Logo Detection and Recognition Using Artificial Neural Network

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Abstract - **Logo detection and recognition are important for brand advertising, and it discovers either improper or non-authorized use of logos. It is a difficult task to match because noise and unclear image greatly complicate the task. To solve this problem, Scale Invariant Feature Transform (SIFT) is used. In the proposed system, Artificial Neural Network (ANN) is used along with SIFT to provide both accuracy and performance. SIFT can robustly identify partial occlusion and illumination changes of the logo. The ANN is used in the training phase in order to classify the logo. In pre-processing stages, noise removal and image enhancement are applied to deliver an image with optimal quality and clarity. The image features are extracted from reference logo and input logo. Further Context extraction is done to get the logo parameter and transform the logo into binary representation. The genuine logo is identified by matching the input logo and trained logo.**

***Keywords*: Scale Invariant Feature Transform (SIFT), Artificial Neural Network (ANN).**

I. INTRODUCTION

A logo is a symbol of identification for companies, products and organizations can be regarded as objects with a planar surface and are significantly valuable in many practical scenarios. Different logos may have slightly different spatial disposition of the graphic elements, localized differences in the size and shape. In the case of malicious tampering differ by the presence or absence of few traits. Graphic logos are a special class of visual objects extremely important to assess the identity of something. Color may have some relevance to assess the identity of the logo. The distinctiveness of logos is often given by a few details carefully studied by graphic designers and experts of social communication. Logo detection and recognition in these scenarios has become important for a number of applications. Among them, several examples have been reported in the literature, such as the automatic identification of products on the web to improve commercial search engines, the verification of the visibility of advertising logos in sports events, the detection of near duplicate logos and unauthorized use. One of the main applications of logo recognition is assisting the blind in the supermarket. Logos often appear in images of real world indoor or outdoor scenes superimposed on objects of any geometry, jerseys of players, shirts of persons, boards of shops or billboards and posters in sports playfields.

II. RELATED WORK

Graphics detection is the basic research problems in document image analysis and retrieval is presented in [2]. An automatic logo based document image retrieval system that handles logo detection and segmentation by boosting a cascade of classifiers across multiple image scales and logo matching using invariant shape descriptors and matching algorithms. Principle component analysis [3] contains a feature selection process and identification process. In the feature selection process the first step is the conversion of scanned 2-D images into 1-D image. Then compute the covariance matrix of ten deviation vectors, Eigen vectors. In identification process, calculate the deviation vector of unknown logo from the referenced logos mean. Then use this deviation vector to get its weighting coefficients by projecting these values on to the Eigen space. The method preserves salient line features as well as curved features efficiently.

SURF (Speeded-Up Robust Feature) [4] is used for the interest point detector. Using SURF we can get higher repeatability and distinctive images. Hessian matrix is used here for the detection of interest points and a distribution of Haar wavelet responses within the interest point neighborhood as descriptor. This method is used to extract interest points from both global and local images. SURF is used to get accurate result, but it's the time consuming process.

The work in [7] describes the effectiveness of the Scale Invariant Feature Transform (SIFT) for Logo matching. The scale invariant feature transform is an algorithm for extracting interest point features from images that can be used to perform reliable matching between different views of a logo. The features are invariant to scale, rotation, noise and changes in illumination of the logo. Compare the each feature from the input logo to the reference logo individually and finding correct matching features based on Euclidean distance of their feature vectors.

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Artificial Neural Network (ANN) [5] is a very powerful method that can be used to solve the most difficult problem. The artificial neural network is used for the problems related to prediction, classification of the images and pattern recognition. ANN makes it possible for the machine learning to learn from the experience. ANN has three types of layers; they are input layers, hidden layers and output layers. It updates and adjusts the numerical weight of the neural network. Pattern recognition is the study of how machines can learn to distinguish patterns of interest from their background and reasonable decisions about the categories of the patterns.

III. SYSTEM ARCHITECTURE

Matching logo is based on scale invariant feature transform which is used for extracting features from reference logo and test images [1]. The first step is the Input logo and the already trained logo is sent to the processing system. The processing system consists of pre-processing, feature extraction and interest point extraction. In pre-processing stage the noise of an input image has been removed. The feature extraction has the extraction of the color, shape and texture and means value has been calculated. The Context extraction is the interest point detector using SIFT feature algorithm. Then calculated the mean and the variance values of all the features are sent as input to the neural network.

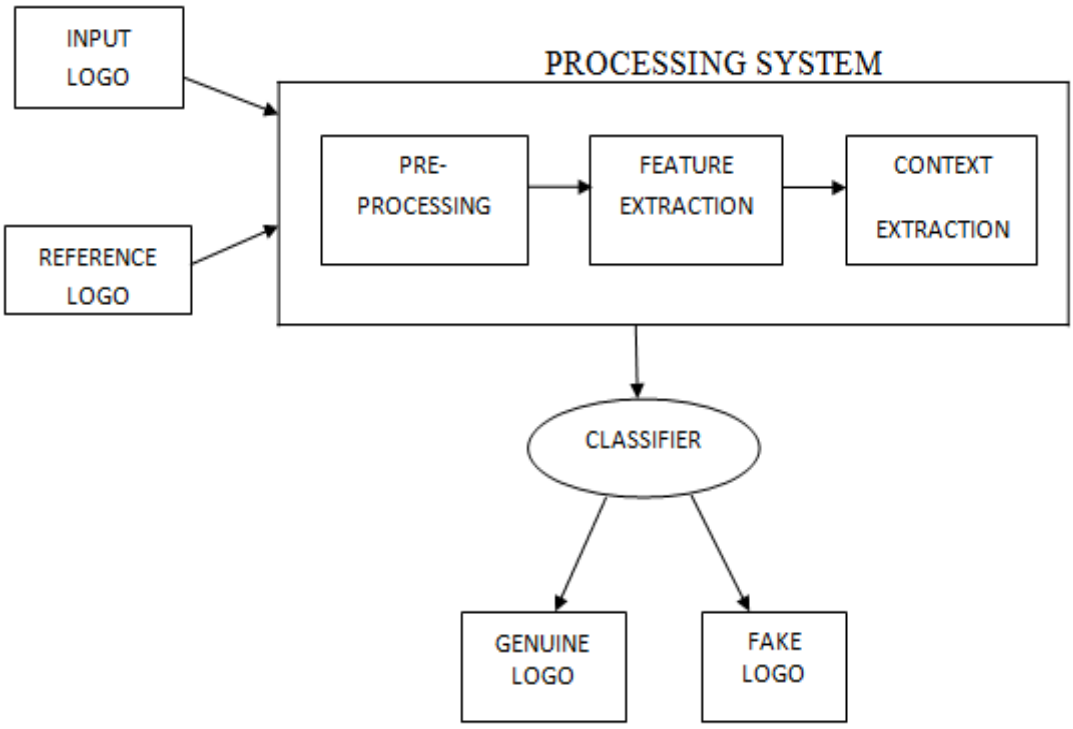

Fig. 1 System Architecture

A. Pre-Processing

Pre-processing is an important technique which is usually carried out to filter the noise of an input logo and to enhance the image. They are three types of filters used to remove noise in the image, they are as mean, median, and wiener filters. The Peak Signal to Noise Ratio (PSNR) is calculated and the logo with a high PSNR value is used for further processing. Mostly median filter is used for reducing the amount of intensity variation between one pixel and the other pixel. The median is calculated by first sorting all the pixel values into ascending order and then replace the pixel being calculated by the middle pixel value. If the neighboring pixel of the image which is to be considered contains an even number of pixels than the average of the two middle pixel values is used to replace.

B. Image Enhancement

To enhance the image for optimal clarity Contrast Adaptive Histogram Equalization (CAHE)

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algorithm is used. It brightens the image that appears dark or hazy and it improves the contrast of the images. The adaptive method computes different histograms, and uses to redistribute the lightness values of the logo. It is suitable for improving the local contrast of an image and bringing out more detail of the logo.

C. Feature Extraction

Feature extraction is the Transformation of the input data into the set of features. The extracted feature has chosen carefully and it is expected that the feature set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input. Feature extraction is a method of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy. The Color feature is the widely used feature in low level feature extraction. These features show better stability and are more insensitive to the rotation and zoom of the logo image.

IV. LOGO DETECTION AND RECOGNITION

Classification of the logo is used to decide whether the input logo is original or duplicate logo. In classifier, artificial neural network is used to recognize the logo. The most common neural network model is the multilayer perception. This type of neural network is known as a supervised network because it requires a desired output in order to learn. The goal of this type of network is to create a model that correctly maps the input to the output using historical data so that the model can then be used to produce the output when the desired output is unknown.

The inputs are fed into the input layer and get multiplied by interconnection weights as they are passed from the input layer to the first hidden layer. Within the first hidden layer, they get summed then processed by a nonlinear function (usually the hyperbolic tangent). As the processed data leaves the first hidden layer, again, it gets multiplied by interconnection weights, then summed and processed by the second hidden layer. Finally the data is multiplied by interconnection weights, and then processed one last time within the output layer to produce the neural network output.

V. EXPERIMENTAL RESULT

The following figures show results for practical work done.

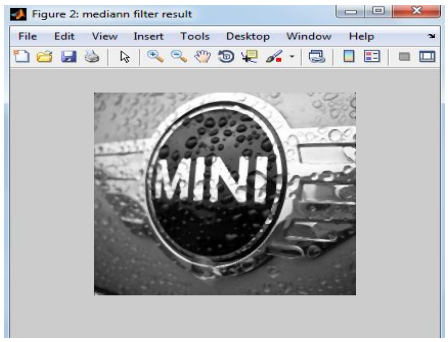

Fig. 2 Noise Removal

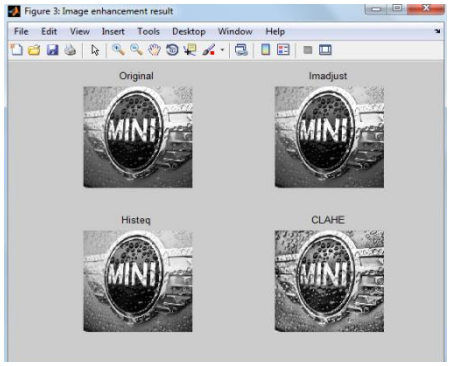

Fig. 3 Image Enhancement

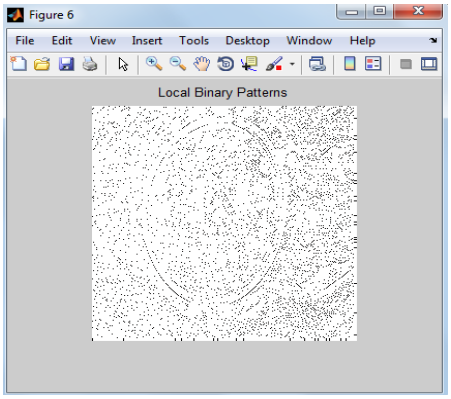

Fig. 4 Texture Extraction

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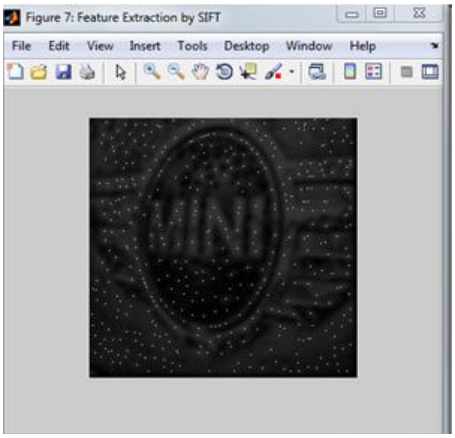

Fig. 5 Extracting the Interest Point

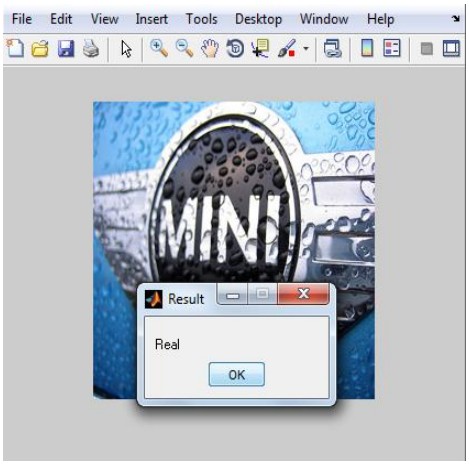

Fig. 6 Genuine logo

VI. CONCLUSION

Logo matching and recognition are based on Scale Invariant Feature Transform (SIFT) and is used to extract the interest points from reference logo and test images. This will overcomes the limitation of processing a corrupted image which contains the logo. The Artificial Neural Network (ANN) is used for classifying the logo and the accuracy of logo recognition is also high. Data to be hidden in the input images will be sends to the processing system. The output will be data extraction and logo detection based on reference logo and test logo to provide better security. The Simulation carried using MATLAB has been performed. Further extension of this work includes the application to logo retrieval in videos.

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