Context Based Matching and Recognition for Multiple Applications

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***Abstract*— An important aspect of the method that has influence on the performance and suits to logo detection/recognition is that the local context is recursively defined. Context Dependent is referred to a class of similarities for logo and medicinal plant detection .Logo and medicinal plant matching and recognition based on context dependent similarity (CDS) kernel is proposed and it's able to match and recognize multiple instances of multiple reference logos and medicinal plants in image. Two interest points match if their local neighbors match, and if the neighbors of their local neighbors match.**

Keywords*— Context dependent similarity, SIFT, Logo detection, Logo matching, Logo recognition.

INTRODUCTION

It is necessary to develop an automatic method that identifies the medicinal plants and logos from their images using image processing techniques by extracting features for identification. This automated recognition system will prove extremely useful in quick and efficient way to correctly recognize and classify medicinal plants of different species and logos of different organizations.

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But the distinctiveness of logos is more often given by a few details carefully studied by graphic designers, experts of social communication. Some logos may have similar layout but are different in disposition of graphic elements, differences in size, shape, and differ by the presence or absence of one or few properties. Some logos superimposed on objects of any geometry, shirts of persons, boards of shops, jerseys of players and posters in sports playfields. In most of the cases they are subjected to perspective transformations and deformations, often corrupted by noise or lighting effects. Such images – and logos, they have often low resolution and quality. Regions that include logos might contain little information.

Medicinal plants form the backbone of system of medicine called Ayurveda and are useful in treatment of certain chronic diseases such as cancer, diabetes, blood pressure, skin problems etc. Ayurveda is considered a form of alternative to allopathic medicine in the world. Medicinal plants being an important natural resource and potentially safe drug plays an important role in helping human by contributing herbal medicines.

Therefore, it is necessary to develop an automatic method that identifies the medicinal plants from their images using image processing techniques by extracting features for identification, such as shape, color, texture. This automated recognition system will prove extremely useful in quick and efficient way to correctly recognize and classify medicinal plants of different species.

I. RELATED WORK

In the present work images of medicinal plants and logos belonging to different classes will be considered. These images will be subjected to pre-processing for noise removal. Each medicinal plant and logo image preprocessed is characterized by certain features. These features will be extracted using image processing techniques and an analysis based on visual perception will be carried out. The database will be created with these extracted features. The image to be recognized will be matched with the features present in the database created. If the features of an image match with the features present in the database then it will be identified as medicinal plant and logo.

A. Feature Extraction:

The feature extraction helps in extracting piece of information for the detailed understanding of image. SIFT algorithm is used for the extraction of the features from reference images and test images. For image detection and recognition bag of SIFT features are taken into account. With respect to SIFT keypoints context is considered with spatial differences of local features.

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B. Feature Database:

The feature database is created using the features extracted from each of the image. The database may contain multiple references images with multiple instances. The features of the test image matched with the features of multiple instances of reference images that are stored in database.

C. Feature Matching:

The extra collected images and randomly selected images from the database are taken, features are extracted and is matched together using efficient matching algorithms. The features extracted from reference images and features of the test images are matched using the SIFT algorithm and context.

D. Image Recognition:

If the features present in extra collected images matches. Exactly with the features present in randomly selected images from database, the image will be recognized and the image is retrieved. To ensure that new coming image is sufficiently distinctive and avoid confusion the system must check whether other registered logos exist that have similar appearance.

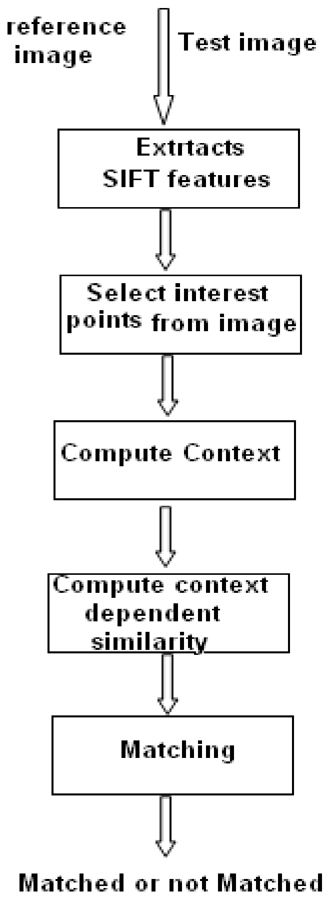

Fig 1. Dataflow diagram of image matching.

III. SIFT WITH CONTEXT DEPENDENT SIMILARITY

Scale-invariant feature transform *(or* ***SIFT****)* is an algorithm in computer vision to detect and describe local features in images. Applications include object recognition, and match moving.

For any object in an image, interesting points on the object can be extracted to provide a "feature description" of the object. This description, extracted from a reference image, can then be used to identify the object when attempting to locate the object in a test image containing many other objects. To perform good recognition, it is important that the features extracted from the reference image be detectable even under changes in image transformations (scale, noise). Such points usually lie on high-contrast regions of the image.

In this image detection and recognition is based on the definition of a "Context- Dependent Similarity" (CDS) kernel that directly incorporates the spatial context of local features. Context is considered with respect to each single SIFT keypoint and its definition recalls shape context with some important differences: given a set of SIFT interest points X, the context of $x \in X$ is defined as the set of points spatially close to x with particular geometrical constraints. Formally, the CDS function is defined as the fixed-point of three terms: (i) an energy function which balances a fidelity term; (ii) a context criterion; (iii) an entropy term. The fidelity term is inversely proportional to the expectation of the Euclidean distance between the most likely aligned interest points.

The context criterion measures the spatial coherence of the alignments: given a pair of interest points (fp, fq) respectively in the query and target image with a high alignment score, the context criterion is proportional to the alignment scores of all the pairs close to (fp, fq) but with a given spatial configuration.

Let $Sr=\{x_r1........x_rn\}$ be the list of interest points taken from reference logo. Let $St=\{x_t1........x_tm\}$ be the list of interest points taken from a test image, n<<m and the value of m and n may vary with objects r,t. An interest point x is defined as $x = \{(\Psi g(x); \Psi f(x); \Psi o(x); \Psi \omega(x)\}$ where the symbol $\Psi g(x)$ stands for the 2D coordinates of x, $\Psi f(x)$ corresponds to the feature of x, $\Psi o(x)$ the orientation of x, which is provided by the SIFT gradient and $\Psi \omega(x)$ to denote the object from which the interest point comes from, so that two interest points with the same location, feature and orientation are considered different when they are not in the same image. Hence we want to take into account the context of the interest point in the image it belongs to.

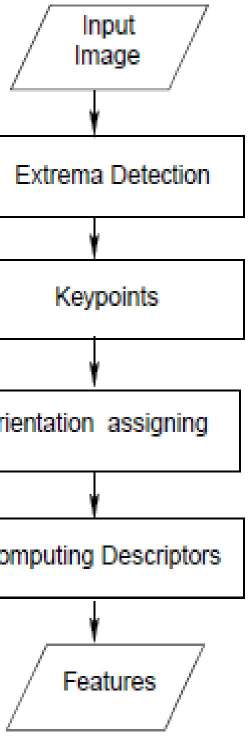

Fig 2. Flow chart of SIFT algorithm

The SIFT descriptor is invariant to translations, rotations and scaling transformations in the image domain and robust to moderate perspective transformations and illumination variations. Experimentally, the SIFT descriptor has been proven to be very useful in practice for image matching and object recognition under real world conditions.

In its original formulation, the SIFT descriptor comprised a method for detecting interest points from a grey level image at which statistics of local gradient directions of image intensities were accumulated to give a summarizing description of the local image structures in a local neighborhood around each interest point, with the intention that this descriptor should be used for matching corresponding interest points between different images.

Later, the SIFT descriptor has also been applied at dense grids (dense SIFT) which have been shown to lead to better performance for tasks such as object categorization, texture classification, image alignment and biometrics . The SIFT descriptor has also been extended from grey level to color images and from 2D spatial images to 2+1D spatiotemporal video.

A. *Equation*

$$N^{\theta,\rho}(x_i) = \{x_j : \omega(x_j) = \omega(x_i), x_j \neq x_i \text{ s.t. } (1),(2) \text{ hold}\}$$

with

$$\frac{\rho-1}{N_r}\epsilon_p \le \| \psi_g(x_i) - \psi_g(x_j) \| 2 \le \frac{\rho}{N_r}$$

and

$$\frac{Q-1}{N_a}\pi \le \angle\left(\psi_0(x_i), \psi_g(x_j) - \psi_g(\right. \le \frac{\theta}{N_a}\pi \quad (2)$$

Where $\psi g(x_j) - \psi_g(x_i)$ is the vector between the two point coordinates $\psi_g(x_j)$ and $\psi_g(x_i)$.

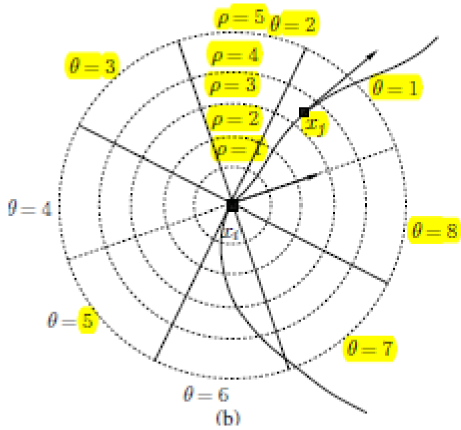

Fig 3.Definition and partitioning of the context of an interest point xi into different sectors (for orientations) and bands (for locations).

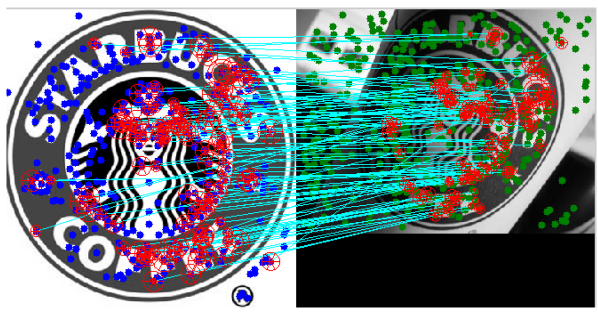

Fig 4.Collection of SIFT points with their locations, orientations, and scales.

IV. LOGO DETECTION PERFORMANCE

Image detection performances can be measured using False Acceptance Rates(FAR) and False Rejection Rates(FRR).

$$\text{FAR} = \frac{\text{\# of incorrect logo detection}}{\text{\# of logo detections}}$$

$$\text{FRR} = \frac{\text{\# of unrecognized logo appearance}}{\text{\# of logo appearances}}.$$

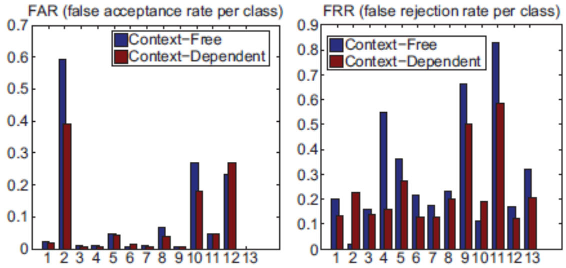

Fig 5. Comparison of image detection using context dependent Similarity and context free.

CONCLUSION

Logos and Medicinal plant recognition system is proposed to identify from their database. Efficient feature extraction can be done by using the methods SIFT. Context dependent is referred to a class of similarities for logo and medicinal plant detection. This method includes aspects like spatial configuration in similarity design; hypothesis of existence of reference image into a test image shows the matching, the invariance in scale, rotation and partial occlusion.

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