ISSN : 2278 – 1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 1, Issue 7, September 2012

Semantic fuzzy Colour Algorithm for Image Retrieval Using Hindi Dialects

Jasmeet kaur[1], Seema[2]

M.Tech. Student (Computer Engineering) [1], Assistant Professor (Computer Engineering) (Supervisor) [2]

Yadavindra College of Engineering, Punjabi University Guru Kashi Campus, Talwandi Sabo, Bathinda, Punjab, India.

Abstract—***Retrieval of an image by segmenting of an image into meaningful regions that can be read by machines and co-related with human language and the labeling of the regions as per concepts is a challenging problem. A framework for simultaneous image segmentation and object labeling leading which focuses on semantic analysis of images stored in the database has been done and it contributes to knowledge-assisted multimedia analysis and has been reducing the gap between semantics and low level visual features. The proposed framework operates at semantic level using possible semantic labels, represented by formal logic as fuzzy sets, to make decisions on handling image regions instead of visual features used traditionally. Contextual information associated with each image is based on a novel semantic processing methodology used , employing fuzzy scale algorithm and taxonomic knowledge representation. So there is a need here is to develop a technique of latent correlation between low level features and high level concepts and merging them in such a way that perspectives , feelings ,expressions about the colour are mapped as human's can understand. It has been acknowledged that research has produced many algorithms for automatic image segmentation, as well as structuring of contents of the image based on English dialects, a context representation approach to use on top of semantic region growing. We introduce a methodology to improve the results of image retrieval, based on contextual information in hindi language dialects. A novel representation for context is introduced, combining fuzzy extraction and fuzzy scale with characteristics derived from the Semantic of concepts of colour.***

Keywords- CBIR, Syntactical Feature, Feature Extraction, Multidimensional indexing, Fuzzy set, Fuzzy scale, linguistic labeling

I. INTRODUCTION

An image retrieval system is a computer system for searching and retrieving images from a large database of digital images as the Image is a visual representation of an object, scene, person or abstraction, produced on a medium. One of the key issues with any kind of image processing is the need to extract useful information from the raw data such as recognizing the presence of particular colours, shapes or textures before any kind of reasoning about the image's contents is possible.

Content Based Image Retrieval (CBIR) was proposed as an alternative to manual indexing and retrieval of images from a database, based on the colours and other visual features present. Content Based Image Retrieval (CBIR) is the process of retrieving images from a collection based on automatically extracted features, differences in colour, shape, structure or texture between different content regions and it is possible to create specialized algorithms for similarity searches. The perception subjectivity and annotation impreciseness may cause unrecoverable mismatches in later retrieval processes. Retrieval by colour has the potential of being the most effective search technique in many application fields.

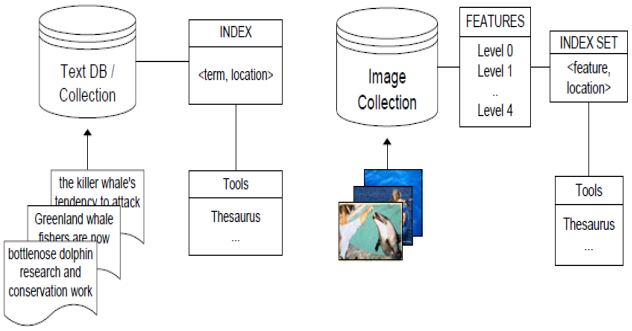

Fig. 1 Text Document collection and image Collection

Colour is an important dimension of human visual perception that allows discrimination and recognition of visual information. Once a colour has been extracted and a representation histogram of that colour has been created, it can be used to measure similarity between the colour histograms by determining colour quantization.

ISSN : 2278 – 1021

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II. LITERATURE REVIEW

Some of the papers relevant to the content based image retrieval of colour contents. Pandey et. al [1] discussed a method that a new matching technique to find the similar value between query colour image and database colour image using histogram, spatiogram and bins uses RGB and HSV colour space.. Dinakaran et. al [2] purposed the interactive system that is integrating text and image context to enhance retrieval accuracy and in this approach the included refining search algorithm that narrow down the search further from the retrieved images. Belongie et. al [3] proposed a method of transformation from a raw pixel data to a small set of image regions which are coherent in colour and texture space called blobword representation based on segmentation using the Expectation-Minimization algorithm on combined colour and texture features. Banerjee et. al [4] Proposed a method that visually significant for retrieving images. The cluster of points around significant curvature regions that may be high, medium, weak are extracted using fuzzy set theoretic approach. The approach uses invariant colour features that are computed from these points to evaluate the similarity between images. Sajjanhar et. al [5] proposed a new semantic category to describe intra region .colour features that complement the existing high level descriptors. The method proposed the intra region colour properties as hue, saturation, warmth, size and position. Othma et. al [6] proposed the whole scene colour appearance descriptors for classification to be used in browsing applications. Semantic based colour appearance approach is a feature used in image analysis, retrieval and classification. Androutsost et. al [7] proposed the image database retrieval based on colour using various vector distance metrics. System based on colour segmentation where only few representation colour vector are extracted from each image and used as image indices. These vectors are then used with vector distance measure to determine similarity between a then used with vector distance measure to determine similarity between a query colour and database image.

III. ARCHITECTURE OF CBIR SYSTEM

Fig. 2 shows a typical architecture of a content-based image retrieval system. Two main functionalities are supported: data Storage and query processing. The data insertion subsystem is responsible for extracting appropriate features from images and storing them into the image database. This process is usually performed off-line.

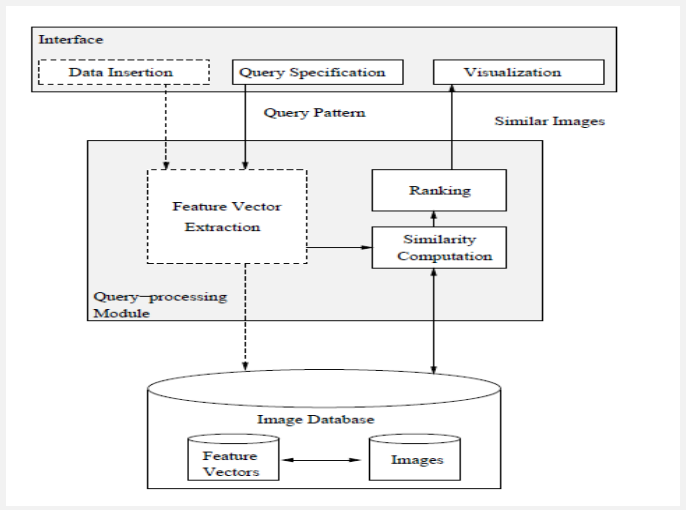

Fig. 2 Typical Architecture Of Content Based Image Retrieval System[2]

The query-processing module extracts a feature vector from a query pattern and applies a metric to evaluate the similarity between the query image and the database images. Next, it ranks the database images in a decreasing order of similarity to the query image and forwards the most similar images to the interface module.

IV.CBIR TECHNIQUES

There are three fundamental bases for content-based image retrieval, i.e. visual feature extraction, multidimensional indexing, and retrieval system design. CBIR operates on a different principle, retrieving stored images from a collection by comparing features automatically extracted from the images themselves. The other approaches suggested here to make the content-based image retrieval truly scalable to large size image collections, efficient multidimensional indexing techniques need to be explored. These approaches for the content based image retrieval are described below.

A. Feature Extraction

CBIR operates on a collection by comparing features automatically extracted from the images themselves. The features may include Text based features like keywords and annotations and visual features like colour, shape, texture, shapes. Several methods for retrieving images on the basis of colour similarity is that each image added to the collection is analyzed to compute a colour histogram which shows the proportion of pixels of each colour within the image. Second perspective is texture retrieval; texture refers to the visual patterns that have properties of homogeneity that do not result from the presence of only a single colour

ISSN : 2278 – 1021

International Journal of Advanced Research in Computer and Communication Engineering
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or intensity. To extend the global colour feature to a local one, a natural approach is to divide the whole image into subblocks and extract colour features from each of the subblocks called segmentation based retrieval.

B. High Dimensional Indexing

To make the content-based image retrieval truly scalable to large size image collections, efficient multidimensional indexing techniques need to be explored. There are two main challenges in such an exploration for image retrieval: High dimensionality, Non-Euclidean similarity measure. For solving these problems, the approach of dimension reduction likes PCA and then to use appropriate multidimensional indexing techniques, which are capable of supporting non-Euclidean similarity measures. We have identified the embedded dimension of the feature vectors, as there was the need to select appropriate multidimensional indexing algorithms to index the reduced but still high dimensional feature vectors.

C. Image Retrieval System

Many image retrieval systems support one or more of the following options: random browsing search by example, search by sketch, search by text (including key word or speech) navigation with customized image categories. QBIC is standing for query by image content, is the first commercial content-based image retrieval system. QBIC supports queries based on example images, user-constructed sketches and drawings, and selected colour and texture patterns other system is Virage is a content-based image search engine similar to QBIC, supports visual queries based on colour, composition, texture, and structure. The Novel approach to evaluate the possibilities of narrowing the Semantic Gap, is it possible to create a framework which can be used by an image retrieval system to assist in retrieving images with similar semantic content but differing structural content.

V. PROPOSED WORK

In this new approach we have borrowing ideas from text based information retrieval, and combining these with image analysis and comparison techniques from image processing. The resulting structure, the colour retrieval, is proposed as a possible extension to an image retrieval system.The objective of reducing semantic gaps and other gaps in our proposed framework and algorithm. The steps involved here lead to development of our research work.

D. Development of the dataset for natural colourful images

The collection is made in accordance with the generic for the colour retrieval, a collection of images depicting natural scenes and related activities. The number of images has been kept small in order to maintain a clear overview of which images are relevant results for each query. Develop dataset from where images are obtained for processing of feature extraction and retrieval process.

E. Select appropriate natural colour images with right kind of colour descriptors and scenarios

There are several considerations while selecting samples of each image instance dataset that are cost for building specification system and time for retrieving selected dataset instance.

F. Extract colour features from image dataset

Extraction of colour features based on colour model approaches considered by algorithm that extract the colour features from the dataset using fuzzy set rules.
Algorithm for Extraction of colour features from Image instances

- Read image data from the image dataset that is built to contain set of natural images.
- Check the type of image and its storage file format and content size .
- Proceed if image is colourful image.
- Get all separate dimensions of RGB , HSV , YCbCr.
- Calculate Mean, Max, Min for each dimension to develop a fuzzy scale.
- For each image, get the path, title and description.
- Insert each extracted value in step 5 in referenced table as per f-codd rules..
- Run fuzzy set algorithm to develop its fuzzy set regions based on the scale.
- Insert and run the interpretation algorithm to get its level and interpretation and labels for each calculated value in step 5 for each image in the referenced table.

G. Development of colour set region for dataset Images

The Colour regions on the basis of which we perform to implement fuzzy semantic for the dialect labeling and descriptions are segmented by regions based segmentation algorithms..The approach starts with seed points that grow regions by appending each seed with neighboring pixels that have predefined properties similar to the seed in terms of intensity or colour.
The predicate criteria for each location for segmented region is as

$$Q = \begin{cases} \text{TRUE} & \text{If the absolute differences of the intensities between The seed} \end{cases}$$

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International Journal of Advanced Research in Computer and Communication Engineering
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. and pixel at (x,y)is <=T
FALSE Otherwise

The second approach is region splitting, merging is to sub divide an image initially into a set of arbitrary disjoint regions and then merge and/ or split regions in an attempt to satisfy the conditions of segmentation. The procedure follows as the split the regions into four disjoint quadrants for which the predicate condition is false ,when no more further splitting is possible, merge any adjacent regions for which the predicate value criteria is true then stop when no further merging is possible.

$$Q = \begin{cases} \text{TRUE} & \text{if the absolute difference of the intensities between the seed and Pixel at } (x, y) <= T. \\ \text{FALSE} & \text{Otherwise} \end{cases}$$

After the region splitting we formulate to assigns descriptors to the image regions that are split by the above specified algorithms ,the approaches for describing image regions use boundary and edge specifications.

H. Develop Hindi Dialect phrases using various linguistic descriptors like fuzzy sets

Descriptors are there to make retrieval representation of the image. To develop descriptive model of human visual system and human semantic perceptive we can compute valuable indicators of image content.

I. Fuzzy Set Development

The bridging of semantic gap is usually approached by mapping the combination of different feature vectors of regions such as colour into high level semantics directly for recognizing and getting right image instance in result, therefore handling this issue.

- **Fuzzy algorithm**

  Step 1: Let X denotes Universal Set of natural colourful Images.

  X = {Img1, Img2, Img3……}

  Step 2: Let A, B, C, D be the fuzzy sets that represents the Fuzzy Scale, therefore for each dataset

  If A (A) = X then Belongs To set A else does not belong set A.

  If B (A) = X then Belongs To set B else does not belong set B.

  If C (A) = X then Belongs To set C else does not belong set C.

  If D (A) = X then Belongs To set D else does not belong set D.

  Where characteristic function of A, B, C, D consists of colour features.

  Step 3: Characteristic Function

  The Function shows the feature comparison logic that are extracted from dataset of colour images.

```
if (val>=Mindb) && (val<=mimdb)
  data = A;
end
```

J. Fuzzy set Descriptors for Low level values of colours

Fuzzy Sets: A paradigm is a set of rules and regulations which defines boundaries and tells us what to do to be successful in solving problems within these boundaries .This is any set that allows its members to have different degree of membership called membership function, in the interval of 0 and 1.

Fuzzy logic algorithm

- Define the linguistic variables and terms (initialization)
- Construct the membership functions (initialization)
- Construct the rule base (initialization)

Linguistic Variables

Linguistic variables are the input or output variables of the system whose values are words or sentences from a natural language, instead of numerical values. A linguistic variable is generally decomposed into a set of linguistic terms and phrases.

Membership Function

Membership functions are used in the fuzzfication and defuzzfication steps of a Fuzzy Language System, to map the non-fuzzy input values to fuzzy linguistic terms and vice versa. A membership function is used to quantify a linguistic term.

The characteristic function: The characteristic function is represented for all the elements of a set suppose a subset of image features set is x, x € X. By its characteristics function

$$\mu A(x) = \begin{cases} 1 & x \in X \\ 0 & \text{otherwise} \end{cases}$$

So according to our algorithm scenario the various conditions are applied to describe datasets fuzzy scales, that further gives the fuzzy descriptors for the colours that we have extracted previously. Based on the extracted colours, we calculate its Min Max Mean values and according to these evaluated values specify the fuzzy rules that are specified for distinguishing the fuzzy region of the colour features of the identified image.

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3. Fuzzy Rules:

In a FLS, a rule base is constructed to control the output variable. A fuzzy rule is a simple IF-THEN rule with a condition and a conclusion. Depending upon the Characterstic function variations the fuzzy rules are applied to the values based on which we decide the variations of colours as Light, Normal, Dark, and Vivid as in Hindi they are written by halka, narmal, gehra, chamkila .As we are Considering the four fuzzy sets A, B, C, D that represent the concepts of a light, normal, dark, vivid, colour representation. The characteristic functions are

$$A(x) = \begin{cases} 1 & \text{When(} x >= \text{Mindb) \&\& (} x <= \text{mimdb)} \\ 0 & \text{Otherwise} \end{cases}$$

$$B(x) = \begin{cases} 1 & \text{When(} x >= \text{ mimdb) \&\& (} x <= \text{ Meandb)} \\ 0 & \text{Otherwise} \end{cases}$$

$$C(x) = \begin{cases} 1 & \text{When(} x >= \text{Meandb) \&\& (} x <= \text{mamdb)} \\ 0 & \text{Otherwise} \end{cases}$$

$$D(x) = \begin{cases} 1 & \text{When(} x >= \text{mamdb) \&\& (} x <= \text{Maxdb)} \\ 0 & \text{Otherwise} \end{cases}$$

In our scenario characteristic function is based on set of images that we stored n the dataset. If the images of A similar features then set A can be represented for all the elements, x € X by its characteristics function μA(x).

K. Object labelling and description

The area of region is defined by the number of pixels in the region. The perimeter of the region is the length of its boundary, area and perimeter can also be used as its descriptors. The measures used as region descriptors include the mean, minimum, maximum of intensity levels, no of pixels with values above and below the mean. The description of topological properties based on the regions element like holes and connected components. That is described by Euler number that considers the number of holes H and number of connected components C can be used to define the Euler number E.

$$E = C - H.$$

This is also topological property. The regions represented by straight line segments have simple interpretation in terms of Euler number. Classification of interior regions of the network into faces and holes , by denoting number of vertices by V and no of Edges by Q, no of faces by F.

The Euler Formula described as

$$V - Q + F = C - H$$
$$= E \text{ (Euler formula).}$$

L. Develop storage design which maps Colour Features

The Storage schema here refers to the involvement of Full Text Catalogs that stores the linguistic descriptors or phrases on the basis of which fuzzy query is made. Full-Text Search queries run faster because they store the words and phrases of a particular language in a specially constructed catalog that can be searched by individual word, rather than by scanning each individual document. The columns can be configured with character data types such as char and varchar or with binary data types such as varbinary and image. A full-text index is made up of word tokens that are derived from the text being indexed. For example, if the indexed text contains the phrase “tables can include indexes,” the full-text index would contain four tokens: “tables,” “can,” “include,” and “indexes.”

M. Develop Information Retrieval system:

The vocabulary of the query language is based on the concept of semantic indicators, while the syntax captures the basic patterns in human perception of semantic templates and semantic categories. The language we propose is simple but expressive. It is simple because both its vocabulary and its syntax are elementary. In effect, the words of the language are almost limited to the names of the semantic indicators. Being “elementary” visual cues, semantic indicators are often described with a single word e.g. people, snow, mountain, object, grass. These words may be composed in order to construct sentences. A sentence is meant to express an assertion about the image, like for instance “the number of image regions is greater than 5” or “scene is dark”. All the images in the database are then tested against the query, and only those that satisfy the assertion are selected.

VI. EXPERIMENTAL RESULTS

To validate the proposed approach, the System is implemented on Matlab tool and been tested for various images captured. The experimental setup is constructed natural images and all these are stored in database as clustered images, which reduce the isolation process time. The features of natural image are pre-computed and stored in database. When test image is input to the system, the pre processing, feature extraction process applied to compare with images in Database. The precision performance curve

ISSN : 2278 – 1021

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shown in Fig.3 shows the retrieved results of the queries retrieved they ensure that a thorough comparison between CBIR and retrieval with a colour Hindi dialect approach proves the efficient and feasible retrieval in terms of time measurement as well as relevance. The analytic view shows that the average precision values percentage lies around 65 % which is considered as effective retrieval as per the experimental evaluation.

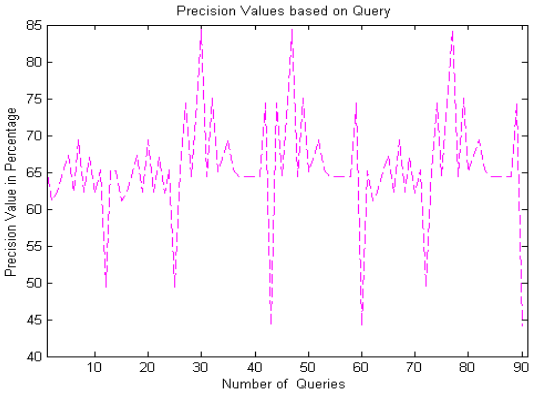

Fig 3 : Precision Performance Curve

The recall performance curve shown in Fig4 explains the recall level, shown as number of *relevant images* retrieved. The first approach gives the relevant image retrieval. The actual recall level achieved at this level, as calculated on the basis of the actual number of relevant images.

TABLE: Average Precision and Recall Values for retrieval

Total No Of Images in the database	No of Relevant images in the database	Total no of images retrieved	No of relevant images retrieved	Precision rate	Recall	Accuracy Rate
120	108	78	36	65%	30%	

The analytic view shows that the recall values percentage lies around 30% which is considered as effective relevance measure as well as retrieval as per the experimental evaluation. For different images, it can be seen that the performance of 6% and 9% filtering is clearly better than 0% filtering and no filtering results. Though the system will have overheads, the overall retrieval performance can be improved.

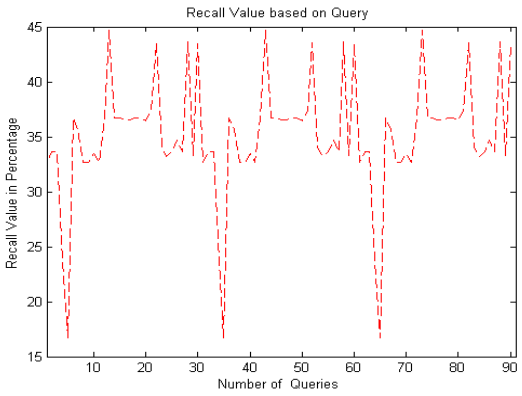

Fig 4: Recall Performance Curve

VII. CONCLUSION

After conducting the research by implementing the fuzzy colour scale algorithm and by corroboration with Hindi dialects we were able to develop a system which not only took case of the current Hindi chological phrases, sentences, adverbs etc. with respect to the low level numeric values of each component of colour space that can be take care of the language dynamics based on which IR system must be build on as no language is static in nature and Hindi language is no exception ,so therefore the man machine interaction needs constantly new levels of language descriptors which are current in content and easily understood by man as well as machine ,therefore we were very successfully able to implement this by reducing the semantic gap which is apparent from the values of precision percentage and recall percentage .Both in cases of image based precision and recall and Annotation based precision .Our results shows that a focused approach on colour in corroboration with Hindi dialects have produced excellent results and average precision closed 65% on average and recall remains around 30% which means 1/3rd of the images remain highly relevant in results .A similar values which we calculate the value of annotated precision and recall.

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Biography

Jasmeet Kaur received her B.Tech degree in computer science and engineering from Malout Institute of Management and Information Technology(MIMIT), Malout, India, in 2008, and pursuing M.Tech degree in computer science and engineering from Yadavindra college of engineering, Punjabi University Guru kashi campus, Talwandi sabo,Bathinda,India. Her research interests include Digital Image Processing, Databases and Data Mining etc.

Mrs. Seema is presently working as Assistant Professor in Computer Engineering at Yadavindra College of Engineering, Punjabi University Guru Kashi Campus, Talwandi Sabo (Distt Bathinda) Punjab w.e.f. year 2008. She has almost seven year of teaching experience of teaching B.Tech. (CSE), MCA and M.Tech. (CE) Classes. She previously worked as Senior Lecturer & Head, Department of Computer Science & Engineering at Bhai Maha Singh College of Engineering, Muktsar and Lecturer (Computer Science & Engineering) at Government Polytechnic, Bathinda. She completed her Bachelor of Technology (CSE) from Institute of Engineering & Technology, Bhaddal, Ropar in year 2004 holding 9th merit position in the University. She completed Master of Technology in Computer Engineering in year 2007 from Punjabi University, Patiala, Punjab. She has guided almost 15 M.Tech. dissertations and a number of B.Tech. Projects. Her research areas include Digital Image Processing, MANET, Adhoc Networks, Video compression and Enhancement, Optimization using GA & PSO etc.