new class of similarities based on Modified Context Dependent algorithm. They implemented Scale invariant feature transform algorithm for key point extraction and enhanced context computation technique which enhances the performance in terms of accuracy in logo matching and computation time [14].Smeulders, Worring .M Santin, S.Gupta, A.jain presents a review of 200 references in content-based image retrieval. The work starts with discussing the working conditions of content-based retrieval: patterns of use, types of pictures, the role of semantics, and the sensory gap. Subsequent sections discuss computational steps for image retrieval systems. Step one of the review is image processing for retrieval sorted by color, texture, and local geometry. Features for retrieval are discussed next, sorted by: accumulative and global features, salient points, object and shape features, signs, and structural combinations thereof. Similarity of pictures and objects in pictures is reviewed for each of the feature types, in close connection to the types and means of feedback the user of the systems is capable of giving by interaction [2].Neumann et al. [4] uses projection profiles, normalized centroid distance, eccentricity, and various density features for logo recognition. These approaches have limitations. First, it is difficult to robustly extract high-level features (e.g. graphical, inverse, or circular text) in a geometrically invariant manner under diverse image qualities and degradations. Second, these methods are hard to extend because they are based on a collection of handpicked and trainable features and a variety of decision rules.D.Lowe *et al* , Proposed Distinctive invariant method which is used for feature extraction. Object recognition is done from nearest neighbor algorithm it also describes an approach to using these features for object recognition. The recognition proceeds by matching individual features to a database of features from known objects using a fast nearest-neighbor algorithm followed by a Hough transform [5].Wei-Qi Yan · Jun Wang · Mohan S. Kankanhalli presented the use of the temporal correlation of video frames to detect and remove video logos. In the video-logo-detection part, as an initial step, the logo boundary box is first located by using a distance threshold of video frames and is further refined by employing a comparison of edge lengths.[15]

III. CONTEXT-DEPENDENT SIMILARITY

In this paper, we present a novel solution for logo detection and recognition which is based on the "Context- Dependent Similarity" (CDS) kernel that directly incorporates the spatial context of local. Let $SX = \{x1. . . xn\}$, $SY = \{y1, . . . , ym\}$ be respectively the list of interest points taken from a reference logo and a test image (the value of n, m may vary with SX , SY).

1) *The use of context for matching:* Context is used to find interest point correspondences between two images in order to tackle logo detection while sometimes context was used for kernel design in order to handle object classification using support vector machines.

2) *The update of the design model:* Adjacency matrices are defined in order to model spatial and geometric relationships (context) between interest points belonging to two images (a reference logo and a test image). These adjacency matrices model interactions between interest points at different orientations and locations resulting into an anisotropic context.

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3) *The similarity diffusion process:* Resulting from the definition of context, similarity between interest points is recursively and anisotropically diffused.
4) *The interpretation of the model:* Designed similarity may be interpreted as a joint distribution (pdf) which models the probability that two interest points taken from $SX \times SY$ match. In order to guarantee that this similarity is actually a pdf, a partition function is used as a normalization factor taken through all the interest points in $SX \times SY$.

IV. PROPOSED METHOD

Image matching is a fundamental aspect of many problems in computer vision, including object or scene recognition, solving for 3D structure from multiple images, stereo correspondence, and motion tracking.The flow diagram for context dependent similarity algorithm is as shown in figure 2.

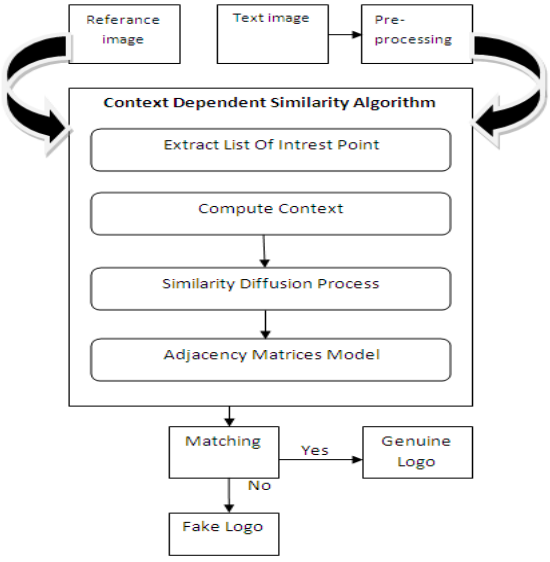

Figure 2: Flowchart of CDS Algorithm

The methodology describes a new logo matching scheme based on Context Dependent Similarity Matrix. There will be logo image as reference image and a video for testing the genunity of the logos. Video frames are extracted from the test video. Context of reference image and all the frames in the video are extracted. Matching between the video frames and reference image is done. SIFT features are invariant to image scaling and rotation, and partially invariant to change in illumination and 3D camera viewpoint..In this method the matching is done by dividing the image of logo into rows and columns. When this process is done the matching will be very accurate. The solution is proved to be highly effective and responds to the requirements of logo detection and recognition in real world images. The probability success of matching and detection is high.

System Design
The system modules are:

- Preprocessing
- Feature extraction
- Interest point recognition
- Logo matching

1) Pre-processing
Pre-processing consists of processes aimed at the geometric and radiometric correction, enhancement or standardization of imagery to improve our ability to interpret qualitatively and quantitatively image components. Pre-processing is an important technique which is usually carried out to filter the noise and to enhance the image before any processing

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- *Radiometric Enhancement:* The main purpose for applying radiometric corrections is to reduce the influence of errors or inconsistencies in image brightness values.
- *Spatial Enhancement:* Used to improve the visual quality analytical properties and extract biophysical/landscape parameters.
- *Contrast Enhancement:* Contrast enhancement used to brighten the images that appear dark or hazy. Used to deliver an image with optimal quality and clarity.

2) Feature extraction

- *Color:*Calculate percentage of color present in image.
- *Text:*Find an unique underlying characteristics of textures.
- *Edge:*Edges correspond to large discontinuities in the image.

3) Interest point recognition

Intersection point between two or more edge segments. The context and orientation of the interest points are considered. Context refers to the 2D spatial coordinates and Orientation refers to the angle of the interest points. Interest point recognition is based on edges and curvature of the logo images.

4) Logo matching

Detect the same feature points independently in both logo images. Reliable matching of a corresponding point. Localization is used to find where exactly a point is.

Similarly for videos the matching and recognition process is calculated. As shown in Fig. 3, after a video clip is input, we detect a video logo by using a frame differencing based approach and prior knowledge to detect video logos with the aid of a logo database.

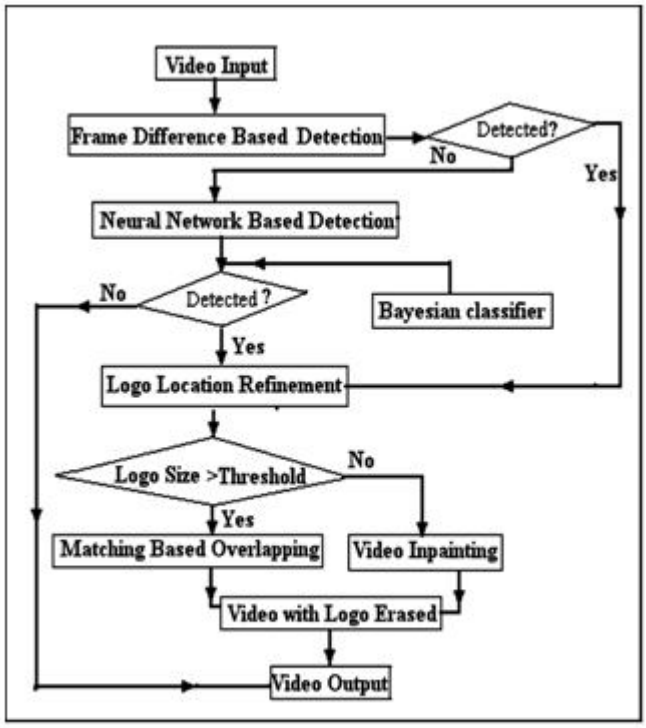

Figure 3: Video Logo Detection

After obtain the rectangular region of the video logo, we refine it to obtain the logo outline. Once the precise logo region is obtained, we remove the logos by using either a matching based overlapping technique or a video inpainting

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technique. For instance, logo detection based on frame difference computation has the capability to detect the logos on frames with motion but it cannot detect them on static frames. In order to detect logos under realistic static conditions, we employ a logo database in order to search for them by using a Bayesian approach. In order to improve the accuracy of detection, we assume that the probabilities of logo appearing at the four corners of the video frames are higher than at the center. We combine this prior knowledge with a neural network based local feature classifier. The primary reason for using two approaches to erase logos from video frames is that the result of matching based overlapping approach is not satisfactory if the motion of the logo region is insufficient to expose the region underneath. Another reason is that if the logo region is too large, the overlapping will result in observable edges for the video region. Hence, the video inpainting approach provides an effective alternative for logo erasure.

V. FUTURE SCOPE

Further extensions of this work include the application of the method to logo retrieval in videos & images with higher accuracy and also the refinement of the definition of context in order to handle other rigid and non-rigid logo transformations.

VI. CONCLUSION

A novel logo detection and localization approach is introduced on a new class of similarities referred to as context dependent. Logo matching is important nowadays to detect non-authorized use of logos. Logo detection used to be done in high quality images only. But using the proposed method, logos with partial occlusion can also be detected and the accuracy of logo recognition is also high.

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