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Image Query Relevance using Edge and Colour Feature Based Technique

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Abstract--The data retrieval process needs a cache and search technique to find the data according to the query inputs. The presented work is focused on the content based image data retrieval using the image query inputs. There are two different kinds of input are ordinarily used for image search viz text or images. But the text query can be misguiding the search comes and search process due to the misbranded data or incorrectly tagged data. On the other hand the query by image can be used for accurate data identification by matching the contents of the image query and database images. Therefore the content based image retrieval technique is proffer for study using the image query inputs. The proposed content based image retrieval process recognize to identify the image contents using their valuable features which are extracted from the image. These features are provides the image properties which are used to find similar contents on two different images. Therefore the image contents are evaluated using the edge for shape feature extraction and colour histogram analysis is performed for colour feature evaluation. These features are normalized and stored for extraction of image. Therefore the query image is also extricate for comparison and accurate image extraction. Additionally that features also helps to improve the time and space complexity by diminish the number of comparison during the KNN based images search .The implementation of the proffer technique is performed using MATLAB technology and their performance is evaluated in divergent performance parameters i.e. precision, recall, f-measures, time complexity, and space complexity. The obtained performance of the system present the improved outcomes and accurate image retrieval as described in the query image.

Keywords— CBIR, Colour feature, Edge Feature, KNN, Implementation;

I. INTRODUCTION

In digital computation the storage and the data processing need the efficient and accurate techniques to obtain the query relevant data in less resource and time consumption. Among the various popular techniques of data management the data retrieval is taken attention in various data retrieval process. Data storage needed to implement an effective data retrieval technique. These techniques are directly depends on the data formats and therefore the retrieval technique change their faces according to the formats of data. In this presented work a popular format of data "image data" is considered for data retrieval process study.

The image data is represented by the numerical matrix, this matrix contains some values for representing the real world objects in a given arrangement. Thus the image retrieval process is deferent from the text data or other formats of data. In this presented work the content based image retrieval process is studied. The image contains the real world objects in form of matrix thus to identify the hidden information in the retrieval process three key features are utilized for discovering the data patterns in image data. The key features include the shape, texture and colour distribution in image data. All these features are associated in the image to recognize the images more accurately.

This section provides the basic details about the proposed work and the next section provide proposed model simulation and detailed design of the proposed system.

II. PROPOSED SYSTEM

In content based image retrieval organism the term "Content-based" means the search made by analysing the contents of stored images in database rather than their analogous text i.e. keywords, or other kind of descriptors. In this context the content may introduce to colours, shapes, and textures features. Additionally, that can also include any other information that receive from image can be used as content of the image. The key reason behind development of CBIR is the restriction of text based image retrieval systems. Textual information about images can be easily searched using various prevail technology, but this requires huge human efforts to describe image and their contents. Additionally due to narrated issues such as use of different words in different regions for description can also affect the performance of image search. Therefore explore by text in image context is not much suitable.

In this presented work the content based image retrieval technique using the query by image is investigated. In query by image technique for searching the images the image is produced as input to the system which works as the user query. In order to demonstrate the techniques of content based image retrieval technique two different techniques namely image retrieval using the colour features and the image retrieval using the colour and edge histogram technique is implemented

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and their comparative study is performed. the colour and edge based hybrid approach promises to provide the accurate results as compared to the colour feature based technique. The basic overview of the proposed working model is given using figure 1.

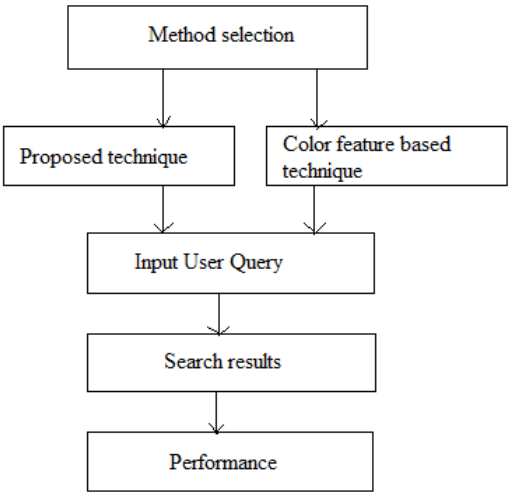

Figure 1 proposed model

The proposed simulation model shows in the above given diagram the method first implements the technique by which the traditional method or the proposed image retrieval model is selected for experimentation. After selection of the user required model for experimentation the user need to produce input to the system as user query. In the implemented techniques the system accepts image as the user query. And by the produced image query is used with the system processes the user request. During the processing the system comparing the query image features to the database image features the search results are populated. When the system returns the search results the system also evaluate the performance parameters for the implemented search methods. That is performed in the final phase of the demonstrated system. The entire system processes for improving the traditional technique is summarized using the algorithm steps as given in table 1.

Table 1 proposed algorithm.

Proposed algorithm
Input: user query image U_i, Database image list D_l Output: list of similar images L_{si} Process: 1. $I_c = ColorHistogram(U_i)$ 2. $I_g = Gabour\_Edge(U_i)$ 3. $N_{cg} = Normalize(I_c, I_g)$ 4. $for\ (i = 1; i \leq D_l.length; i++)$ a. $I_c^d = ColorHistogram(I_i^D)$ b. $I_g^d = Gabour\_Edge(I_i^D)$ c. $N_{cg}^d = Normalize(I_c^d, I_g^d)$ d. $S = \sum_{j=1}^{N} \sqrt{{N_{cg}}^2 - {N_{cg}^d}^2}$ e. $if(S \leq 0.25)$ i. $L_{si}.Add(I_i^D)$ f. end if 5. end for 6. Return L_{si}

The proposed algorithm for colour and edge based image retrieval technique is given using table 1 in this algorithm the user input image and database image list is required to produce for searching the relevant image. The input query image is evaluated using the colour histogram algorithm and the edge detection technique. The extracted features are combined using the normalization technique. The normalized feature of query image is stored for further use. On the other hand the database list is processed for finding both the features of the image. These features are compared using Euclidean distance and the most similar features images are listed for representing the search outcomes.

III. RESULTS ANALYSIS

The implemented enhanced image retrieval technique is evaluated on the basis of the different experimental scenarios and different sets of data. The evaluated performance of the obtained system is described in this chapter with their evaluation and outcomes.

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A. Precision

In any data retrieval or search applications the precision is a fraction of search results which is most relevant to the input query. The provided precision of the proposed content based image retrieval system are given using figure 2. This can be evaluated using the user feedback basis and can be evaluated by the following formula.

$$precision = \frac{relevent\ document\ \cap retrieved\ documets}{retrieved\ documents}$$

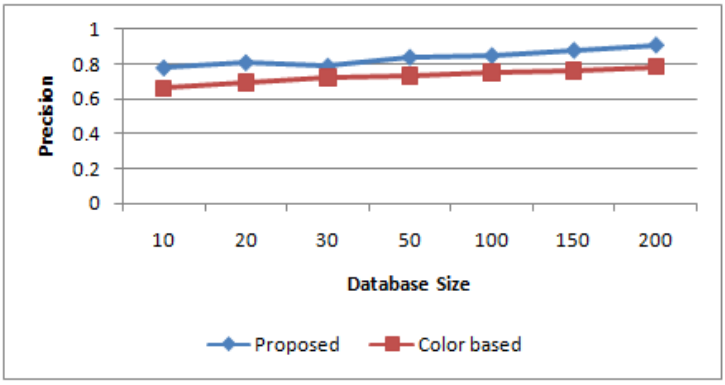

Figure 2 precision rate

The precision rate of the implemented system is described in the figure 2 and table2, the computed precision values are demonstrated using the Y axis of the given figure and the X axis of the figure. It shows the amount of training images in the database. According to the obtained results the performance of the proposed system and traditional system is increases as the quantity of data in database is increases. In addition of the precision rate is growing continuously as the similar kinds of images are also increases in data base.

Table 2 precision rate

Amount of image in database	Proposed technique	Traditional technique
10	0.78	0.66
20	0.81	0.69
30	0.79	0.72
50	0.84	0.73
100	0.85	0.75
150	0.88	0.76
200	0.91	0.78

B. Recall

In data retrieval application or the search application recall values are measured for accuracy measurement in terms of relevant document retrieved or relevant data obtained according to the input user query. This can be evaluated using the following formula.

$$recall = \frac{relevant\ document \cap retrieved\ documents}{relevant\ documents}$$

The figure 3 and the table 3 show the recall values of the proposed and traditional image retrieval application. In order to represent the performance of the both image retrieval system the X axis contains the amount of images in database and the Y axis reports the obtained recall rate of the implemented system. According to the obtained results the performance of the proposed system is enhances as the quantity of data is expand in the database.

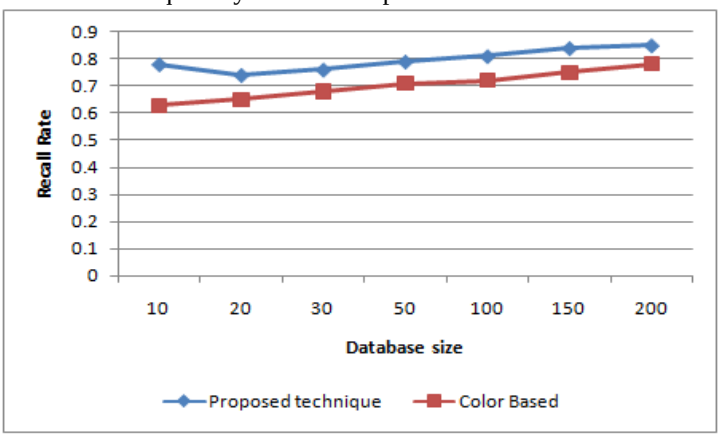

Figure 3 recall rate

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The retrieval accuracy with the increasing quantity of data is also increases thus the proposed concept is adoptable for the image search applications. Therefore the performance of the proposed system is much efficient as compared to the traditional method of image retrieval.

Table 3 recall rate

Amount of image in database	Proposed technique	Color technique
10	0.78	0.63
20	0.74	0.65
30	0.76	0.68
50	0.79	0.71
100	0.81	0.72
150	0.84	0.75
200	0.85	0.78

C. F-measures

The f-measures of the system demonstrate the fluctuation in the computed performance in terms of precision and recall rates. The f-measures of the system can be approximated using the following formula.

$$F - measures = 2.\frac{precision\ X\ recall}{Precision + recall}$$

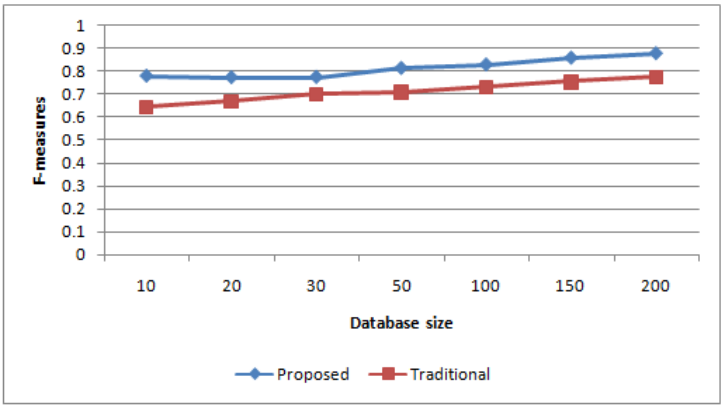

Figure 4 f-measures

Table 4 f-measures

Amount of image in database	Proposed technique	Traditional technique
10	0.78	0.6446
20	0.7734	0.6694
30	0.7747	0.6994
50	0.8142	0.71
100	0.8295	0.7346
150	0.8595	0.7549
200	0.8789	0.7756

The figure 4 and the table 4 show the performance of both the systems in terms of f-measures. To demonstrate the performance of the system the X axis shows the amount of data is placed in storage during experiments and the Y axis shows the obtained performance in terms of f-measures. According to the obtained results the performance of the proposed system is much stable and enhancing as compared to traditional method. In addition of that the results are more progressive manner as the amount of data base is increases. Thus the acquire results are adoptable and efficient for the image retrieval applications.

D. Memory used

The memory used sometimes also called the memory consumption or the space complexity. That amount of main memory required to execute a given algorithm with the amount of data is known as the memory consumption or space complexity of algorithm. The figure 5 and the table 5 show the performance of the system in terms of space complexity, in this diagram the X axis shows the amount of data available in data base and the Y axis shows the amount of memory consumed in terms of KB (kilo bytes). According to the acquire results the performance of the system becomes consistent and not consuming more memory even when the amount of data to be process is increases in the database but that produces a small amount of effect in memory consumption.

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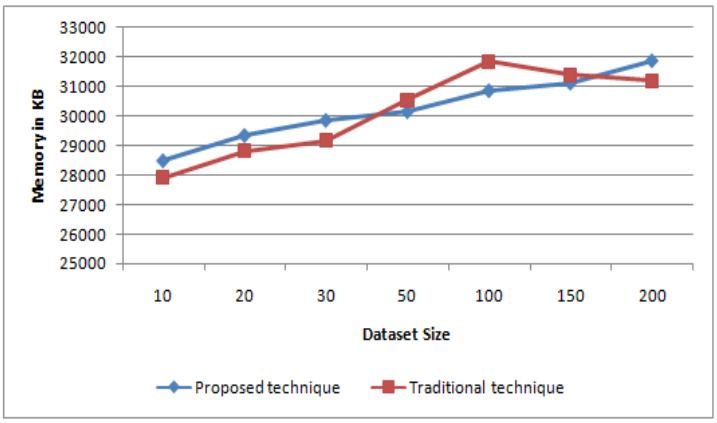

Figure 5 space complexity

Table 5 space complexity

Amount of image in database	Proposed technique	Traditional technique
10	28498	27918
20	29347	28829
30	29854	29173
50	30148	30542
100	30852	31847
150	31104	31382
200	31859	31182

E. Time consumption

The amount of time required to complete the retrieval task after providing input to the system is termed as time consumption of the algorithm. The time consumption of the proposed technique is given using figure 6 and table 6. According to the demonstrated results the X axis contains the amount of images available in the database and the Y axis shows the amount of time consumed during the retrieval process in terms of milliseconds. According to the obtained results the performance of the system is fluctuating with the amount of data produced in the data base thus as the quantity of data is increases the number of collation time is increases. Therefore the outcomes of the retrieval system take long time as the quantity of data in database is enlarge.

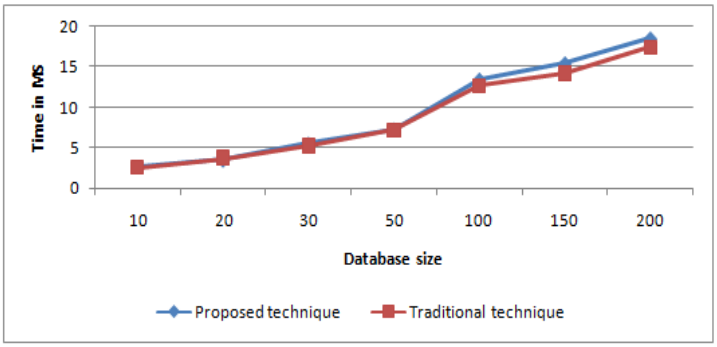

Figure 6 time complexity

Table 6 time complexity

Amount of image in database	Proposed technique	Traditional technique
10	2.63	2.61
20	3.46	3.78
30	5.48	5.25
50	7.26	7.22
100	13.43	12.73
150	15.44	14.25
200	18.53	17.42

IV. CONCLUSIONS

The implementation of the present image retrieval system using the colour and edge feature extraction for query by image technique is performed successfully. Additionally their performance is also evaluated based on their experimentations some facts are concluded that are reported in this chapter. Furthermore the future extension of the work is also included.

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A. Conclusion

In this era of technology the need of data and computation is increases continuously. Each and every hand is mounted with the new generation gadgets and smart devices. Additionally these devices are internet enabled thus user continuously search data from the internet and other sources of data. Due to this the need of multimedia contents i.e. image and video contents are also increases by these users. There are two kinds of methods are popular for making search text based techniques and content based techniques. The text based techniques are working on the basis of text and description associated with these multimedia data but the content based techniques are finding the contents that are actually hidden in the multimedia data. Therefore the content based techniques are much effective then the text based techniques.

In this presented work the content based technique is studied in detail and using the available image features i.e. shape, and colour distribution the images are searched. That technique helps to group the similar image contents in a group, in addition of the proposed technique is works on the basis query by image technique thus that make more promising outcomes from the retrieval.

The implementation of the proposed technique is performed by the MATLAB based technology and their performances in different performance parameters are evaluated. These performance parameters are also used for computing and comparing the difference among the proposed and traditional techniques of image retrieval. In order to analyse the obtained outcomes a summarized results are also listed using the given table 7.

Table 7 performance summary

S. No.	Parameters	Proposed technique	Traditional technique
1	Precision	High	Low
2	Recall	High	Low
3	f-measures	High	Low
4	Space complexity	Similar	Similar
5	Time complexity	Similar	Similar

According to the obtained results the performance and relevancy of the proposed technique is adoptable due to less fluctuating accuracy in terms of precision, recall and f-measures. Additionally the method produces the less time and space complexity and most similar to the traditional method thus the proposed technique enhancing the results as compared to traditional method more effectively.

V. FUTURE WORK

The proffer technique is implemented successfully and their performance in different parameters are estimated, according to results the performance of the proposed technique is adoptable and efficient thus the following expected extensions are possible with the proposed method extension.

1. The computational complexity in terms of time complexity is required to enhance because the time complexity of the system is increases with the amount of data
2. The presented work is only works for the image based query for similarity computation that can also be implemented for text based query processing
3. The method can also be extended with the semantic annotation based techniques for improving the image retrieval performance for text based processing.

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