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Finding Fake Logo Using CDS Logo Detection And Recognition Algorithm

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ABSTRACT

This paper deals with finding fake logo by matching and recognizing it with the ori\ginal logo. This is done by dividing the image of logo into rows and columns and thus each cell has its index value .Taking the index value of each cell which belongs to the image of logo to be verified check it with the original image index value of the corresponding cell. From the relation between index values of both the original logo and the one being considered we could decide it whether it is fake logo or original logo. If the index values of all the cells are exactly matching with the actual logo then it is considered to be original logo, otherwise it is the fake logo. This process is achieved by using CDS logo detection and recognition algorithm.

Example of popular logos depicting real world object and pair of logos with malicious small changes

Index Terms – logo detection, Near Duplicate, Recognition, spatial configuration.

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1. Introduction

The Expanding and massive production of visual data from companies and institutions, and the increasingly popularity of social system. Graphics logos are special class of visual objects extremely important to access the identity of something or someone. 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. Most of the research related to trademark recognition deals with the problem of content-based indexing and retrieval in logo databases, with the goal of assisting the process of trademark registration. In this case the image acquisition and processing chain is controlled so that the images are of acceptable quality and are not distorted. 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 required to comply with all the possible conditions of image/video recording. Since in real world images logos are not captured in isolation, logo detection and recognition should also be robust to partial occlusions. At the same time, especially if we want to discover malicious tampering or retrieve logos with some local peculiarities, we must also require that the small differences in the local structures are captured in the local descriptor and are sufficiently distinguishing for recognition.

2. Related Work

Early work on logo detection and recognition was concerned with providing some automatic support to the logo registration process. The system must 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 . Kato's system was among the earliest ones. It mapped a normalized logo image to a 64 pixel grid, and calculated a global feature vector from the frequency distributions of edge pixels. Interest points and local descriptors were used by many authors and appear much more appropriate to support detection and recognition of graphic logos in real world images.

3. Existing System

The previous work on "Shape matching and object recognition using shape contexts," and "ANSIG—An analytic signature for permutation-invariant two-dimensional shape representation," have used different global descriptors of the full logo image either accounting for logo contours or exploiting shape descriptors such as shape context. A two-stage algorithm proposed in "Logo detection based on spatial-spectral saliency and partial spatial context," that accounts for local contexts of key points. They considered spatial-spectral saliency to avoid the impact of cluttered background and speed up the logo detection and localization. Appropriate metrics is accomplished among available methods, using two publicly available fundus datasets. In addition, the paper proposed the comprehensive normalization method which recorded acceptable results when applied for color normalization. The drawback of this method is that it assumes 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. The major limitation of this approach is image resolution and their solution has revealed to be very sensitive to occlusions.

4. Proposed System

In this paper, we present a novel solution for logo detection and recognition which is based on the definition of "Context-Dependent Similarities". In this process 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.

4.1 Context-Dependent Similarity Algorithm:

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). We borrow the definition of context and similarity design in order to introduce a new matching procedure applied to logo detection.
Algorithm used here is given below:

Algorithm 1: CDS Logo Detection and Recognition.
Input: Reference logo image: *IX*, Test image: *IY*, CDS parameters: _, *Na,Nr, α, β, τ*.
Output: A Boolean value determining whether the reference logo in *IX* is detected in *IY*.
Extract SIFT from *IX, IY* and let *SX:* = {*x*1, . . . , *xn*},
SY := {*y*1, . . . , *ym*} be respectively the list of interest points taken from both images;
for *i* ← 1 ***to*** *n* **do**
Compute the context of *xi*, given _, *Na* , *Nr* ;
for *j* ←1 ***to*** *m* **do**
Compute the context of *y j*, given _, *Na* , *Nr* ;
Set *t* ←1, *maxt* ←30;
repeat
for *i* ←1 ***to*** *n* **do**
for *j* ←1 ***to*** *m* **do**
Compute CDS matrix entry **K***(t)*
xi ,y j, given *α, β*;
Set *t* ←*t* + 1;
until *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 **K***y j* |*xi*
←
K*xi ,y j*
_ms
=1 **K***xi ,ys*
;
A match between *xi* and *y j* is declared iff
K*y j* |*xi* _ *_ms*
_=*j* **K***ys* |*xi* ;
if *number of matches in SY* > τ|*SX* | **then**
return *true* i.e. logo detection
else
return *false*;
Provided that τ 1/*q*
ν
n→+∞
−→ 0 and *P* **K***YJ* |*X* ≥
m
_
j _=*J*
K*Yj* |*X*
n→+∞
−→ 1.

Context

The context is defined by the local spatial configuration of interest points in both SX and SY. Formally, in order to take into account spatial information,

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an interest point xi ∈ SX is defined as xi = (ψg(xi), ψf(xi),ψo(xi),ψs (xi),ω(xi)) where the symbol ψg(xi) ∈ R2 stands for the 2D coordinates of xi while ψf (xi) ∈ Rc corresponds to the feature of xi .

Let d(xi,y j) = ||ψf (xi) − ψf (y j)||2 measure the dissimilarity between two interest point features. The context of xi is defined as in the following:

$$\mathcal{N}^{\theta,\rho}(x_i) = \{x_j : \omega(x_j) = \omega(x_i), x_j \neq x_i \text{ s.t. (i), (ii) hold}\}$$

with

$$\frac{\rho - 1}{N_r}\,\epsilon_p \leq \|\psi_g(x_i) - \psi_g(x_j)\|_2 \leq \frac{\rho}{N_r}\,\epsilon_p \qquad \text{(i)}$$

and

$$\frac{\theta - 1}{N_a}\pi \leq \angle\left(\psi_o(x_i), \psi_g(x_j) - \psi_g(x_i)\right) \leq \frac{\theta}{N_a}\pi \qquad \text{(ii)}$$

where (ψg(xj)−ψg(xi)) is the vector between the two point coordinates ψg(xj) and ψg(xi).

Similarity Design:

We define *k* as a function which, given two interest points *(x, y)* ∈ *SX* × *SY*, provides a similarity measure between them.For a finite collection of interest points, the sets *SX*, *SY* are finite. Provided that we put some (arbitrary) order on *SX*, *SY*, we can view function *k* as a matrix **K**,
Let $\mathbf{D}_{x,y} = d(x, y) = \|\psi_f(x) - \psi_f(y)\|_2$
Using this notation, the similarity **K** between the two objects *SX*, *SY* is obtained by solving the following minimization problem

$$\min_{\mathbf{K}} \quad \mathrm{Tr}(\mathbf{K}\ \mathbf{D}') + \beta\ \mathrm{Tr}(\mathbf{K}\ \log\ \mathbf{K}') - \alpha \sum_{\theta,\rho} \mathrm{Tr}(\mathbf{K}\ \mathbf{Q}_{\theta,\rho}\ \mathbf{K}'\ \mathbf{P}'_{\theta,\rho})$$
$$\text{s.t.} \quad \begin{cases} \mathbf{K} \geq 0 \\ \|\mathbf{K}\|_1 = 1. \end{cases}$$

Here $\alpha, \beta \geq 0$ and the operations log (natural), ≥ are applied individually to every entry of the matrix.

Solution:

Let's consider the adjacency matrices $\{\mathbf{P}_{\theta,\rho}\}_{\theta,\rho}$, $\{\mathbf{Q}_{\theta,\rho}\}_{\theta,\rho}$ related to a reference logo *SX* and a test image *SY* respectively.

$$\zeta = \frac{\alpha}{\beta} \sum_{\theta,\rho} \|\mathbf{P}_{\theta,\rho}\mathbf{u}\mathbf{Q}'_{\theta,\rho} + \mathbf{P}'_{\theta,\rho}\mathbf{u}\mathbf{Q}_{\theta,\rho}\|_\infty$$

where $\|.\|_\infty$ is the "entry wise" L_∞ norm.

5. Conclusion

We introduced in this work 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 the 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-duplicate logos as well as logos with some variability in their appearance, and (iv) the theoretical groundedness of the matching framework which shows that under the hypothesis of existence of a reference logo into a test image, the probability of success of matching and detection is high.

6. References

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