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TRADITIONAL INDIAN PAINTING RETRIEVAL SYSTEM BASED ON THE FUSION OF CURVELET AND GABOR TRANSFORM

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ABSTRACT

Great interest in research on Content Based Image Retrieval has been witnessed by last decade. Now this has become the basis for large number of new techniques, systems and growing interest in related field to support such systems. Due to advancement of digital technology, spatially image capturing and data storage, bulk of images are being created and stored digitally. This results in creating large number of digital libraries. The need has risen for intuitive and effective image storage, indexing, classification and retrieval mechanism.

Gabor and Curvelet transform are well known technique for texture feature extraction. But when individually used are unable to give the benchmark results due to each suffers from some limitations. To get the improved results In this paper fusion of Gabor and Wavelet are applied on the dataset which has been created by three traditional Indian paintings named as Warli, Madhubani, and Fadd as our country is well known all over the world for its art. In the second part of the paper the retrieval is also compared with the retrieval by using very effective Curvelet transform.

INTRODUCTION

The most important service of any digital image system is image retrieval procedure. The two main approaches developed for this purpose are Textual image retrieval and Content based image retrieval. Former requires annotation and hence is very time consuming, laborious and expensive. In the later one, retrieval is visual based i.e. color, texture and the shape based. Visual feature extraction is one of the fundamental operations of CBIR. In this paper our focus is on texture feature extraction, one of the important features of an image. There is a wide range of techniques used for texture analysis which are broadly classified as spatial and spectral methods. In the former techniques compute low order statistics from query and stored images. The texture features like degree of contrast, coarseness, directionality and regularity or periodicity, directionality and randomness are calculated by these methods. Alternative technique includes the use of Gabor filter, Wavelets and DCT. Statistical or spatial methods suffer from insufficient number of features also are sensitive to image noise. In the literature however the spectral methods do not able to capture edge information accurately. Following points show how our research finally reached to the use of Curvelet transform.

In 1999, an anisotropic wavelet transform, called Ridgelet transform was introduced by Candes and Donho, was optimal at representing straight line singularities. But due to limitations Ridgelet transform is only applicable to the objects having global straight line singularities.Which are rarely possible in real life applications. Hence for local straight lines and curve singularities, idea applied was to partition for the image, and then to apply the Ridgelet to the generated subimage. This new idea of block Ridgelet is named as Curvelet transform. But the applications of so called first generation Curvelet were limited as the ridgelet's geometry was unclear as a result comparatively simple second generation Curvelet transform based on frequency partition was proposed. This transform has been proven to be an efficient tool for large variety of applications **like image processing, Seismic data exploration, fluid mechanics and solving PDEs**.

Gabor transform in the recent years has been used successfully used in many applications like texture segmentation/ classification, character recognition, target detection, fingerprint recognition, face recognition, edge detection, image analysis and compression etc. Gabor filter has received a considerable attention as it possess the optimal localization properties in both the spatial and frequency domain.

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Systematic study from FT to Gabor filter of texture feature extraction Spectral methods has shown that each method has shown some improvement than its previously developed methods still were suffering from some limitation. Even the Gabor filter (one of the Wavelet transform), which was used in many application also has disadvantage of energy loss from the gap of oval frequency spectrum and thus result in loss of information. Reviewing both important transform that is Curvelet and Gabor, we have decided to work with the combination in our project. Which is applied on the spatially created dataset containing three types of Indian tradition painting named as **Warli**, **Madhubani** and **Fadd**. In the second part the result is compared with Curvelet only.

The organization of paper is as follows. II section is **RELATED WORK** in which the related methodologies were already used for different applications are mentioned. III section is **PROBLEM DOMAIN** which covers some of the limitations previous methods had. IV section is **SOLUTION PROPOSED** which describes our work against the problem faced by previous methods.V section is about **DESCRIPTION OF GABOR AND CURVELET** in which working of Curvelet is described. In the VI section **CONCLUSION**, VII is **FUTURE WORK** and lastly

RELATED WORK

The major areas for Curvelet applicatons are Image processing, Seismic exploration, Fluid mechanics, PDEs solving and compressed sensing. The following papers are the evidence of how useful Curvelet transform is.

1.Monochrome Image Compression using Log-Gabor Filter by Sanjay J. Bagul et.al, IJCA, November 2014
Description- complex graphics are growing in the fields of computing applications such as games, education, desktop publishing, graphical design and many more. High compression ratio severely affects the quality of the image. This paper attempts to improve compression ratio while at the same time minimizing the degradation in quality of images. In this paper compression of the images is based on Log-Gabor filter.
It was concluded that if the Log Gabor filtering is used on the images prior to compression technique, it helps to improve the compression ratio. Filter input parameters decide the filter performance that is directly related to image compression ratio and resultant filtered image quality

A CT Image Denoise Method Using Curvelet Transform, published in Springer Berlin Heidelberg, by unmin Deng **et.al**
Description- In this paper, an adaptine denoising approach, aiming to improve the visibility and detectability of hemorrhage from brain computed tomography(CT) was presented.This approach fused the images denoised by total variation(TV) method, denoised by Curvelet method, and edge information extracted by noise residue of TV method. The noise residue of TV extracted edge information by processing through Curvelet transform. The proposed approach's visual implementation showed that it not only reduces the staircase effect caused by total variation method but also visual distortion induced by Curvelet transform in the homogeneous area of CT images are also reduced.The ability of denoising of the proposed method was further evaluated by segmenting the hemorrhagic area bt the use of region growing method. For different noise levels the sensitivity, specificity, jaccard index, and Dice coefficients were calculated. The comparative results showed that in the brain hemorrhage detection from CT images, a significant improvement,after denoising it with the proposed approach.

Digital Curvelet Transform for Palmprint Recognition, published in Springer Berlin Heidelberg 2005 by Kaifeng Dong, Guiyu Feng, Dewen Hu
Description A new feature extraction method for palmprint recognition was presented. Digital Curvelet was revised as Discrete Meyer Wavelet transform had been used by replacing a Trous transform. Ridgelet transform is applied to each block which is obtained by sub-banding as the discrete Meyer wavelet transform is applied to the image containing palmprint. According to the system performance the best coefficients threshold are obtained by the use of this threshold Curvelet coefficients are filtered and less than 2% of coefficients are selected. With this compressed coefficients set the correctness up-to 92.5%, for plamprint identification obtained was quite satisfied.

Handwritten Hindi Character Recognition Using Curvelet Transform, published in Springer Berlin Heidelberg 2011 by Gyanendra K. Verma, Shitala Prasad, Piyush Kumar
DescriptionIn this paper, a new approach using Curvelet transform for Hindi character recognition was proposed. As the Curvelet transform well approximate the curved singularities of images, they are useful in feature extraction of character images. More than 49 characters are contained in Devnagari script(13 vowels and 33 consonants). All the characters are rich in curves information. First the input image is segmented then Curvelet features are obtained by the calculation of statistics of thick and thin images after applying curvelet transform. With K- nearest

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neighbor classifier the system was trained. An in- house dataset of 200 images of characters was used for experiment evaluation. The result obtained was promising with 90% recognition accuracy.

Forgery Detection in Biometric System with Efficient Image Analysis by Priyanka C. Wankar et.al, IJIRCCE September 2015

Description- In this method a fake detection method was presented that can be used in multiple biometric systems to find out different kinds of fraudulent access attempts. As Biometric detection and authentication generally deals with non-ideal scenarios like blurred images, off-angles, and reflection and expression changes. The motive of the proposed system is to detect fraudulent biometric samples. The method proposed here presents a very low degree complexity, making it suitable for real-time applications, by the use of Gabor feature extraction.

PROBLEM DOMAIN

Gabor filter responses are widely and successfully used as general purpose features extractor in many applications areas. For the Feature construction, the Gabor filters are utilized via multi-resolution structure, consisting of filters tuned to several different frequencies and orientations.

Though Gabor filters are similar in working with respect to Curvelets, they do not cover entire frequency spectrums due to their oval shape. Fig. 1(a) represents the holes between ovals in the frequency plane of Gabor wavelet and thus result in information loss.The complete coverage of the frequency spectrum by curvelet can be observed in Fig. 1(b). In sthis figure, si stands for scale i, and the numbers 1, 2.. etc. show the orientations or sub-bands.

Although curvelet can cover spectral domain completely due to the wedge shape of its frequency response, the Gabor wavelets are very effective in representing objects with isolated point singularities. Thus, Gabor wavelets and curvelets are mutually complementary.

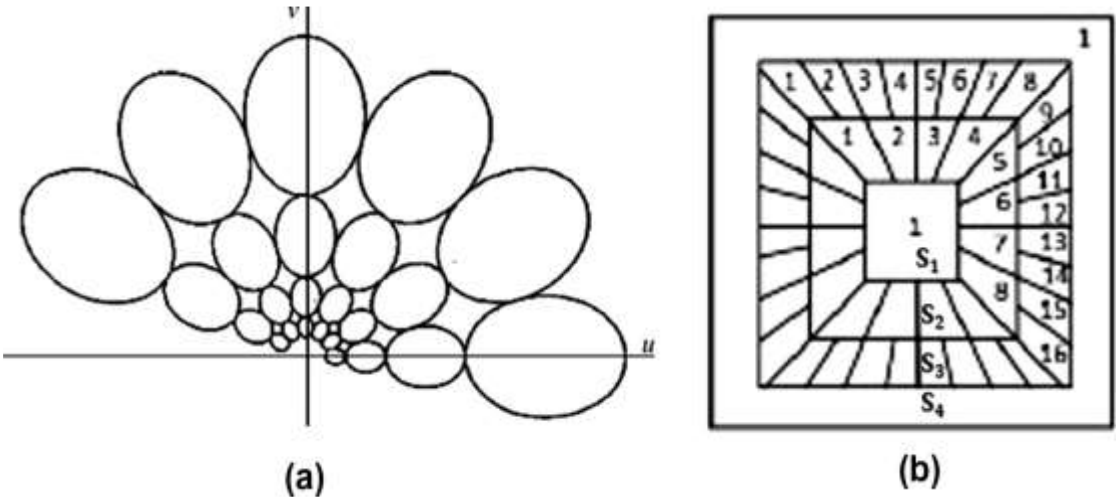

Figure 1 Frequency spectrum coverage by (a) Gabor (b) curvelet.

SOLUTION PROPOSED

As we have seen both the transforms have their limitations while used independently. In this paper we shall work on the fusion of Gabor and Curvelet transform.

SYSTEM ARCHITACTURE

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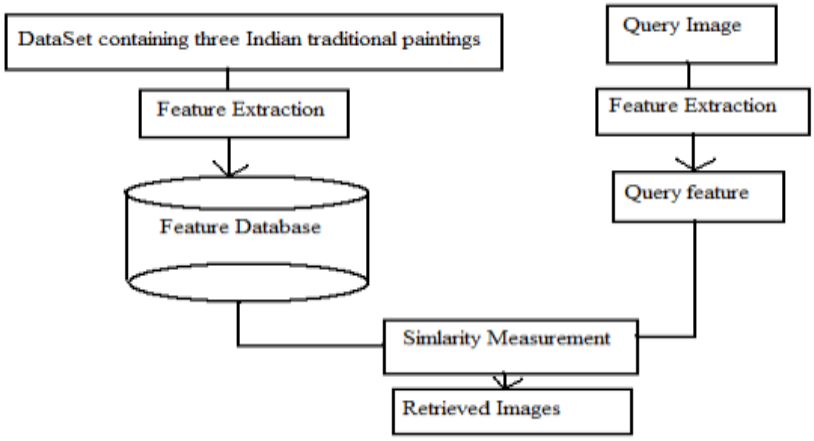
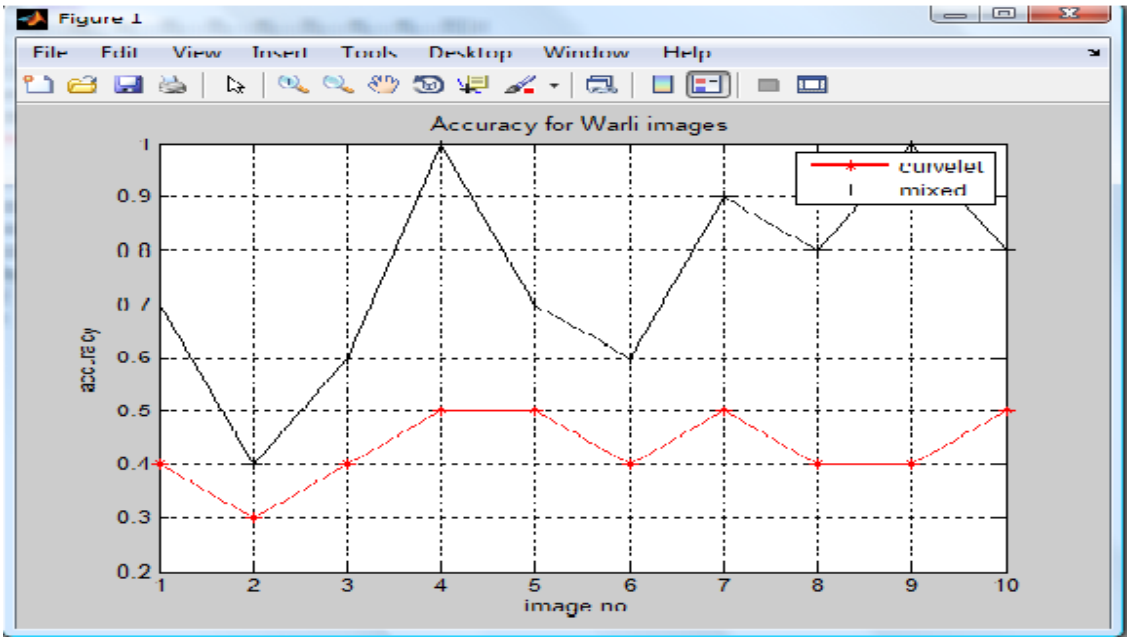


Figure 2 Working model

RESULT & COMPARISION

Three different graphs for three different traditional paintings are given below. Each type of painting has been retrieved by fusion of Curvelet and Gabor and then by only Curvelet.

WARLI PAINTING RETRIEVAL



FADD PAINTING RETRIEVAL

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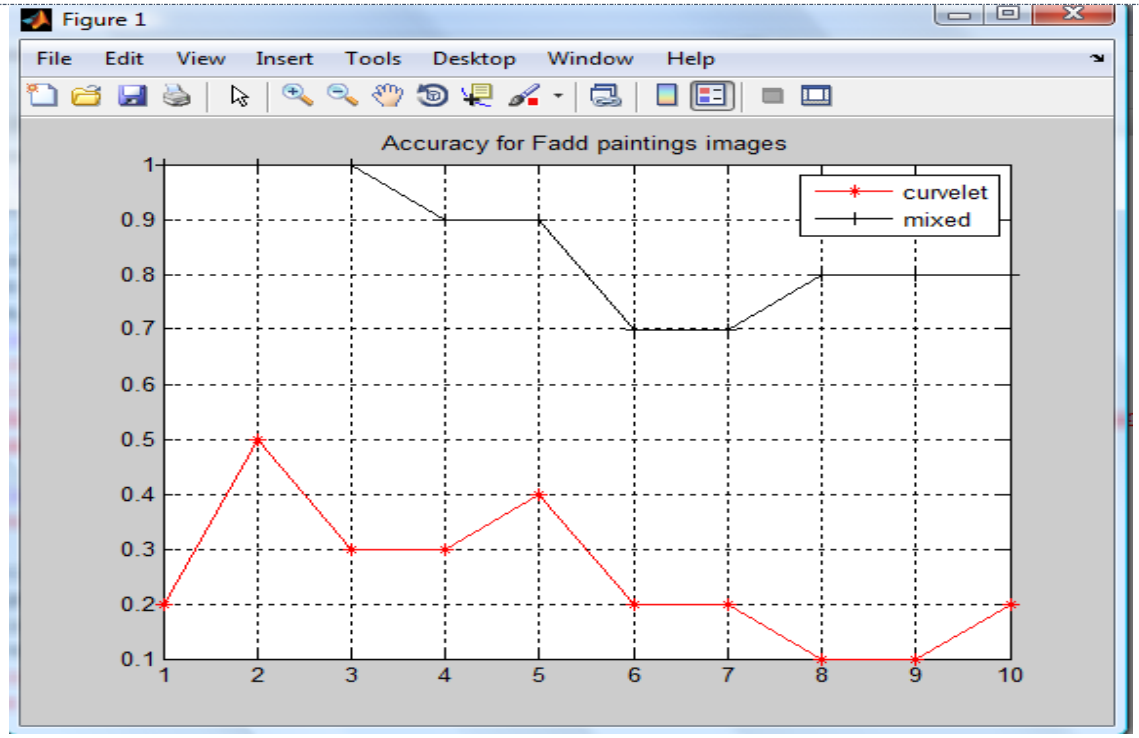
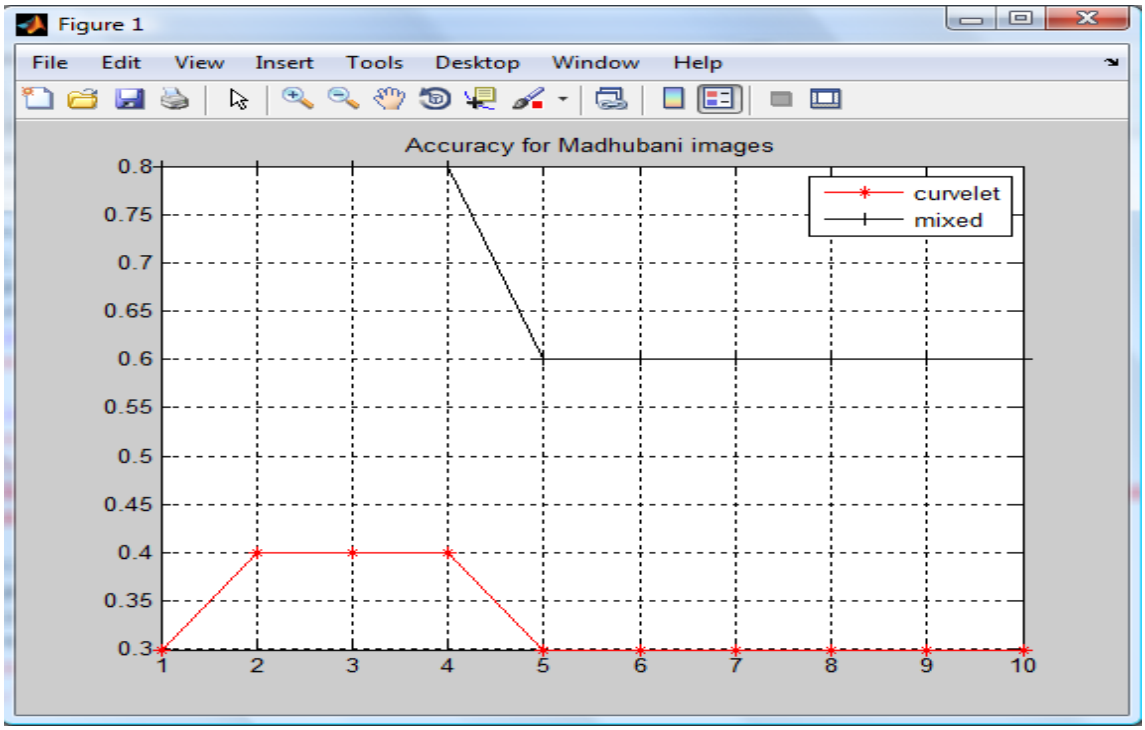


MADUBANI PAINTING RETRIEVAL



CONCLUSION

In this paper, a new methodology, in which combination of Curvelet and Gabor transform is introduced. Firstly study of various papers show how promising this new method is, secondly it shows how significantly it outperforms other best proven methods like Curvelet and Gabor transform, when used seperately and the application area of this method is so vast that perhaps it hasn't untouched any field.

Lastly the dataset which has been selected, composed of three Indian tradition paintings, for the retrieval system, make interesting and exciting to work upon.

FUTURE SCOPE

In the above described paper work in which we aim to create the retrieval system, stored with three Indian traditional paintings named Warli, Madhubani and Fadd. Curvelet transform is chosen as retrieval method after studying the limitations of other feature extraction methods used in the past.

In future we can work on combination of low level features like it can be combination of color + texture or texture + shape. Also we can develop the methodology which is built by combination of methodologies like Ridgelet,Wavelet, Gabor and Curvelet. By permutation and combination we can enhance efficiency in terms of accuracy and speed both. Apart from the above trails we can work for better Ridglets, better bandpass filter and better decimation. Lastly to be more efficient in retrieval system, relevance feedback techniques can be incorporated such that more precise results can be obtained as the user provides feedback. However, existing relevance feed-back based CBIR usually request for a number of iterative feedback to get refined search result, spatially when the dataset is too large. In real application this is impractical as well as inefficient.

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