Implementation of CBIR System for CAD Jewellery Images Using PCA

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Abstract— It is not easy to look for a specific image in a large database but it can be an interesting topic for research. It is well known that we face any issues in searching for images in large databases using various algorithms. In this research work we have developed a Content Based Image Retrieval (CBIR) System for jewellery images. As it is true that a lot of work has already been done in this field (CBIR) for Medical diagnosis, military and Intellectual property but none has been done for CAD jewellery images. The Content Based Image Retrieval (CBIR) system which we have developed works on the principle of Principal Component Analysis (PCA). Principal component analysis (PCA) is used for dimension reduction such as dimension of datasets, classification, feature extraction, etc. so that the computation cost for the system of Content Based Image Retrieval (CBIR) will be reduced. In this process we develop a new hybrid algorithm Principal component analysis (PCA) along with a distance classifier and with fuzzy color segmentation, jewellery domain specific fuzzy annotation scheme. As distance classifier is used to arrange the unknown image data to classes. It is used to minimize the distance between the image data and the classes. Image data is classified into the different image characteristic and arrange data into set of categories. Image Classification algorithms have two phases are training and testing. In the training phase characteristic properties of image features are isolated. In testing phase, these feature partitions are used to categorize image features. Algorithm with jewellery mind map put together to work as a highly reliable retrieval system for getting high Precision and Recall values. In this Precision and Recall methods are used to measure the performance of Content Based Image Retrieval (CBIR). After the processing of the query we have relevant document, non relevant document and retrieved document so these all are used to measure the performance.
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Index Terms—. Content Based Image Retrieval (CBIR), Principal Component Analysis (PCA), Computer Aided Design (CAD), Information retrieval (IR)

1 INTRODUCTION

INFORMATION retrieval (IR) term means that it is relate with the search of structured information which is fit for relational database, unstructured information which is not fit for relational database, search for the documents, information of the document, metadata about the documents and searching relational databases. Information retrieval system is a traditional model. Information retrieval provides the user with effective access and interaction with information resources. [6]

Some Problems which we face in information retrieval system:

- How to arrange information intelligently?
- How to specify analysis of information and interaction intelligently?
- What type of systems use for information retrieval processes?
- What type of techniques to use for information retrieval processes?

In an information retrieval system user can enter a query and then system look for the query into the system. Queries are formal statement. [1] It is not possible to recognize a particular object. Many object match with the query. An object is an information that is need by the user and which is match with the collection of data in the information retrieval system.

1.1 How Information Retrieval Systems Work

In information Retrieval Systems user enter query what user need. The query is represented in the form of question. The system looks that what is in the file and in resources this is known as acquisition of documents and objects. [7] In system indexing is used for representation. System selects the document and other objects from various sources. In this way que-

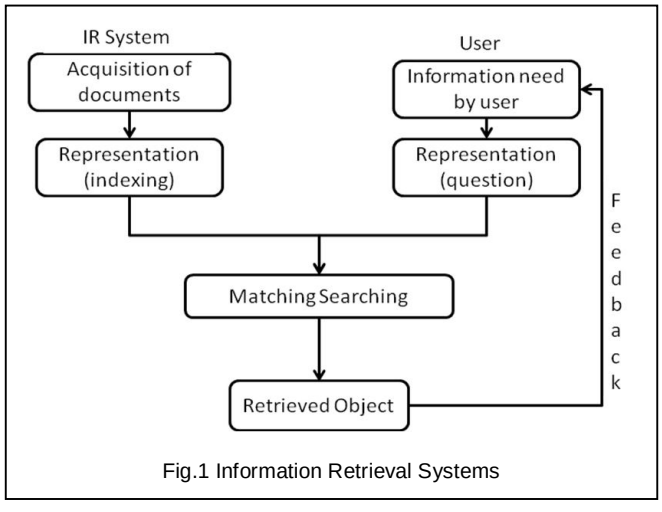

Fig.1 Information Retrieval Systems

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ry is matched with indexed document.

2 WHAT IS CBIR

Content based image retrieval (CBIR) is the retrieval of images that matches the user query by analyzing the visual content of the images in the database. When a query is made features like shape, colour and texture are searched to find the exact match to the features queried by the user.

There are two methods to retrieve an image from huge amount of data one is text based and second one is content based. Text based means that an image can be retrieve by textual information like file keywords, tags, descriptions and name. [1] We face many problems in using various methods to retrieve an image; image indexing is one of them, it is very difficult task to index images in a huge database of images.[3] This problem will help to develop a technique to retrieve an image from large collection of images with the help of features such as colour, texture and shape. This technique to retrieve an image from huge amount of data on the basis of automatically-derived features is referred as Content-Based Image Retrieval (CBIR). [4]

Content-Based Image Retrieval (CBIR) means that the search will focus on the actual contents of the image rather than the name, tags or text related to it. [1] The term 'content' means colors, shapes, textures, or any other information that can be derived from the images. We have many web based search engines which depend on the metadata such as tags, keywords, file name and description. The result of these search engines is that they result in large amount of unwanted data, so we require Content-Based Image Retrieval (CBIR). [2] It is a better approach to retrieve an image with content based rather than image indexing. Content-Based Image Retrieval (CBIR) infers many of its approaches from the field of image processing. Its approaches accent to retrieve an image with desired characteristics but its approaches differ from the field of image processing principally. Image processing covers a vast area including Basic Gray Level Functions, Image enhancement, Image Averaging, Image Restoration, Image compression, Image transmission, and Image interpretation.[5] In image processing objects are recognized by feature analysis. The difference between image analysis and CBIR is very much clear. As we are using automatic face recognition systems, this type of system may be used in two ways. The first way is in which the image is compared with a single individual's database record. The Second way is that, the image is compared with the whole database to obtain the exactly matching images.

CBIR include many topics. Many of them are cover by image processing and information retrieval. Some topics are:-

- Try to understand what kind of information a user looking for.
- What kind of image user need?
- Recognition of applicable techniques for describing image content.
- Extracting features from raw images.
- Support compact storage for large amount of image databases.
- Access efficiently stored images by content.
- Matching of query image with image database.

3 PROPOSED ARCHITECTURE

In this system our first step is to create jewel database and train the jewel database. With the help of Feature Extraction the internal measurement of image can be derived. These processes and techniques are used to extract features of the image like materials, colors, sizes and patterns available for jewellery. In feature extraction we give some input data for example "green color stone in a ring" this input data will be transformed into a reduced representation set of features. And then we use Fuzzy Color Base Annotation Scheme. Fuzzy Color Base Annotation Scheme can be useful in building a more versatile Content Based Image Retrieval System that can handle the usual linguistic queries. Users can give relevant or irrelevant examples together with their significance. Then we use Principal Component Analysis (PCA). Principal Component Analysis (PCA) is a mathematical process or statistical technique for data contact and information extraction. It is used to reduce the dimension of datasets, classification, feature extraction, etc. PCA is used to find the similar images. Then we run Distance Classifier. In distance classifier is used to arrange the unknown image data to classes. It is used to minimize the distance between the image data and the classes. After reducing the distance between the image data and the classes our next step is to match the classes as the image data is classified into the different image characteristic and arrange data into set of categories.

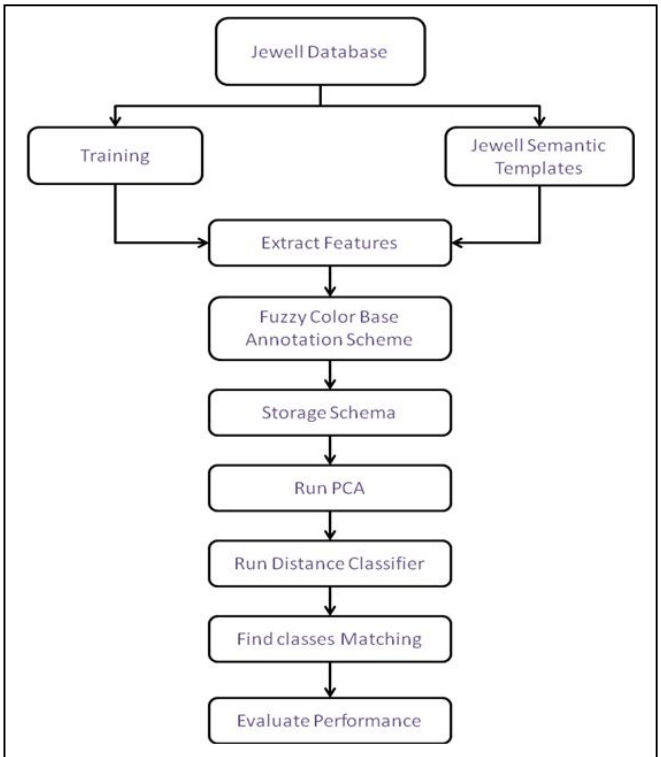

Fig.2. Proposed Architecture of CBIR for Jewellery Images

4 ALGORITHMS

4.1 Algorithm for Query by Semantic Template

For each Image in Training Dataset

Step (1) Read Image ( )
Step (2) Calculate_PCA ( )
Step (3) Add To_Projected Matrix*Image
Step (4) Create _Training Data
Step (5) End

For each Image in Semantic Template

Step (1) Read Image ( )
Step (2) Calculate_PCA ( )
Step (3) Create Projected Matrix*Calculate Euclidean distance between each Training Image
Step (4) Find min distance and Index of each Training Image and Semantic Template
Step (5) If min ≤ Range
Step (6) Collected all Image Indexes with this Range
Step (7) End If

4.2 Algorithm for Annotation Labeling Algorithm

Step (1) Let RF and BF be fuzzy set representing. For each Image in Training Dataset
Step (2) Find all pixels
Step (3) If pixel € Fuzzy set colour(i)
Step (4) Create Project Image(i)
Step (5) Annotation of image with jewellery specifications
Step (6) Related to colour(i)
Step (7) End If
Step (8) End

4.3 Algorith for Query by Text

Step (1) For each Image in Dataset, find Image
Step (2) If Query Text matches Image title, Description, Annotation
Step (3) End If
Step (4) End

5 CONCLUSIONS

5.1 Discrimination: - Discrimination means that how much irrelevant items are rejected by the system or we can say that how good is the system to reject the irrelevant document?

$$\text{Discrimination} = \frac{\text{How much irrelevent items are rejected}}{\text{All the irrelevent items we have in collection}}$$

5.2 Recall: - Recall means that how much relevant items are correctly received or we can say that how good is the system to find the relevant document? Recall varies from 15% to 45% and its average value is Recall=30.7494.

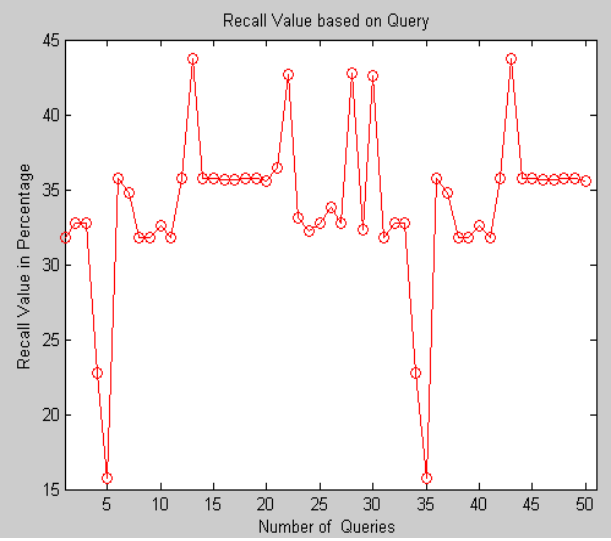

Fig.3. Recall value varies from 15% to 45% and its average value is Recall=30.7494

$$\text{Recall} = \frac{\text{How much relevent item are correctly retrieved}}{\text{All relevent items we have in collection}}$$

5.3 Precision: - Precision means that all relevant items are retrieved from all relevant items and the precision is depends upon the recall and discrimination. Precision varies from 35% to 80% and its average value is Precision=54.1370

$$\text{Precision} = \frac{\text{Relevent items received}}{\text{All items are retrieved}}$$

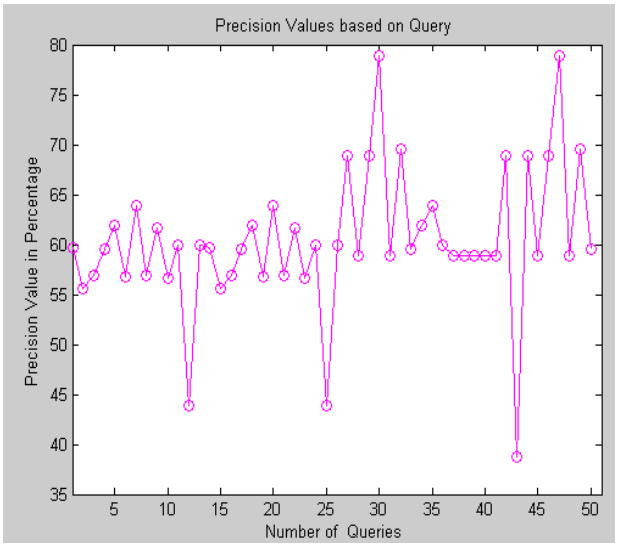

Fig.4. Precision varies from 35% to 80% and its average value is Precision=54.1370.

5.4 Time: - Time means time taken by the system to find the desired result is depending upon the number of queries.

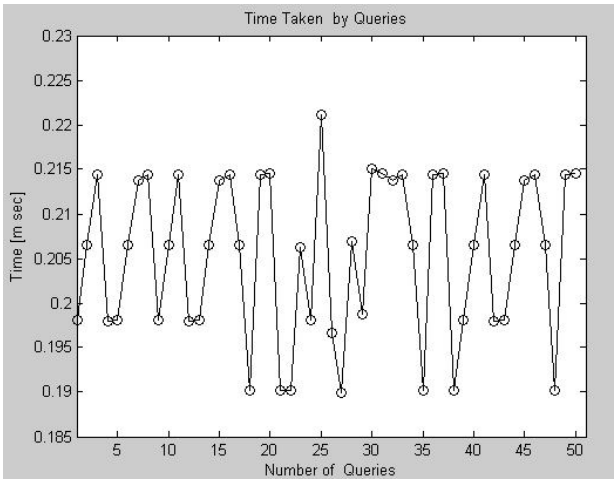

Fig.5. Time is depending upon the number of queries.

It is apparent from the graph that the value of both recall and precision varies. Recall varies from 15% to 45% and its average value is 30.7494. Similarly the precision varies from 35% to 80% and its average value is 54.1370. The shape of the graph has a lot of peaks and valleys which show the results highly depends upon the type of query for which the result has been retrieved and calculated for both of the graphs x-axis have no queries as a parameter which means all these results are specific to these set of queries and no two queries are similar in nature but are drawn from jewellery terminology and uses. Since the recall value is above 30% which means the dataset has 30% highly relevant information in both image and annotation components. Since the precision value is above 50% it is retrieving fairly, good, accurate result.

6 FUTURE SCOPE

We use PCA for doing dimension reduction so that processing is fast; there are other dimension reduction algorithm that can also be used for dimension reduction like Nonlinear Dimensionality Reduction Algorithm, Locally-linear embedding and Laplacian eigenmaps etc. These all techniques to perform dimensionality reduction and also that can be elaborated for future work like CBIR system for SAR images and CBIR system for finding pattern of design in cloths. Therefore we need to explain and know their efficiency also. Then we can also explain our work to work with other. Determine also like methodologies where color is most important but hard to explain.

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