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Advanced Sketch Based Image Retrieval System Using Object Boundary Selection Algorithm

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ABSTRACT

In recent era for some cases, colorful image retrieval on the basis of their sketches is area of interest as far as image processing is concern. In image retrieval process sketch of particular image is given as an input and its colorful image is expected as an output. Problem of sketch and actual image matching is that there is appearance gap between them. This gap is due to noise in edges of photo realistic images. Hence our proposed process considers these issues in Sketch Based Image Retrieval process. Our system eliminates the impact of noise in edges of photo realistic images. Our proposed process is based on histogram of line relationship (HLR) descriptor. We proposed "Object boundary selection" algorithm that followed by HLR. In our system we mainly contributing that, matching process is done on Hadoop using Map-reduce technique.

Keywords: Sketch Based Image Retrieval, histogram of line relationship, object boundary selection, Hadoop, Map-reduce

I. INTRODUCTION

In old era people were used to communicate with each other using signs, symbols, sketches and images. Sketch is perfect conceptual representation format for communication. Also from sketch, objects can be recognized by humans with the help of their analytical skill. The process of recognition of object from sketch is not hampered by language barrier [8][11]. Hence sketches can be truly universal communication media. Sketch can be sometimes more content full as compared with the text content. Hence in information retrieval process sketch can perform well. We proposed a sketch system that is based on image improvement. It is known as SBIR system that can be useful as far as image information is concern [4][5]. Hence apart from keyword based search, image based search is having focus in this informative era. It motivates us to work on the process in which image can be retrieved based on sketch. From sketch, image or object can be easily recognized by human. While human draw sketch, they simply focus on prominent boundaries of particular image and real image is having color, fancy edges and texture with background. Existing system had worked on this matching process in which edges are extracted from real images and sketch images are also matched [2]. Therefore we, work on such edge matching process. In this edges matching process we extract some noisy edges from real image because of clutter background which makes this matching process messier [1]. Our main objective is to retrieve image from sketch when given as input, then minimize the noisy edges impact on matching process. For better sketch and extracted edges processing we used boundary selection algorithm. We also use Map-reduce technique for matching process that is divided into nodes and hence our system can effectively manage from time requirement point of view. As per our objectives, there must be system that works to reduce noisy edge impact in sketch based image retrieval process. Our system should work on exact edge extraction and matching. Also system should finalize the output image correctly based on sketch. This edge matching process is time consuming hence proposed system should also prefer platforms like Hadoop so that matching process should be fast enough and time required for it should be minimized. This concept is useful where data is represented with symbols and fetched through sketches. Our system can be

implemented for smart phones where user can draw sketches using the smart slates offered by smart phones and can get real life images from the server. Idea of this concept can be used in applications like assisting the police to search suspects and solve a criminal case based on sketch.

So in this paper we have studied some major tasks to be performed.

1. To retrieve image from sketch when given as an input.
2. To minimize the noisy edges impact on matching process.
3. To implement object boundary selection algorithm.
4. To implement robust histogram of line relationship (HLR) descriptor for better process to describe sketch and extracted edges.
5. To enrich image database with real images and their respective sketches.
6. To avoid false matches with spatial and coherent constraints.

II. METHODS AND MATERIAL

1. Related Work

Shu and Zhenjiang Miao [1] proposed a stepwise strategy to overcome arrival of disturbance in SBIR. In Proposed strategy, sketches as well as derived edges are used as group of line segments, for the temporal foundation of the better sketch edge characterization as well as the deduction of noise impact from a new angle. Object boundary selection algorithm is used to reduce the impact of noisy edges.

K. Bozas and E. Izquierdo[2], identified similarities between a hand drawn sketch and the natural images in a database. They used voting process to detect duplicate shape and structure patches.

R. Zhou, L. Chen, and L. Zhang [3], proposes an algorithm that is based on sketch. It is used for large scale image fetched system to improve search result among millions of images search. Two candidate regions are used for feature extraction, firstly orientation features are extracted and then these features are organized in tree form to build global-to-local features.

M. Eitz, K. Hildebrand,et al[4] and R. Hu & J. Collomosse[5], defined a formal criteria for computing the performance of any SBIR system. For matching of pictures SBIR system uses the information from 3D shape. Hildebrand, T. Boubekeur et al., introduces Spark feature for specialized SBIR in a Bag of Visual Words framework, GF-HOG is an image descriptor suitable for Sketch based Image Retrieval (SBIR).

M. Eitz, K. Hildebrand et al. [6] and P.Sousa et al. [7] construct tensor based image lemma for huge scale sketch that is based image retrieval. Tensor based image lemma used to search a unique vector that is nearest to the parallel direction of the majority of the edges in a local region.

R. Hu, T. Wang, J. Collomosse[8] and T. Menp et al.[9], defined bag of locality to build a sketch based image retrieval system. This system encodes the salient shapes at various levels of details in the form of enclosed contours of regions. They proposed BoW framework that is based on GF-HOG, SIFT and SSIM descriptor to localize the sketched object within the retrieved image. T. Menp et al. proposed multi-resolution LBP. It is a powerful mechanism to measure image textures.

O. Chum, J. Philbin, et al. [10] and MaYan, Hang, Ruan[11], used bag-of-features model to build feature set for sketches. In this large dataset of sketches collected to evaluate human recognition, certain limitations with this system are nuance of certain features may be dependent on context in the sketch. Hand-drawn sketch based on stroke features are introduced by C. Ma, X. Yang, C. Zhang et al., for maintaining structural information of visual words codebook is organized in a hierarchical tree.

P. Salembier and T. Sikora[12],MPEG-7 is the standard is introduced by P. Salembier and T. Sikora, in this paper authors provided large library of core description tools and a DDL for describing multimedia data. It is expanded by Eitz et al. and motivated by Y.L.Lin, Huang, H.J. Wang, and then it helps to generate multi-view sub-queries. Lee, C. L [13] and C. L. Zitnick[14], introduced the system that dynamically producing shadows generated or extracted from thousands of images. This system retrieves related images in real time based on incomplete sketches by the user.

Y. Cao, C. Wang, et al [15], X. Sun, [16] proposed index structure and the regarding to raw contour-based matching algorithm. It is used to evaluate the similarity among query of sketch and natural images, and make sketch-based image retrieval scalable to millions of images.

J. Philbin, M. Isard, et al.[17] and L. Zheng, S. [18], determined, transforming descriptors prior to clustering for boosting baseline retrieval method and can produce results using visual words. Multi-vocabulary merging is an effective method for visual matching.

J. Canny [19] proposed edge pointer. For detection and localization criteria in a mathematical form are used for this.

E. Shechtman and M. Irani[20] suggested an approach to match the similarity between visual entities such as, images and videos.

2. Overview of System

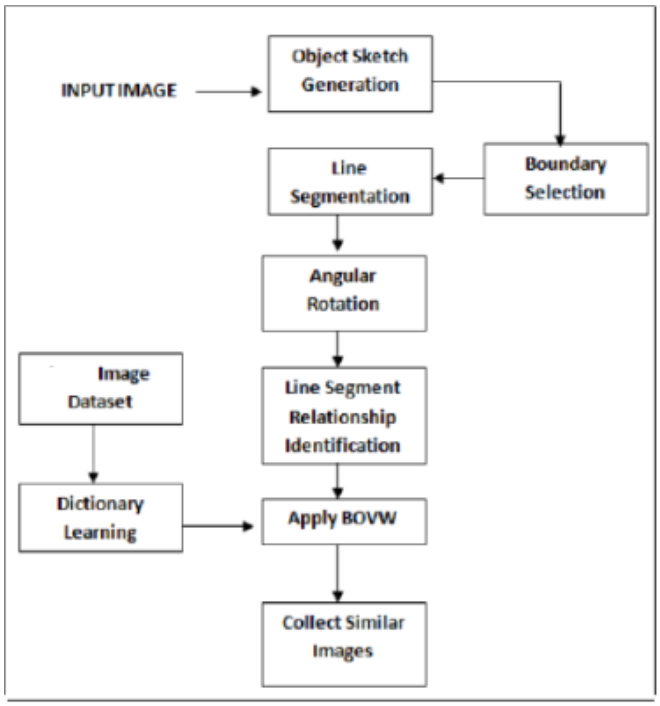


Figure 1: System Architecture

Above fig.1 shows our proposed system architecture. We used map reduce functionality for image processing. It contains, dataset boundary selection, Line Segmentation, HLR Descriptor, Bag of Visual Words i..e BoVW and Index Generation Our systems propose a novel object boundary selection algorithm to predict the shaping edges. Line segmentation is used to select best words i.e. best line segments in matching process. HLR descriptor is utilized to select central lines and blocks to cover all noisy edges that are nearest to the central line. BoVW is the dictionary learned by applying clustering algorithms such as, k-means. By applying this strategy result i.e. matched images are displayed to end user.

Following are the modules details:

A] Input Image:

In this module using HTML, JSP and JAVA servlet GUI is designed. Here, User can upload image which is to be matched with other images.

B] Object Sketch Generation:

When image is uploaded, first thing that system needs to do is, it has to convert it into sketch format which is achieved by using Object sketch detection module which internally uses Canny Edge detection algorithm.

C] Object Boundary Selection:

In our system we proposed object boundary selection algorithm to preserve the shaping edges.

In this process first HLR descriptor is centered on every single line segment and rotated to the same angle as the line segment. In this process first line is selected known as “Central Line” and blocks are formed near central line to cover all the strokes and noisy edges near central line. Only strokes showing low distance from central line is considered as part of sketch and lines in other blocks are considered as noise. In this HLR blocks, redundancy is avoided by considering strokes or edges in one block only. This HLR plays vital role in considering the genuine edges and noisy edges. While selecting the object boundary using HRL descriptor, noisy edges are removed first known as “removing operation”.

D] Line Segmentation:

This is also part of boundary selection which comes in focus after removing operations. In this system

compares new descriptor into a new word and define it as the best line segment is selected in matching process.

E] Angular Rotation:

After line segmentation, there will be some false matches. To avoid false matched two major constraints are consider. Following are the names of constraints.

I] Spatial constraints:

Users usually sketch with large variations therefore there is no absolute spatial relationship between different parts of an object. It is finding co-occurring words of two images. The goal of spatial constraint is to find maximal subset in which words have similar transformation. Given that the transformation parameter is 3-dimensional and proposed approach quantize the transformation parameter space into small cubes and then vote the words into the space according to their transformation parameters.

II] Coherent Constraints:

In this proposed approach the coherent relationship is defined as, if two words are on one edge in a SLS image, the corresponding words and in a PLS image should also be on one edge.

F] Line Segment Relationship Identification:

After process satisfies these two constraints, final line segments or words are defined.

G] Apply BoVW :

In the BoVW model, the dictionary is studied by applying a clustering algorithm (such as K-Means, K-Medoids) on the training set. Intuitively, different dictionaries and performance will be generated by different training sets. Based on training dataset and extracted visual words, it will finalize the image structure.

H] Input Image Dataset and Dictionary Learning

Dataset required having pair of photos and its sketches.

I] Collect Similar Images:

Based on BoVW, final sketch is defined and respective photo image is retrieved.

3. Algorithms

i. Canny Edge Detector Algorithm

Input: Image 'i'.
Output: Image with edges.
Process: Canny Edge Detector
Step 1: Gaussian Filter is used to make smooth images.
Step 2: Gradient magnitude is computed as,
M[i,j]=(P[i,j], 2) +Q [i,j], 2)
Step 3: Identify thin edges by applying non-maxima suppression to the gradient magnitude.
E[i,j]=tan¯1 (Q[i,j] , P[i,j])
Step 4: Detect edges by double thresholding.

ii. Boundry Selection Algorithm

Input: Sketch image word set
Output: Final Candidate Visual Words, similar images segment.
Process:
Step 1: Apply spatial constraint S on hit original words:
G ={ (wi,p), S(wi,p) =1}
Step 2: Apply coherent constraint Q on the word set:
R= {w (i,p), S(w(i,p),G)=1 }
Step 3: Evaluate the hit hypothetical words :{W (i, j)}
For all i do,
For all j do,
if S(W(i ,j)) =1 then
if Q(W(i,j),R) =1 then
h(i,j)=1 ;
Di = W(i,j) ; R← W(i,j) ;
Break ;
end if
end if
end for
end for

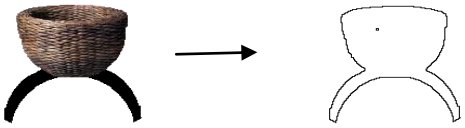
III. RESULTS AND DISCUSSION

Dataset Details :

Dataset containing various images like airplane , bicycle , bird , butter-fly , duck , swan , horse , moon , mushroom , bridges , towers , various building structures etc. Almost 60 items are included in dataset. Each item is having minimum 100 of variety. These images are used to train the system. All these image folders (i.e. dataset) are given as an input and then using boundary detection algorithm sketches are generated. Almost 330

sketches / shapes are generated using boundary selection technique. These sketches are used to describe particular image. Using K-Means algorithm features of these sketches are extracted and saved in cluster.

Result : Output of sketch generation



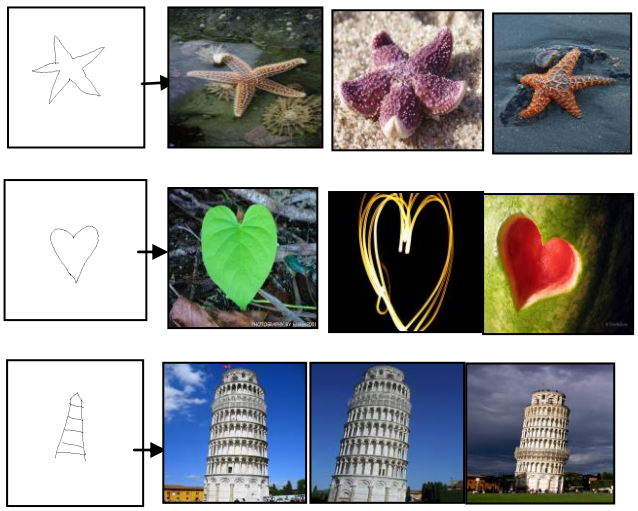
Sketch Generation

This item belongs to the image dataset. This colorful shape is selected as an input and using object boundary selection algorithm shape is generated and used to describe further.

Result : Search output

In this process sketch is given as an input and it is expected that from target dataset color image showing similarity with the feature of input image will be display as search result. Following are the output of the system for given input sketch

Input **---Output Images--**



In case of final searching process, we give sketch image as an input. After that searching process is carried out and finally we get 7 to 10 images showing similarity with input sketch image.

Result : Final search result details

While performing the searching process , readings are taken from correct result point of view. Following are the observations listed.

Table 1. Results

Number of Images searched	Number of correct images	Number of wrong images
5	4	1
10	8	2
15	12	3
20	18	2

Result : Precision

From the above observations following will be the precision for the searching result.

Precision is the ratio of the number of relevant records retrieved to the total number of irrelevant and relevant records retrieved. It is usually expressed as a percentage.

Table 2. Precision

Number of Images searched	Number of correct images	Precision (%)
5	4	80
10	8	80
15	12	80
20	18	90

Result : Recall

Recall is the ratio of the number of relevant records retrieved to the total number of relevant records in the database. It is usually expressed as a percentage.

Table 3. Recall

Number of Images searched	Number of correct images	Number of relevant records not retrieved	Recall (%)
5	4	2	66.66
10	8	3	72.72

15	12	2	85.71
20	18	2	90

Following is the graphical representation of the precision and recall for the observations:

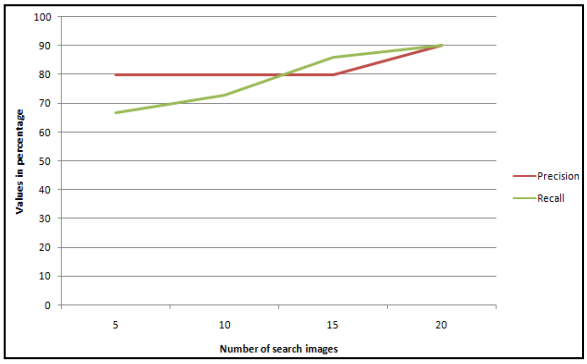


Figure 2. Graph of Precision and Recall

System is evaluated based on following parameters: **1: Time**

We have evaluated time for search on different dataset sizes.

Table 4. Index Time

Dataset (Number of images)	Index Time (In seconds)
200	2025
400	4460
600	6790
800	8060
1000	10050

Following is the graphical representation of the above observations.

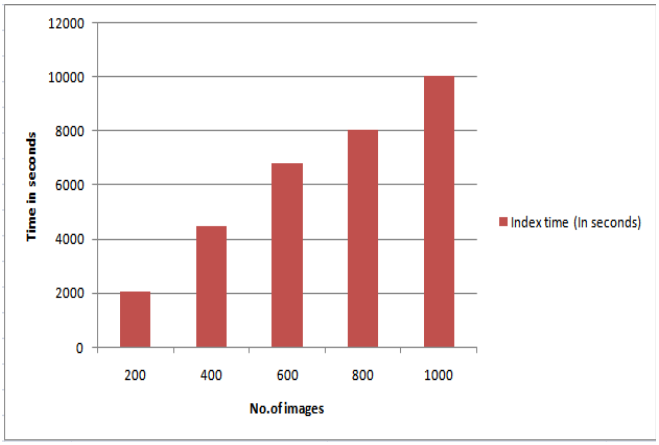


Figure 3. Graph of Index Time Required

2. Performance

We compare our system performance on hadoop. We run our algorithm on hadoop based system and without hadoop and evaluated the search time.

Table 4. Performance Evaluation

Dataset	With Hadoop (In Seconds)	Without Hadoop(In Seconds)
200	4	6
400	5	7
600	5	9
800	6	10
1000	7	12

Following is the graphical representation of above observations

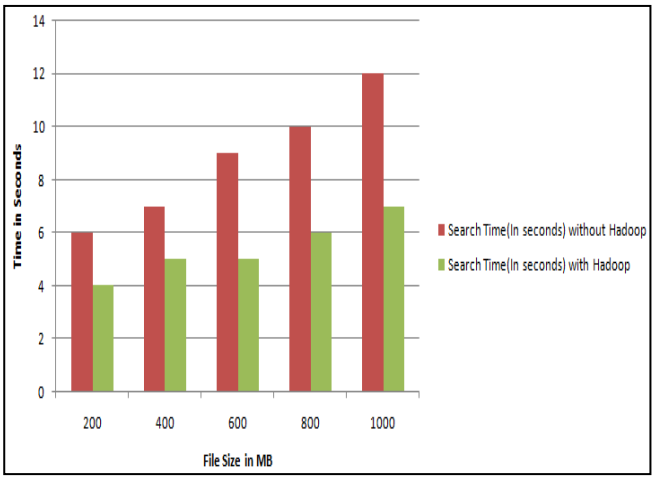


Figure 4. Graph of Performance Evaluation

IV. CONCLUSION

Our proposed Sketch based image retrieval (SBIR) process works on reducing the impact of noisy edges in sketch matching process. In this process canny edge detection algorithm is used, which helps to generate the sketches with refine edges of clear selected realistic images. These realistic images have to be retrieved on the basis of input sketch. Noise in extracted edge was bottle neck area which is rectified in this proposed process by using strong line segment based descriptor named as histogram of line relationship (HLR). In this newly proposed scheme line segment matching is done hence more accuracy can be achieved. Also object boundary selection algorithm is proposed which detects the correct edges and removes the noisy edges. Using

bag of visual words algorithm, final selection of image having resemblance with the input sketch is fetched. As a part of contribution to make this process faster, Hadoop platform is used which performs matching process on different virtual nodes and time effective solution is achieved for SBIR process.

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VI. REFERENCES

[1] Shu Wang, Jian Zhang, Tony X. Han, and Zhen jiang Miao, "Sketch-Based Image Retrieval Through Hypothesis-Driven Object Boundary Selection With HLR Descriptor" vol. 17, no. 7,pp. 1045-1057 , july 2015

[2] Baisa L Gunjal and Suresh N Mali,"MEO based secured, robust, high capacity and perceptual quality image watermarking in DWTSVD domain", SpringerPlus,pp 1-16 ,2015.

[3] K. Bozas and E. Izquierdo, Large scale sketch based image retrieval using patch hashing, Adv. Visual Comput., vol. 7431, ,pp. 210-219, 2012.

[4] R. Zhou, L. Chen, and L. Zhang, "Sketch-based image retrieval on a large scale database", in Proc. 20th ACM Int. Conf. Multimedia, ,pp. 973-976, 2012

[5] M. Eitz, K. Hildebrand, T. Boubekeur, and M. Alexa, "A descriptor for large scale image retrieval based on sketched feature lines", in Proc.6th Eurograph. Symp. Sketch-Based Interfaces Modeling , pp. 29-36,,2009.

[6] Baisa L. Gunjal , Suresh N. Mali ,"Insight into New Color Image Watermarking With DWT-DCT and only DCT with Comparative Analysis in YIQ Color Space", International Journal of Advanced Research in Computer Science,Volume 3, No. 3, pp.493 May-June 2012.

[7] R. Hu and J. Collomosse, "A performance evaluation of gradient field hog descriptor for sketch based image retrieval", Comput. Vis. Image-Understand., vol. 117, no. 7, pp. 790-806, 2013,

[8] M. Eitz, K. Hildebrand, T. Boubekeur, and M. Alexa, "Sketch-based image retrieval: Benchmark and bag-of-features descriptors", IEEE Trans. Vis. Comput. Graph. vol. 17, no. 11, ,pp. 1624-1636, Nov. 2011

[9] P. Sousa and M. J. Fonseca, "Sketch-based retrieval of drawings using spatial proximity " , J. Vis. Languages Comput., vol. 21, no. 2, pp. 69-80, 2010.

[10] R. Hu, T. Wang, and J. Collomosse, "A bag-of-regions approach to sketch-based image retrieval", in Proc. IEEE Int. Conf. Image Process, pp. 3661-3664, Sep. 2011.

[11] O. Chum, J. Philbin, J. Sivic, M. Isard, and A. Zisserman," Total recall: Automatic query expansion with a generative feature model for object retrieval", in Proc. IEEE Int. Conf. Comput. Vis.,pp. 18. Oct. 2007

[12] T. Menp and M. Pietikinen, , J. Bigun and T. Gustavsson, Eds, "Multiscale binary patterns for texture analysis, in Image Analysis", ser. Lecture Notes Comput. Sci.. Berlin, Germany: Springer-Verlag, vol. 2749, pp. 885-892.,2003,

[13] C. Ma, X. Yang, C. Zhang, X. Ruan, M.-H. Yang, and O. "Coporation,Sketch retrieval via dense stroke features", in Proc. Brit. Mach. Vis.Conf. , vol. 2, pp.165. 2013

[14] Y. Cao, C. Wang, L. Zhang, and L. Zhang, "Edgel index for large-scale sketch-based image search", in Proc. IEEE Conf. Comput. Vis. Pattern Recogn., pp. 761-768,June 2011.

[15] Baisa L Gunjal and Suresh N Mali "Strongly Robust and Highly Secured DWT-SVD Based Color Image Watermarking: Embedding Data in All Y, U, V Color Spaces", I.J. Information Technology and Computer Science,NO. 3, PP.1-7, 2012.

[16] C. L. Zitnick," Binary coherent edge descriptors", in Proc. 11th Eur.Conf. Comput. Vis.: Part II, pp. 170-182,2010

[17] J. Philbin, M. Isard, J. Sivic, and A. Zisserman, "Descriptor learning for efficient retrieval", in Proc. 11th Eur. Conf. Comput. Vis. Conf. Comput. Vis.: Part III, vol. 6313, pp. 677-691, 2010.

[18] J. Canny," A computational approach to edge detection", IEEE Trans.Pattern Anal. Mach. Intell., vol. PAMI-8, no. 6, pp. 679-698, Nov.1986.

[19] S. Parui and A. Mittal, "Similarity-invariant sketch-based image retrieval in large databases",

in Proc. 13th Eur. Conf. Comput. Vis. Conf. Comput. Vis, vol. 8694, pp. 398-414., .2014

[20] E. Shechtman and M. Irani, "Matching local self-similarities across images and videos," in Proc. IEEE Conf. Comput. Vis. Pattern Recogn., Jun. 2007, pp. 1–8

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