International Journal of Scientific Engineering and Applied Science (IJSEAS) - Volume-1, Issue-4, July 2015
ISSN: 2395-3470
www.ijseas.com

CONTENT BASED IMAGE RETRIEVAL USING EMPIRICAL MODE DECOMPOSITION

PRANOTI M. KULKARNI **PARUL S. ARORA BHALOTRA**

Abstract:

Content Based Image Retrieval is process of retrieving an images by using contents of an image. Content of an image may be its shape, texture or color, etc. These are principle components of an image. But in our paper we are using IMF as principle component for retrieving an image. Empirical Mode Decomposition decomposes signal in to some finite oscillations. Finite oscillations are called as Intrinsic Mode Function. This paper is divided into 3 parts 1. EMD (Empirical Mode Decomposition) 2. CBIR (Content Based Image Retrieval) 3. CBIR using EMD. In third part first it will take input image then empirical mode decomposition process will takes place. We are using IMF as principle component to retrieve an image.

Keywords : EMD, CBIR

I. INTRODUCTION

All of us knows CBIR i.e. Content Based Image Retrieval. We are using contents of an image rather than metadata[1]. In CBIR, search is carried out by using color, shape or texture feature. These are principal components in CBIR. Lots of techniques are available to retrieve an image such as Low level feature extraction, Relevant feedback method, Semantic-Based image retrieval, etc. Shape, color, texture these are low level features.

In Color feature extraction search is carried out by using colors in an image. Process is carried out by calculating color histogram of an image. Color histogram of query image is calculated first and it will be matched with available image database[2].

PRANOTI M. KULKARNI
pranoti.kulkarni0@gmail.com

PARUL S. ARORA BHALOTRA
parul.arora@raisoni.net

In shape based image retrieval Shape does not means shape of image but it refers shape of any particular region. Edge detection or segmentation method can be used shape based image retrieval[3].

But in this paper we are using Empirical Mode Decomposition method to retrieve an image. This is highly accurate method. EMD decomposes fast oscillations in to slowest oscillations. This method is useful for linear and non-linear signals. In this method we are using multiple iterations to decompose a signal . Multiple iterations calculates IMF of an image. IMF is basic part of EMD. IMF stands for Intrinsic Mode Function. We are using EMD to retrieve an image so IMF act as Principle component. When we enter query image first IMF is calculated after that it will be matched with IMF of available database image.

Paper is divided into seven sections. I. Introduction, II. Related work, III. What is EMD? IV. Algorithm of EMD, V.CBIR, VI. Content Based Image Retrieval using Empirical Mode Decomposition, VII. Results and Discussions, VIII. Conclusions.

II. Related work

According to K. Hemalchandram et al. [4] Now a days content based image retrieval is used for many applications. Color and Texture feature can be extracted through color histogram and wavelet transform.

With the help of lots of methods we can improve performance of Content Based Image Retrieval system. One of them is Relevance Feedback. Dacheng Tao et al. Evaluated Support Vector Machine (SVM) and Traditional Kernel BDA (KBDA) based RF algorithms [5].

Xiaoou Tang et al. States that our previous approaches treats positive and negative feedback equivalently. But we know that they are not equal [6]. Homogeneous concept was shared by positive feedback where negative feedback did not.

Combination of Color-shape feature and color-texture feature was taken by S. M. Zakariya et al. [7]. Robust feature set for image retrieval can be provided by this combination.

Said Jai-Andaloussi et al. Introduces Bidimensional Empirical Mode Decomposition for mass segmentation in image mammography. Process start by calculating

Decomposition and Last one is segment of mass injuries by edge linking algorithms[8].

Zhiyuan Shen et al. Shows procedure of Empirical Mode Decomposition. Intrinsic Mode Function is basic step of EMD. After that sifting and other calculations are performed[9].

An EMD can make suitable operations on tri-variate signals also. Most critical step in EMD is to make local mean envelope of given input signal. So, estimation of local mean can be performed by taking projection on multiple directions in 3D spaces. Naveed ur Rehman et al. Proposed algorithm which extracts rotating component from the signal .So, accurate time-frequency analysis can be performed [10].

Hyperspectral Image Classification and boundary processing strategy was proposed by Zhi He et al. [11].

III. EMD

EMD is acronym of Empirical Mode Decomposition. One wonders what is meaning of Decomposition? It means breaking down compound process into separate constituent components. As EMD is basic part of Hilbert Hung transforms. It was first invented by Hung et al. In 1998. EMD decomposes a signal into Intrinsic Mode function. Time Frequency information can be obtained by Hilbert Spectral Analysis of Intrinsic Mode Function & also determines the amount of variation due to oscillations at different time scales &time locations.

By using EMD we can remove highest frequency from a signal. Once highest frequency removed from signal, same procedure is applied to the residue signal to identify next highest frequency.

A next new signal will be a residue signal which will be used for decomposition[9].

So finally we have,

$$x(t) = \sum_{i=1}^{n} imf_i(t) + r(t)$$

Where,

$imf_i(t) = IMF$,

$r(t) = Residue.$

IV. EMD Algorithm

1. Read i/p image
2. Pre-process the image.
3. Identify local maxima and minima in an i/p image.
4. Deduce an upper and a lower envelope by interpolation.
5. Subtract the mean envelope from the image.
6. Subtract the so-obtained Intrinsic Mode Function (IMF) from the image.
7. Separate out residue.

Process of EMD can be carried out by

1. Calculate IMF
2. Sifting Process
3. Stopping Rule
4. Boundary Adjustment.

A. Intrinsic Mode Function

Intrinsic Mode Function is also known as IMF.

IMF Extraction:

1. Let x(t) be a mono-dimensional signal
2. Identify all local maxima of x(t).
3. Do the same thing with the local minima.
4. Interpolate between maxima ending up with some envelope.
5. Compute the mean $m(t) = \frac{e_{\min}(t) + e_{\max}(t)}{2}$
6. Likewise for the minimal envelope
7. Extract the detail **d(t) = x(t) – m(t)**
8. Iterate on the residual **m(t)**
9. We finally obtain the decomposition of the signal:

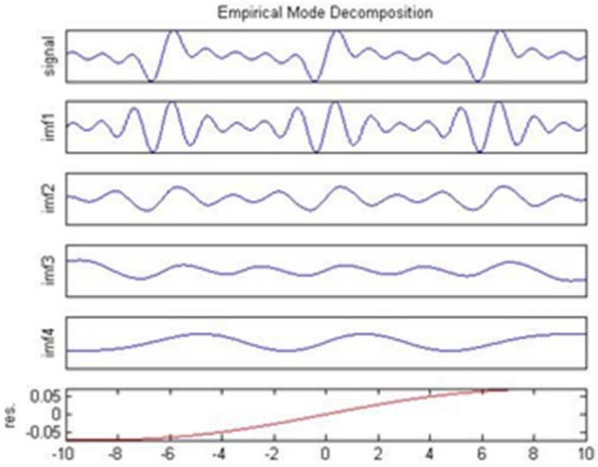


fig.1

B. Sifting Process

For obtaining equivalent frequency or a sinusoidal wave from a given signal x a data adapted algorithm suggested by Hung et al. In 1998.

1. Identify a local extrema.
2. Generate two functions called upper envelop and lower envelop by interpolating local maxima and local minima, respectively.
3. Take their average, which will produce a lower frequency component than original signal.

By subtracting the envelop mean from the signal x, highly oscillated pattern is separated.

Hung et al. States that an Oscillating wave can be Intrinsic Mode Function if and only if it satisfies following two conditions:

1. The number of extrema & number of zero crossing differs only by one.
2. The local average should be zero.

After one iteration conditions of IMF are checked if these conditions of IMF are not satisfied by one iteration, the same procedure is applied to the residue signal.

Automatic retrieval of an image by using color and shape feature was presented by T. Kato [12].

Relevant Feedback can be used to improve performance of the system. With the help of this relevant feedback image feature subset can be selected to measure dissimilarities. So, Direct Kernal Based Image Retrieval was proposed by Xiaoou Tang et al. [5].

Relevant feedback schemes are widely used with the help of support vector machine. Sample size problem can be solved by Kernel Machine. Multitraining Support Vector Machine gives better performance than older ones[13].

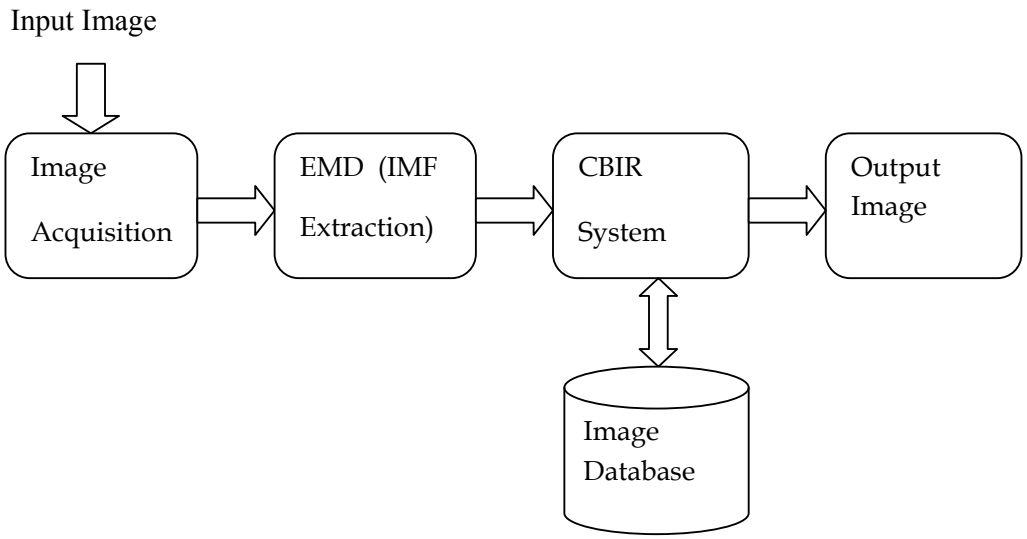


fig. 2

C. Stopping Rule

Sifting process stops when any process satisfies properties of IMF.

D. Boundary Adjustment

Boundary effect can be eliminated by adjusting a signal at the boundary. We can extend the original signal on both sides of the boundaries by adding artificial waves repeatedly.

V. CBIR

CBIR stands for content based image retrieval. In CBIR search uses content of an image instead of metadata. CBIR system extracts features from an image based on that retrieves relevant images.

There are basically two types of feature extraction Low level feature extraction and High level feature extraction. Low level features are just like shape, color, texture. By using these features retrieving of an image is very old method. Wavelet transform is used to extract texture feature and color feature can be extracted through color histogram [4].

VI. EMD using CBIR

In this paper we are using Empirical mode decomposition to retrieve an image. As we know Content Based Image Retrieval requires Principle component so in this process we are using Intrinsic Mode Function as Principle component Above Fig. Shows Content Based Image Retrieval using Empirical Mode Decomposition. Fig. 2 Consist of four main blocks.

A. Image Acquisition
B. EMD (IMF Extraction)
C. CBIR System
D. Output Image

A. Image Acquisition

Any vision system requires image acquisition base. Image Acquisition block takes an input image. This input image may be colored image or gray level image. If an entered image is colored image then we have to convert this image into gray level image. Then our input image may contains noise so denoising i.e. Image is filter out by using median filter. After that size of image is adjusted by using Resize process.

B. EMD (IMF Extraction)

EMD i.e. IMF extraction process is carried out in this block. First it will read image from Image Acquisition

Read i/p image , Pre-process the image. Then after that Identify local maxima and minima in an i/p image. Deduce an upper and a lower envelope by interpolation. Then Subtract the mean envelope from the image. Next step is Subtract the so-obtained Intrinsic Mode Function (IMF) from the image. And finally Separate out residue.

C. CBIR system

Next Block after EMD is CBIR system. It will take Intrinsic Mode Function of Input image from EMD block and compare with IMF of available database images.

So, finally we get output image.

VII. Results and discussion

If we enter query image as shown below

Query Image

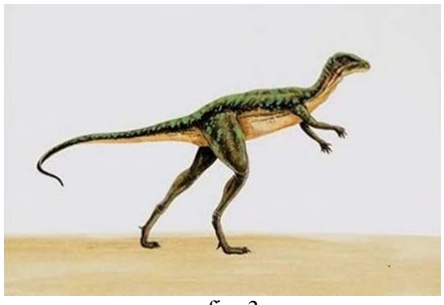
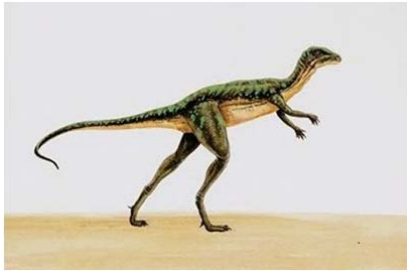
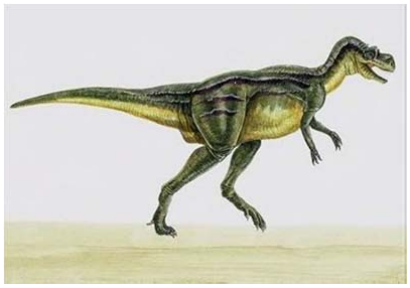


fig. 3

Then we get retrieved images as shown in fig.4

Found images:





block then preprocessing of an image will be performed.

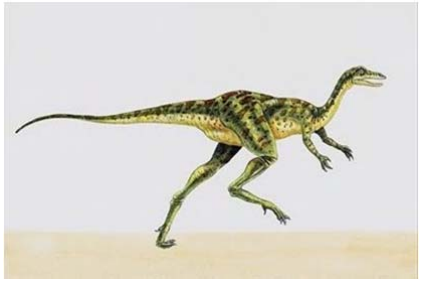


fig. 4

If we enter query image then Intrinsic Mode Function (IMF) of that image will be calculate . after that calculated IMF will be compared with available database image IMF and finally we get retrieved images.

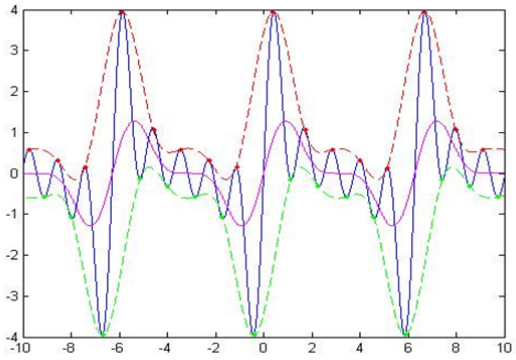


fig. 5

As shown in fig.5 Dotted Red line indicates Interpolated local maxima, Dotted Green line indicates interpolated Local Minima and Blue line Indicates mean of two signals. This mean will be subtracted from original signal. So, From this process we will get IMF1 and Residue signal.

We have also seen in fig. 1 multiple iterations can be carried out to get IMF 1, IMF2, IMF 3,..etc. Once we calculate IMF of query then we have to compare this with IMF of available database. After this process we get relevant images as shown in fig. 4.

CONCLUSION

Content based image retrieval using Empirical Mode Decomposition has two parts first Empirical Mode Decomposition and second one is Content based image retrieval. Empirical Mode Decomposition (EMD) plays an important role in our project. EMD matches oscillations of query image and database images. Because of that we get accurate images.

From this experiment we can retrieve image with the help of Empirical Mode Decomposition. This method has

highest accuracy and Data Loss is less as compared to other methods.

REFERENCES

[1] www.wikipedia.org
[2] Alexandre Xavier Falcao, Ricardo da Silva Torres, "Content-Based Image Retrieval: Theory and Applications," *RITA, Volume XIII, Número 2, 2006.*
[3] Prabir Bhattacharya,fellow,IEEE ,MD. Mahmudur Rahman,student Member,IEEE and Bipin C.De, "A Framework for Medical Image Retrieval Using Machine Learning and Statistical Similarity Matching Techniques With Relevance Feedback, " *IEEE Transaction on Information Technology in Biomedicine, VOL.11, NO.1, January.*
[4] K.Hemachandran, Manimala Singha, "Content Based Image Retrieval using Color and Texture," *Signal & Image Processing: An International Journal (SIPIJ) Vol.3, No.1, and February 2012.*
[5] Xiaoou Tang and Yong Rui, Senior Member ,IEEE, Xuelomg Li, Member ,IEEE and Dacheng Tao , Student Member,IEEE, "Direct Kernel Biased Discriminant Analysis: A New Content-Based Image Retrieval Relevance Feedback Algorithm," *IEEE Transaction on Multimedia,VOL.8, NO.4, August 2006.*
[6] Xiaoou Tang Senior Member, IEEE, Xuelomg Li, Member, IEEE and Dacheng Tao, Member,IEEE, "Which Components are Important for Interactive Image Searching?," *IEEE Transaction on circuits and systems for Video Technology, VOL.18, NO.1, January2008.*
[7] Rashid Ali, S.M. Zakariya and Nesar Ahmad,"Combining Visual Features of an Image at Different Precision Value of Unsupervised Content Based Image Retrieval," *IEEE 2010.*
[8] Said Jai-Andaloussi, Abderrahim Sekkaki, Gw´enol´e Quellec, Mathieu Lamard, Guy Cazuguel, Christian Roux , "Mass Segmentation in Mammograms by Using Bidimensional empericalmode Decomposition BEMD ," *35th Annual International Conference of the IEEE EMBS Osaka, Japan, 3 - 7 July, 2013.*
[9] Zhiyuan Shen, Naizhang Feng, Yi Shen□, Member, IEEE, and Chin-Hui Lee, Fellow, IEEE ,"A Ridge Ensemble Empirical Mode Decomposition Approach to Clutter Rejection for Ultrasoun Color Flow Imaging ," *IEEE Transactions On Biomedical Engineering, Vol. 60, No. 6, June 2013.*
[10] Naveed ur Rehman, Student Member, IEEE, and Danilo P. Mandic, Senior Member, IEEE , "Empirical Mode Decomposition for Trivariate Signals," *IEEE Transactions On Signal Processing, Vol. 58, No. 3, March 2010.*
[11] Zhi He, Qiang Wang, Member, IEEE, Yi Shen, Member, IEEE, Jing Jin, and Yan Wang , "Multivariate Gray Model-Based BEMD for
Hyperspectral Image Classification," *IEEE Transactions On Instrumentation And Measurement, Vol. 62, No. 5, May 2013.*
[12] T. Kato, "Database architecture for content-based image retrieval", In Proceedings of the SPIE - The International Society for Optical Engineering, vol.1662, pp.112-113, 1992.
[13] Jing Li, Nigel Allinson*, Member, IEEE*, Dacheng Tao, and Xuelong Li*, Member, IEEE, "* Multitraining Support Vector Machine for Image Retrieval," *IEEE Transactions On Image Processing, Vol. 15, No. 11, November 2006.*
[14] Ebroul Izuierdo and Qianni Zhang, Senior Member, IEEE,"Histology Image Retrieval in Optimized Multifeature Spaces," *IEEE Journal of Biomedical and Health Informatics, VOL. 17, NO.1, January 2013.*
[15] Lei Ye and Jun Zhang, Senior Member, IEEE, "Content Based Image Retrieval Using Unclean Positive Examples," *IEEE 2009.*
[16] Yang Xin-xin, Zhou Bing,"A Content-based Parallel Image Retrieval System," *ICCDA 2010.*
[17] Yuqing Song, Wei Wang and Aidong Zhang," Semantics-based Image Retrieval by Region Saliency,"
[18] Muhammad Sharif, Mehwish Rehman, Mudassar Raza Muhammad Iqbal," Content Based Image Retrieval: Survey," *World Applied Sciences Journal 19 (3): 404-412, 2012, ISSN 1818-4952;© IDOSI Publications,2012,DOI:10.5829/idosi.wasj.2012.19.03.1506.*
[19] Dr.S.K.Singh,Mrs Monika Jain ," A Survey On: Content Based Image retrievalsystems Using Clustering Techniques For Large Data sets," *International Journal of Managing Information Technology (IJMIT) Vol.3, No.4, November 2011.*
[20] Manisha Sharma, Latika Pinjarkar, Kamal Mehta," Comparison and Analysis of Content Based Image Retrieval Systems Based On Relevance Feedback, " *Journal of Emerging Trends in Computing and Information Sciences, VOL. 3, NO. 6, July 2012 ISSN 2079-8407.*
[21] Sharon Rose Victor J, B. Syam, Y. Srinivasa Rao, "Efficient Similarity Measure via Genetic Algorithm for Content Based Medical Image Retrieval with Extensive Features," *IEEE 2013.*
[22] Adi T. Pinhas, Hayit Greenspan, Member, IEEE, "Medical Image Categorization and Retrieval for PACS Using the GMM-KL Framework," *IEEE Transaction on Information Technology In Biomedicine, VOL. 11,No.2, March 2007.*
[23] Thomas S. Huang, Xiang Sean Zhou, "CBIR: From Low-Level Features to High-Level Semantics,"
[24] M.S. Lew, Q. Tian, E. Loupias, N. Sebe, T. S. Huang, "Content-Based Image Retrieval Using Wavelet-based Salient Points,"
[25] Ying-Chuan Chen and Chin-Chin Lai, Member, IEEE, "A User- Oriented Image Retrieval System Based on Interactive Generic Algorithm," *IEEE, 2011.*
[26] Metin N. Gurcan, Senior Member, IEEE and Hatice Cinar Akakin, "Content-Based Microscopic Image Retrieval System for Multi-Image queries," *IEEE 2012.*
[27] Chao Zhou, BO Geng, Yangxi Li, Chao Xu, "From Document To Image: Learning A Scalable Ranking Model For Content Based Image Retrieval, " *2012 IEEE International Conference on Multimedia and Expo Workshops.*
[28] Nilam N. Ghuge , Parul S. Arora Bhalotra, B. D. Shinde," Shot Boundary Detection for a Video under the Influence of Illumination: A Adaptive Thresholding Approach ," *International Journal of Computer Applications (0975 – 8887) Volume 56– No.11, October 2012.*
[29] Nilam N Ghuge, B. D. Shinde, Parul S Arora Bhalotra, "CBIR using Textural Feature," *International Journal of Computer Applications (0975 – 8887) Volume 56– No.11, October 2012.*
[30] Parul S. Arora Bhalotra, Priyanka B. Kutade," A Survey on Various Approaches of Image Steganography ," *International Journal of Computer Applications (0975 – 8887) Volume 109 – No. 3, January 2015.*

PRANOTI M. KULKARNI
Dept. of E & TC Engg.,G.H. Raisoni College of Engg. & Management, University of Pune, Pune,
India.

Parul S. Arora Bhalotra
Assistant Professor, Dept. of E & TC Engg, G.H. Raisoni College of Engg.& Management, University of Pune,
Pune, India .