International Journal of Engineering & Technology, 7 (3.6) (2018) 276-280

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

CBIR Using Slant Transform Using DC & AC Coefficients

N. Sravani[1*], K. Veera Swamy[2]

[1]*Assistant Professor, Department Of ECE, QIS College Of Engineering & Technology, Vengamukkapalem.*
[2]*Professor, QIS College Of Engineering & Technology, Vengamukkapalem. E-Mail:Kilarivs@Yahoo.Co.In*
**Corresponding Author E-Mail:Sravanisrv@Gmail.Com*

Abstract

In the CBIR- (Content Based Image Retrieval) technique requires low-level or primitive features- color, texture, or other data that can be taken from its image Extracting feature vectors of database images as well as query image can be calculated with the help of slant transform by considering DC & 3 AC coefficients obtained in each block of an image. Slant transform represents the gradual brightness changes in an image line effectively. By calculating the difference between feature vector data base and feature vector for a query by using the distance measuring techniques. The vector of the smaller distance is the closest to query image. The experiment is performed in the Corel 500 Image Database. Finally, CBIR results are evaluated by the recall, precision, and F-Score.

Keywords: *CBIR, slant transform, DC coefficients, AC coefficients, distance metrics, precision, recall.*

1. Overview

In an internet large number of images are accessible. In order to acquire the images, an efficient as well as effective content based image retrieval system is essential. Here the word 'content' refers to the shape-, texture and color or other data that can be extracted from its image. Without the ability to navigate content of search images, metadata, such as keywords or titles, are ambiguous. It is also possible to skip a picture that uses other words or substitutes in your description. There has been a significant increase in the development of the CBIR due to image settings.

CBIR% is achieved in 2 steps, i.e., indexing phase and the searching phase. In step-1, characteristics of an image are acquired and put in the feature vector and form a feature database. In searching phase, query image feature vector is extracted as same as data base images and compute the distance with the feature database. Based on the smaller distance retrieve the most resemblance images to the query image from the database. .

CBIR digital software includes pictures, geometry, geometry, and satellite imagery, museum images such as EEG, ECG and Citizen Infrastructure Systems. Traffic, geo-architecture, architecture, environmental control, paper preparation, identification of agricultural land mines, mathematical data, and baseline data.

In this article, our key role is to provide better practices in retrieval techniques, by extracting features of the each image efficiently, and finding similar query images from database images using the slant transform technique. The suggested method starts with attaining YCbCr color space from the RGB color space image. In YCbCr, the Y color space represents the intensity or luminance components, while Cb and Cr have color components that describe the color information. Later, slant transform is applied to the non-overlapping 8×8 blocks of intensity components (Y-component) in an image. To construct the feature vectors we have to consider the DC and 3 AC coefficients obtained from the each block of an image. The similarities between image and query images are calculated using the distance metric using feature vectors. The efficiency of the extraction is calculated based on the performance measures.

The rest of the paper illustrates the various chapters. Chapter 2 determines the feature vector extraction using the slant transform method, and the proposed technique is discussed in the chapter-3. Chapter 4 demonstrates the experimental outcomes. Lastly, chapter 5 concludes the effectiveness of proposed technique.

2. Feature Extraction

Slant Transform

Slant transform is the transformation technique whose matrix having a fixed function in the first and second rows and linear functions of a column index. Matrix is created by repetitive construction shows the matrix as the product of a rare matrix, results a fast transform.

A slant matrix has the following properties: 1) fast calculation algorithm 2) a constant velocity vector; 3) order properties, 4) an empty vector, 5) "varying the variable size"; 6) orthonormal set of basic vectors and 7) high power compact. The following section describes the matrix construction and shows the calculation algorithm quickly. The 2×2 slant-transform matrix is given by

$$S_2=1/\sqrt{2}\begin{pmatrix}1 & 1\\ 1 & -1\end{pmatrix}$$

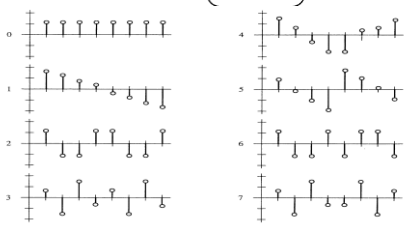


Fig. 1: Basis function of slant transform matrix for N=8

$$S_N = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 0 & \mathbf{0} & 1 & 0 & \mathbf{0} \\ a_N & b_N & & -a_N & b_N & \\ \mathbf{0} & & \mathbf{I} & \mathbf{0} & & \mathbf{I} \\ 0 & 1 & \mathbf{0} & 0 & -1 & \mathbf{0} \\ -b_N & a_N & & b_N & a_N & \\ \mathbf{0} & & \mathbf{I} & \mathbf{0} & & -\mathbf{I} \end{bmatrix} \begin{bmatrix} \mathbf{S}_{N/2} & \mathbf{0} \\ \mathbf{0} & \mathbf{S}_{N/2} \end{bmatrix}$$

Here I denotes an identity matrix order {N/2-2},

$$a_{2N} = \sqrt{\frac{3N^2}{4N^2-1}} \quad \text{and} \quad b_{2N} = \sqrt{\frac{N^2-1}{4N^2-1}}$$

The slant transform of 8 ×8 order kernel is

$$S_8 = 1/\sqrt{8} \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1/\sqrt{5} & -3/\sqrt{5} & 3/\sqrt{5} & -1/\sqrt{5} & 1/\sqrt{5} & -3/\sqrt{5} & 3/\sqrt{5} & -1/\sqrt{5} \\ 7/\sqrt{105} & -1/\sqrt{105} & -9/\sqrt{105} & -17/\sqrt{105} & 17/\sqrt{105} & 9/\sqrt{105} & 1/\sqrt{105} & -7/\sqrt{105} \\ 1 & -1 & -1 & 1 & 1 & -1 & -1 & 1 \\ 7/\sqrt{21} & 5/\sqrt{21} & 3/\sqrt{21} & 1/\sqrt{21} & -1/\sqrt{21} & -3/\sqrt{21} & -5/\sqrt{21} & -7/\sqrt{21} \\ 1/\sqrt{5} & -3/\sqrt{5} & 3/\sqrt{5} & -1/\sqrt{5} & -1/\sqrt{5} & 3/\sqrt{5} & -3/\sqrt{5} & 1/\sqrt{5} \\ 3/\sqrt{5} & 1/\sqrt{5} & -1/\sqrt{5} & -3/\sqrt{5} & -3/\sqrt{5} & -1/\sqrt{5} & 1/\sqrt{5} & 3/\sqrt{5} \\ 1 & -1 & -1 & 1 & -1 & 1 & 1 & -1 \end{bmatrix}$$

3. Proposed Algorithm

The proposed technique Block diagram and detailed algorithm is shown in below

1. Read an input image (I) RGB color space from collection of database images.
2. Obtain the YCbCr color space from the input image RGB color space.
3. Resizing the image to 128 × 128
4. The intensity plane [Y component] in an image is divided into 8×8 non-overlapping blocks.
5. Apply the slant transform to each 8×8 block.
6. In each 8×8 block of an image consider the DC & first 3 AC coefficients [AC1, AC2, AC3]. These 4 coefficients are united and form a single feature Vector (FV).Feature Vector can be denoted by using following expression

   FV= [DC, AC1, AC2, AC3]
7. Generate a feature database by computing the feature vectors (FV) for all images in the database.
8. Feature vector for the query-image is calculated in the similar manner like database images.
9. compare feature vectors of database images and query image by using Distance metrics for similarity checking
10. The most related or resemblance for a query- image is the feature vector of images with lesser distances.

Euclidean distance $(\Delta d) = \sqrt{\sum_{i=0}^{n}(|Q_i - D_i|)^2}$

Here Q ----- feature vector for a Query image

D-----Feature vector for a database image

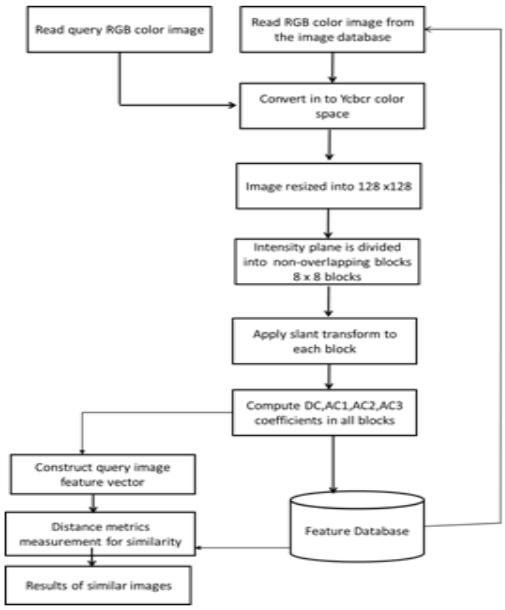


Fig. 2: Block diagram for the proposed method

4. Experimental Results

Our proposed technique has been executed on Corel image database of 500 images using MATLAB. Corel image database has 5 various categories and each category or set consists '100 images'. All images belong to the RGB and JPEG '(.jpg)' with 256 × 384 or 384 × 256 pixels.

Similarity Measurement

The 2nd step in CBIR% is similarity measurement. In %CBIR process image query feature vector compares with the feature database. The resemblance of query image with database images can be measured by calculating the variance between Query (FV) and feature database using Euclidean distance method. The lowest variance between two vector elements specifies that the distance is the smallest which is best suited to the image of the query.

Stages of Proposed Technique

CBIR technique is implemented in two stages.

Stage 1

In stage-1, feature vectors are extracted subsequently from database images and store them in the form of feature vector for creating a feature database.

Stage 2

In this second stage, the user is asked to enter the query image to extract the relevant image from the database using the same technique. The feature vectors of query image is created and compared with the feature database. Similarity checking can be done by using the distance measures. The corresponding image is displayed based on the user according to the query image.

Performance Measures

The Performance of the retrieval system is based on the extraction of the feature vectors of the image, as well as the similarity measurement. To evaluate the efficiency of CBIR system by using the parameters recall, precision, & F-Score.

Precision

Precision evaluates the effectiveness of the system retrieval. It is calculated as fraction of relevant retrieved images or documents to the query of the total retrieved images or documents.

Precision = {RRI}/ {TRI}

Here, 'RRI' --- 'Relevant Retrieved Images'
'TRI' --- 'Total Retrieved Images'.

Recall

Recall-is stated as the "ratio between number of relevant retrieved images and the query of the Total Data Base Images".

Recall= {RRI}/ {TDI}

Here, 'TDI' ---'Total Data Base Images'
'RRI' --- 'Relevant Retrieved Images'

'F-score' or 'F-measure'

Performance measurements associated with image retrieval systems with respective to database and query images are precision and recall and these both values are always calculated to illustrate the process for retrieving an image. So we have to calculate 'F-measure' or 'F-score' or "Harmonic-mean (H.M) of the recall and precision" by using precision and Recall.

$$\text{F-score/ F-measure} = 2\times .\{\frac{Precision \times Recall}{Precision + Recall}\}$$

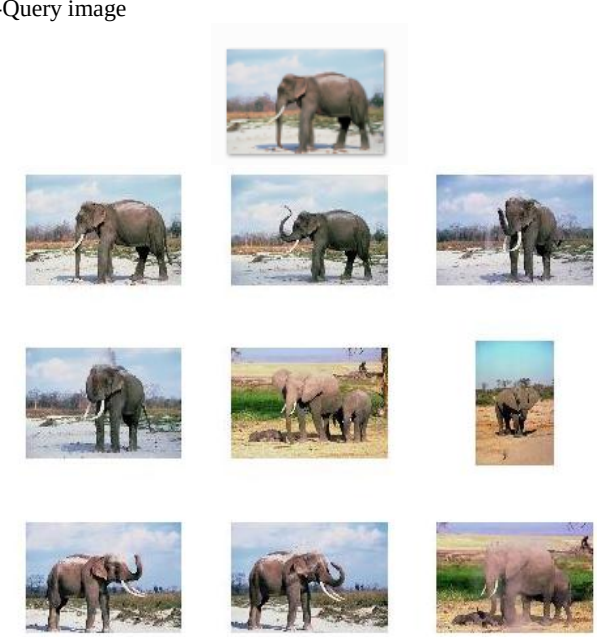
Query image

Results of a retrieval images for 'Dinosaur'- query image

-Query image

Results of a retrieval images for 'Roses'- query image

-Query image



Results of a retrieval images for 'Elephants' - query image

-Query image

Results of a retrieval images for 'Horses'- query image

Table 1: Comparison of Proposed Techniques with Other Techniques on the Basis of Precision (category wise)

CATEGORY	DCT(Existed)[1]	SLANT TRANSFORM(proposed)
Dinosaurs	100	100
Roses	96	100
Horses	93	100
Elephants	79	92
Mountains	62	77

Table 2: Comparison of Proposed Techniques with Other Techniques on the Basis of Recall (category wise)

CATEGORY	DCT(Existed)[1])	SLANT TRANSFORM(proposed)
Dinosaurs	100	100
Roses	87	98
Horses	91	95
Elephants	77	85
Mountains	68	74

Table 3: Comparison of Proposed Techniques with Other Techniques on the Basis of F-score (category wise)

CATEGORY	DCT(Existed)[1])	SLANT TRANSFORM(proposed)
Dinosaurs	100	100
Roses	91.27869	98.9899

Horses	91.98913	97.4359
Elephants	77.98718	89.95556
Mountains	64.86154	75.4702

Table 4: Average Execution Time (sec) for Proposed Method (i.e., Similarity Verification of 'query image' with Database Images

Total images	DCT(Existed)[1]	SLANT TRANSFORM(proposed)
500	64.132	41.32

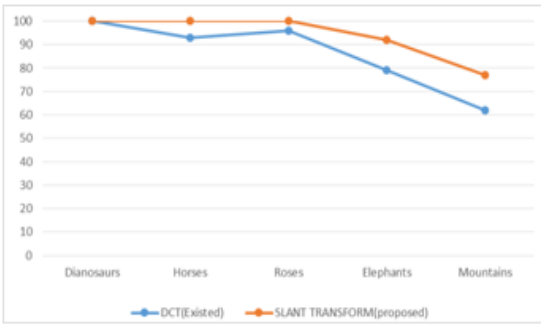
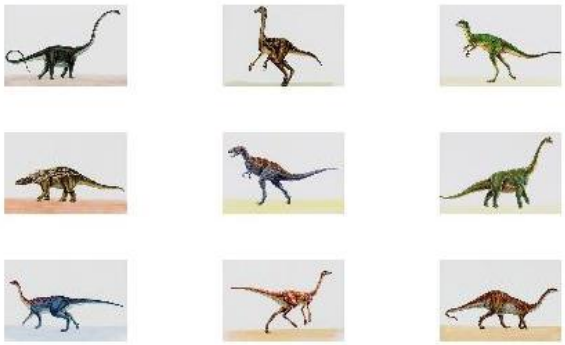


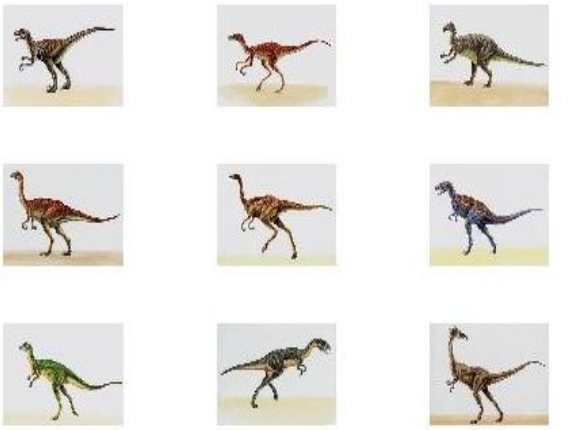
Fig. 3: Average Precision for different image categories in data base

To assess the efficiency of the system, the reliability of proposed technique is also verified. Here, the results indicates that the proposed system is relatively vigorous to transformation or alteration images such as filtering, rotation, noise, and intensity variations, variance in sharpness and some other intentional falsifications. The following results shows some alterations of query images and the best performing results of 9 extractions. The system is vigorous for the following variations i.e., rotate by 90^0, rotate by 270^0, darken by 40%, brighten by 30%, adding salt & pepper noise, smoothing, sharpening and rotate by 45^0.

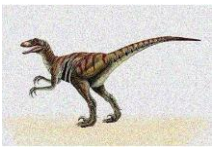


Rotate by 90^0

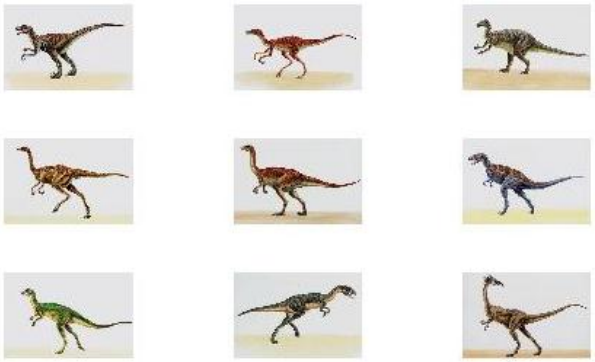
Rotate by 180^0



Adding salt & pepper noise



By adding gaussian noise



Smoothing operation

5. Conclusion

CBIR Using slant transform using DC & AC coefficients is presented in this paper. By constructing Feature vectors from the image and used for retrieving relevant images. Precision is improved by 9% and recall is enhanced by 6.4 with the proposed method. Computation time is reduced to 36% with the proposed method.

References

[1] Malik F & Baharudin B, "Analysis of distance metrics in content-based image retrieval using statistical quantized histogram texture features in the DCT domain", *Journal of king saud university-computer and information sciences*, Vol.25, No.2,(2013), pp.207-218.

[2] Pratt W, Chen WH & Welch L, "Slant Transform Image Coding", *IEEE Transactions on Communications*, (1974).

[3] Jadhav SH & Ahmed SA, "Content based image retrieval system with hybrid feature set and recently retrieved image library", *International Journal of Computer Applications*, Vol.59, No.5, (2012).

[4] Mumtaz A, Gilani SAM & Jameel T, "A Novel Texture Image Retrieval System based on Dual Tree Complex Wavelet Transform and Support Vector Machines", *IEEE 2nd International Conference on Emerging Technologies*, (2006).

[5] Soman S, Ghorpade M, Sonone V & Chavan S, "Content Based Image Retrieval using Advanced Color and Texture Features", *International Conference in Computational Intelligence (ICCIA)*, (2011).

[6] Albuz E, Kocalar E & Khokhar AA, "Scalable color image indexing and retrieval using vector wavelets", *IEEE Transactions on Knowledge and Data Engineering*, Vol.13, No.5,(2001), pp.851-861.

[7] Corel database http://wang.ist.psu.edu/~jwang/test1.tar

[8] Malik FE & Baharudim B, "Effective content-based image retrieval: Combination of quantized histogram texture features in the DCT domain", *International Conference on Computer &Information Science (ICCIS)*, (2012).

[9] Ruzon MA & Tomasi C, "Color Edge Detection witb tbeCompass Operator", *IEEE conference on Computer Vision and Pattern Recognition*, Vol.2, (1999), pp.160-166.

[10] Komali A, Satish Kumar V, Ganapathi Babu K & Ratnam ASK, "3D Color Feature Extraction in Content-Based Image Retrieval", *International Journal of Soft Computing and Engineering (IJSCE)*, Vol.2, No.3, (2012).

[11] Yumin T & Lixia M, "Image Retrieval Based on Multiple Features Using Wavelet", *5th IEEE International Conference on Computational Intelligence and Multimedia Applications*, (2003).