

# A Novel Content Based Image Retrieval using ICA and Neural Network

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## **ABSTRACT**

Rapid growth in the digital technology of picture, diagrams has made previous methods ineffective for searching of image. Content-Based Image Retrieval (CBIR) is an effective way of searching an image in the database having similar properties. But nowadays the main issue is the feature extraction using effective technique. So, this paper solves the problem of image retrieval using combination of ICA and NN. Firstly feature extraction will be done using ICA. Then, at first, the neural network is trained based on the features of images in the database. The image features considered here are average value, min value and max value. The training is carried out using NN algorithm. For effective indexing and fast searching of images based on visual features, neural network based pattern learning can be used to achieve effective classification. This trained when presented with a query image retrieves and displays the images which are relevant and similar to query from the database. The whole simulation has been taken place in MATLAB environment.

## **KEYWORDS**

*Content Based Image Retrieval, ICA, And Neural Network.*

## **1. INTRODUCTION**

Advancement in the image acquisition and storage leads to the development of the large database for images. It is very important to develop a system which can manage large number of images [1]. For this the most common method is CBIR systems (Content Based Image Retrieval). These systems try to search the similar image from large database by specifying the query image in the database. Main advantage is to automatic getting of the image.

The emergence of the World Wide Web as a digital communications infrastructure, the impending convergence of computers and television, and the

increase in use and availability of digital cameras and video recorders [2].

With the massive growth in the amount of visual information available, there exists a real need for systems to catalogue and provide retrieval from digital image and video libraries. During the past decade, remarkable progress has been made in both theoretical research and system development. However, there remain many challenging research problems that continue to attract researchers from multiple disciplines [3].

Conventional, keyword based search for image, is an ineffective technique for the recovery of the required

image in the database with the growth of the digitization of images, diagrams and detonation of World Wide Web (www) [4]. So there comes a new technique called CBIR systems. Content-Based Image Retrieval (CBIR) system is based on the recovery of the identical images from wide database, when a query image is inputed. CBIR mainly uses the low level features for searching of identical images like color, texture, pattern etc [5].

1.1 Advantages of CBIR

- Easy to implement.
- Fast image retrieval
- Better Crime prevention
- Personal storage of images/videos [7]

1.2 Block diagram of CBIR

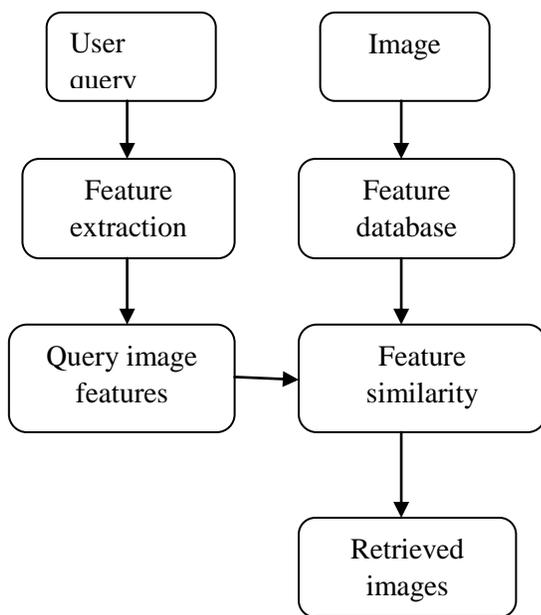


Figure .1 Architecture of CBIR Systems

Above Figure 1 shows the construction of a content based image retrieval system.

Visual features of image are extracted and then stored in the database. Then the query image is entered into

the system by the user. The features of query image are then matched with the feature matrix using some similarity methods. Then the resultant images are displayed [8].

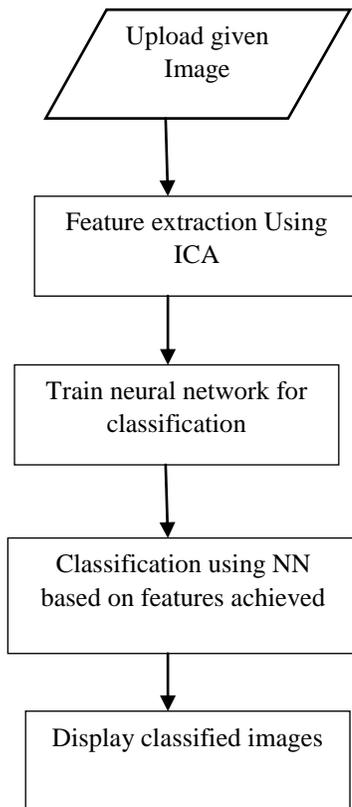
The image files are just stored in the database by using conventional data compression methods appropriate for image files. The database component is independent of the other system parts. However, some performance gains can be realized if the database component is coupled with other parts of the system [10]. The CBIR system often has to present numerous database images to the user. Consequently the volume of transferred data can get large. On the other hand usually only some parts of the images stored in the database are relevant to a given query. The data traffic can be limited if the database is designed so that the relevant parts can conveniently be separated from other image data. In such case it is possible to transmit only the relevant parts of the images to the user when image is being searched. When the search has finished, the chosen images can be transmitted in full detail [11].

In this research, the problem of image retrieval will be solved using combination of ICA and NN. Firstly feature extraction will be done using ICA. Then, at first, the neural network is trained based on the features of images in the database. The image features considered here are average value, min value and max value. The training is carried out using NN algorithm. This trained when presented with a query image retrieves and displays the images which are relevant and similar to query from the database.

2. OUTLINE OF SYSTEM

The problem of this research work is to extract the features of the image sets using ICA algorithm and

train the Neural Network on the basis of the features extracted and also to test the image on the basis of the features at the database and the features extracted of the image to be tested [12].



**Figure .2 Proposed Flowchart**

The subsequent steps demonstrates the variety of phases that need to be accomplished:

*Step-1:* Upload given dataset

*Step-2:* Feature extraction using ICA in which three features are extracted.

- Maximum value
- Minimum Value
- Average Value

*Step-3:* Implement neural network for classification purpose. It has basically two steps:

- Training phase and
- Testing Phase

*Step-4:* Calculate performance metrics like precision rate and recall rate.

**A. Image acquisition**

Image uploading is the first step of CBIR systems, in this step image taken for training has been uploaded.

**B. Feature extraction**

Feature extraction is basic step in which three features has been extracted min value, max value and average value using ICA [13].

Independent Component Analysis (ICA) is a computational method to get hidden values of random variables. ICA basically designed for multivariate data. ICA is somewhat related to Principal Component Analysis (PCA). But it is capable when PCA fails. The data used for analyzing using ICA can be originated from many fields like economics, digital images, document databases etc.

We have presented ICA of images as a computational method for the creation of new independent filter bank. It helps in extraction rich features of an image.

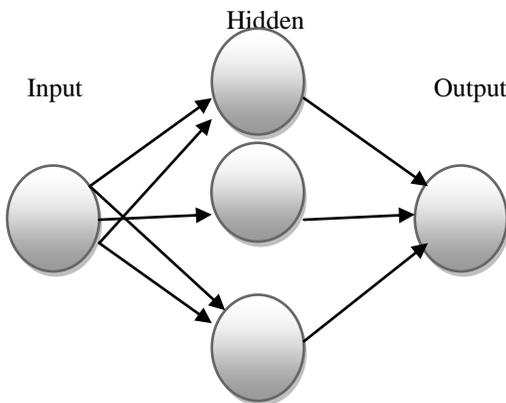
*ICA working steps:*

- Get data dimension
- Input data has to be centre.
- Draw data points
- Use data points for mean calculations.
- Choose random weights
- Increment counter
- Save last weight matrix.
- Compute negentropy scores

- Update weights in the direction of maximum negentropy
- Normalize weight vector
- Decorrelate weight vectors
- Compute innovation
- Display innovation
- Return transformation matrix
- Compute independent components

**C. Classification**

The classification of images will be done using NN. Neural network is a network of “neuron like” units entitled as nodes [6]. This neural evaluating method is utilized in fields of optimization, classification, as well as control theory and also for solving regression problems. NN are very effective in case of classification problems where detection and recognition of target is required. NN is preferred over other techniques due to its active nature.



**Figure .3 Neural Network**

This active nature is attained via amending the weights according to final output and also to applied input information [7]. This amendment of weights

takes place iteratively until desired output is obtained. And this weight adjustment of network is known as “learning” of neural system. Figure 3 shows the structural design of neural network. It is made up of a large number of nodes and interconnection of nodes. A multiple-input neuron with multiple inputs ‘ $In$ ’. The individual inputs are each weighted by corresponding elements of the weight matrix. The neuron also has a bias ‘ $b$ ’, which is summed with the weighted inputs to form the net input ‘ $n$ ’.

*Neural Network Working Steps:*

- Upload data for training
- Input-images
- Define training parameters like epochs, gradient, validation checks.
- Output-target

**3. PROPOSED ALGORITHM**

- Upload apple, hammer, octopus images for training
- Apply canny operator for noise removal
- Apply histogram equalisation
- Save Results
- Apply ICA for feature extraction
- Apply Neural Network using newff function for training
- Load test image
- Test image histogram
- Matching using neural network
- Find category of upload image among CAT1, CAT2 and CAT3.
- Calculate precision rate and recall rate.

#### 4. IMPLEMENTATION AND RESULTS

The datasets used in object classification are presented. The datasets can be divided in three groups: apple images, hammer images and octopus images and the implementation will take place in MATLAB 7.10 environment.

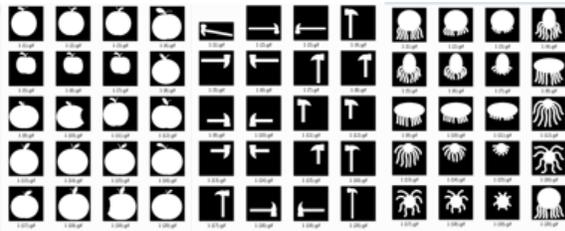


Figure .4 Database Used

The whole simulation is being done using various parameters like Precision rate, Recall rate. Various parameters can be defined as following:

- *Precision rate*

It is the true predicted value.

- *Recall Rate*

It is the false predicted value.

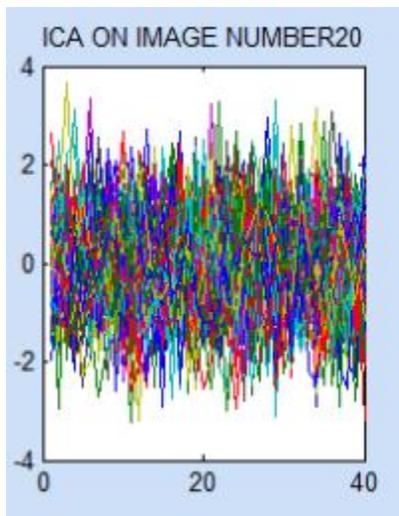


Figure .5 Feature extraction using ICA

Above figure shows the feature extraction done using ICA technique. In this we get the ICA feature vector values.

Similarly whole process will be done for CAT2 and CAT3.

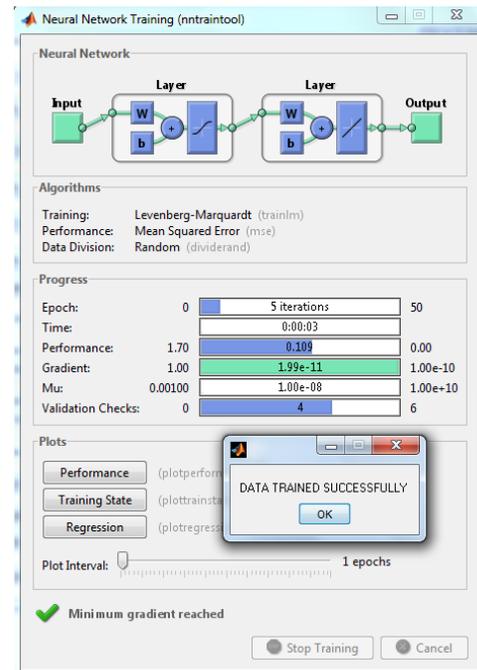


Figure .6 Training using Neural Network

Above figure shows the parameter values for proposed algorithm and it has found to be Recall rate= 0.94 and precision rate= 0.95.

#### 5. CONCLUSION AND FUTURE SCOPE

CBIR is the emerging field in today's era. The accuracy of CBIR system can be improved using better feature extraction and classification methods. To achieve more accurate results, in this work two algorithms has been presented namely ICA (Independent Component Analysis) and NN (neural network). From the result implementation obtained values are Recall rate=0 .94 and precision rate=0 .95, that are good enough.

The future scope includes implementing the CBIR system considering more low-level image descriptors and highly efficient deep learning neural network, that may possibly verify to be quite fast as well as precised one. This work can be extended by integrating with Fuzzy C-means clustering algorithm for better efficiency.

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