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TELEVISION CHANNEL LOGO RECOGNITION

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Abstract: This paper presents the television channel logo recognition by Kernel Principal Component Analysis algorithm which overcomes the ineffectiveness by extracting the image features in high dimensional spaces. Kernel Principal Component Analysis (KPCA) is an improvement of Principal Component Analysis which extracts feature set more suitable for categorization than classical Principal Component Analysis. KPCA is an appearance based approach that decomposes logo images into small sets of characteristics.

1. INTRODUCTION

Television Channel Logo Recognition is essential for many practical applications like detection of commercials, avoidance of illegal broadcasting, avoidance of commercials in personal recordings etc. Logo is an image which can be processed and identified through image processing algorithm. Principal Component Analysis and Kernel Principal Component Analysis algorithms are used in this paper for identification of Television Channel Logos. Image processing usually refers to digital image processing. In Digital Image Processing the image may be defined as a two dimensional function, f(x, y), where x and y are spatial coordinates and the amplitude of f at any pair of coordinates (x, y) are called the intensity or gray level of the image at that point. Fig 1 sketches the general flowchart of the work.The initialization state occurs during the database creation of different color and shape television channel logos. Next input is fed from the television. The given logo is compared with the existing database, if it is matching then logo name will be displayed or otherwise "logo not detected" message will be displayed.

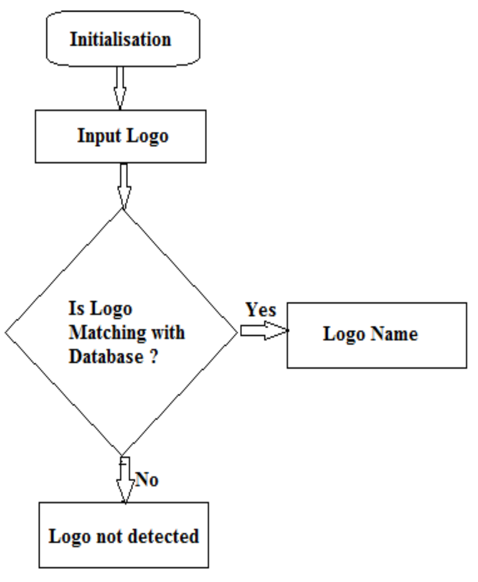

Fig.1:Flow chart

2. PRINCIPAL COMPONENT ANALYSIS

The objective of Principal Component Analysis is to take the total variation on the training set of logos and represent this variation with just some little variables i.e to reduce the dimension of the work space. The maximum numbers of principal components are the number of variables in the original space. Even so to reduce the dimension,some principal components can be discarded because they only have a small quantity of data, considering that the larger quantity of information is contained in the other principal components.

The eigen values are the principal components of the original logo images, obtained by the decomposition of PCA, forming the logo space from these images. So any new logo can be expressed as linear combination of these eigen logos.

PCA involves a mathematical procedure that transforms a number of possibility correlated variables into a smaller number of uncorrelated variables called principal components. The first principal component accounts for as much of the variability in the data as possible, and each succeeding component accounts for as much of the remaining variability as possible.

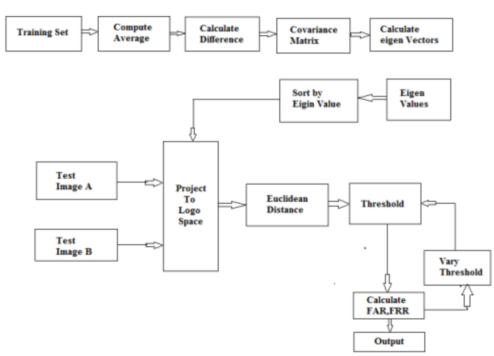

Fig.2. Block diagram of Principal ComponentAnalysis

2.1. ALGORITHM FOR PCA

Step S-1: Assure that all the images are normalized so that the resolution is 128x128 pixels, 256 gray levels, black-and-white;
Step S-2: Group the images in 56 classes. Each class contains 18 images of the same logo;
Step S-3: Choose m images to represent each class, (0_m_18). This choice can be made manually, may cause much difference in the results. When m=18 the training and test data are the same;
Step S-4: Generate and store 56 items m signature matrices, one for each image used. Each matrix consists of the wavelet transform of the image so that its length changes according to the level of the wavelet transform applied to the data. The tests are performed by using a j-level of some DWT;
Step S-5: Input the query image, represented by its signature-matrix, q, and apply the PCA algorithm for all signature-matrices in step s-4and for q. The PCA algorithm consists of extracting the mean data, calculate the covariance matrix and generate eigen values and eigen matrices;
Step S-6: They are ordered, according to their normal size;
Step S-7: All the matrices in the data-base, Excluding q, are projected onto the most suitable subspace, the one which contains the longer matrix;
Step S-8: Find the matrix x that minimizes Euclidian(x, q). This is the system’s output;
END

3. KERNEL PRINCIPAL COMPONENT ANALYSIS

Kernel Principal Component Analysis is a technique for nonlinear extraction, closely related to methods applied in support vector mechanics and so on. KPCA extracts feature sets more suitable for categorization than classical PCA. KPCA is good at dimensional reduction, and it achieves better performance than PCA.

Hence the non-linear mapping need not be explicitly constructed, but can be specified by defining the functional form of the dot products in terms of a Mercer kernel function K. First of all, a nonlinear mapping F is used to map the input data space Rn into the feature space F:

F: Rn F

X F(X)

Correspondingly, a pattern in the original input space Rn is mapped into a potentially much higher dimensional feature vector in the feature space F.

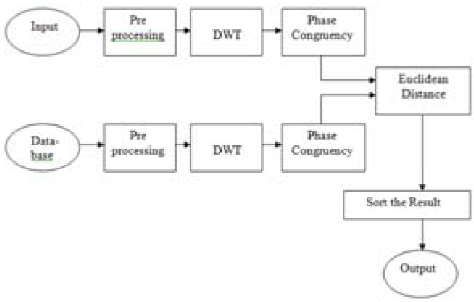

Fig.3. Block diagram of logo recognition using KPCA

According to the block diagram images should be preprocessed to make them suitable for recognition process by noise reduction and histogram equalization. Discrete Wavelet Transform (DWT) is a type of signal representation that can give the frequency content of the signal at a particular time or spatial location. Phase congruency is a measure of significance in images, a method of edge detection that is particularly robust against changes in illumination and contrast. Euclidean distance is the most widely used distance metric. It is a special case of a general class of norms and is given as:

$$||x-y|| = [|x_i - y_i|^2]^{1/2}$$

If this Euclidean distance is less than the threshold value the logo is found to be recognized. On the contrary if the Euclidean distance is greater than the threshold value the logo will be treated as unrecognized logo.

4. RESULTS

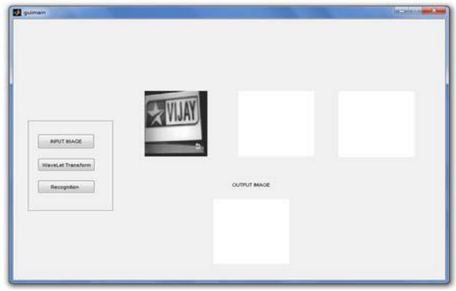

Fig.4. Uploading of logo

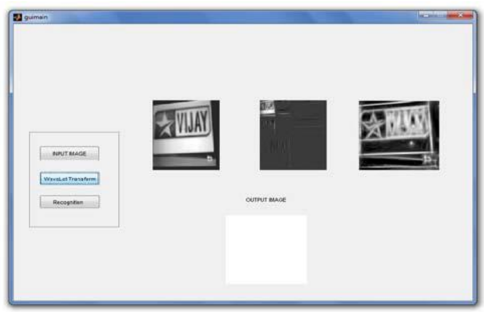

Fig.5. DWT and Phase Congruency of Input

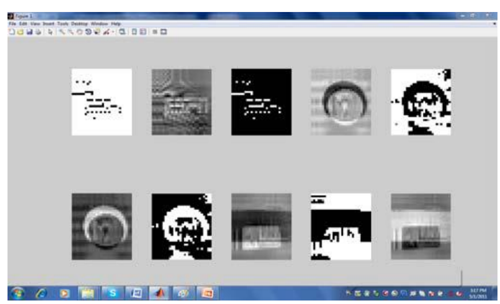

Fig.6. Kernel Principal Component Analysis

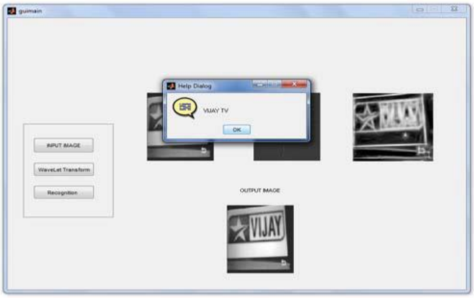

Fig.7. Logo Recognition

5. CONCLUSION

The KPCA approach for logo recognition process is fast and simple which works well under constrained environment. It is one of the best practical solutions for the problem of logo recognition at best with 97% accuracy. Many applications which require logo recognition do not require perfect identification but just low error rate. So instead of searching large database of logos, it is better to give small set of likely matches. By using phase congruency feature extraction this small set of likely matches for given images can be easily obtained.

6. REFERENCES

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