Content Based Image Retrieval Scheme using Color, Texture and Shape Features Along Edge Detection

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ABSTRACT
Content Based Image Retrieval is a very dominant area which uses the perceptible contents of the image such as color, texture and shape combines to represent the features of the image which is discussed in this paper .Operative research in CBIR is engaged towards the advancement of different methodologies for analyzing, explaining, cataloging and indexing the heavy databases. The proposed scheme is based on three algorithms: Color distribution entropy(CDE),Color level co-occurrence(CLCM) and Canny edge detection+hue moments.CDE considers the correlativity of the color spatial distribution of an image or we can say effectively tells the spatial color information of images .CLCM takes in account the texture features of an image, whose base is from the old algorithm grey level co-occurrence matrix(GLCM) which only takes the grey level images but in CLCM it takes colored texture images ,it is a colored alternative to old texture recognizing GLCM. And Canny edge detector is used for detecting the edge of an image with hue moments which are frequently used as shape extraction feature considering its qualities of in variance under translation, changes in scale and rotation. The proposed scheme achieves a higher retrieval result by taking these diverse and primitive image descriptors which relates to better retrieval result. The similarity measure matrix is both Euclidean and Manhattan distance.

General Terms
Content Based Image Retrieval, Feature Extraction

Keywords
Canny Edge detection, color distribution entropy, similarity matching, co-occurrence matric

1. INTRODUCTION
Interest in digital images has increased enormously in last year's, which leads to rapid growth of World Wide Web and sophisticated technologies. Different users are exploiting the new ways to remotely store images in the databases which they can access and use them. It is a type of 'multimedia mining' because we have extract the valuable knowledge from large multimedia repository. But the image contents are not easy to understand without a deep knowledge and interrogating feature of the researcher. So this has caught up the interest of many people globally. Typically in this domain of CBIR describes the search analysis of content of images in the large databases to correctly identify the related images to the query images with different methods and algorithms taking in account content of image as color, texture and shape. These are mainly low level features of the images [1][2] .

Many different approaches are made to retrieve better results with more similar images from a large database collection. As Zhijie Zhao [3] introduced a new approach by taking three different algorithms that are CDE,CLCM,hue moments for color ,texture and shape extraction from the image which gives very good results.As CDE(Color distribution Entropy)is new algorithm used here for color extraction features as it takes in account the spatial color content of the image. A different approach is used in Alamadar written article [4] using the dynamic distribution entropy of adjacent pixels to probe in the color spatial relationship. In H.b. kakre [5] the way used is very impressive that reduces the dimension of the feature vector , through which a separated set of red ,green and blue images are obtained and after that calculated quantized histogram ,the gets barycenter which segment each bin to have color feature.

More further good descriptors are used to improve the retrieval efficiency of the CBIR system and better performance .Pulse coupled neural network takes both Color distribution entropy and texture gradient graphically to describe the image contents in [6].In [7] the are many images used and the combination of gray-level co-occurrence matrix and simply entropy is preferred for good result by taking successive map means .The performance level of this paper is far better than [8], [9].In [10] a novel edge detection method was imposed to improve efficiency and performance. Firstly an Kuwahara filter makes the image smooth .after that edge detection takes place with each RGB color space the an adaptive threshold method is applied to get the right threshold and after that edge thinning algorithm is put to take accurate edges.

In [11] Wang And Yan proposed and edge detection approach based on vector morphological operators which is applied on color image processing. Firstly the RGB ordering is presented then analyzing why noise is contaminating the data image and with which characteristics. In [12] Hao has studied that principle of obtaining contour of object to be clear we have to set appropriate parameters in canny edge detection method which is based on canny theory. Take the Higher vector 3 3 neighborhood instead of old to calculate the gradient .after the Maximum between-class variance methods is put on the image to have high and low threshold.

1.1 Color Feature Extraction
Color Distribution Entropy: CDE color distribution entropy expresses the color spatial information of an image. It tells that in a particular histogram representation of a color bin how much is its color distribution. This descriptor based on the NSDH (Normalized Spatial Distribution Histogram). NSDH is a better version of Annular Color Histogram. Color distribution entropy for an image can be written as h_1E_1; :::::; h_iE_i; :::::; h_nE_n ,where h_i is the histogram of color bin i, E_i is the CDE of color bin i and n is the number of bins.

Color distribution entropy describes how pixels patches of identical color are distributed in an image. The disperse degree of the pixel block of a color bin in an image can be defined as CDE of the color in I.

$$h_i (p_i) \; nP_{ij}\log2P_{ij}$$

Here H_i tells the distribution of the pixels in the image. So to create a Feature Vector we combine all color bins H_i where Feature Vector $F_c = (H_1; H_2; ::::; H_n)$

Fig.1 Query Image

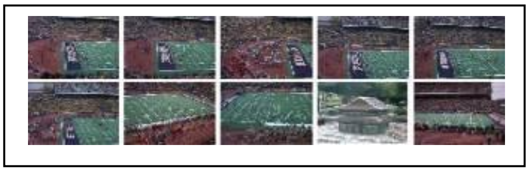

Fig.2 Query result of color distribution entropy

1.2 Texture Feature Representation

Color Level Co-occurrence Matrix: A co-occurrence matrix is a matrix that is defined over an image to be the dis-tribution of co-occurring values at a given offset. It is mainly used for measuring the texture in the images. GLCM is defined by the joint probability density of the pixels position, which not only reflect the distribution characteristics of luminance, but also mirror the position properties of the pixels that have close or identical brightness. The GLCM is a tabulation of how often different combinations of pixel brightness values (grey levels) occur in an image.

Rough texture: a large distance between high and low points. Silky texture: small distance between high and low points. Owing to GLCM , considers the gray level of image and loses other information of the image. Generally, color images contain more information than gray images. As a matter of course, we reckon that extract the texture feature form color image rather than convert it to gray level [3]. Thus, the color information is taken into account for texture extraction. CLCM is the two dimensional matrix of joint probabilities between two adjacent pixels, separated by a distance D in a given direction ,means it s a matrix defined in an image to be the distribution of co-occurring pixel values at a given offset. In order to describe the state of texture it has 4 parameters:

Energy: It denotes the degree of uniform distribution of color image and the texture coarseness. If value of energy is high it means the texture changes homogeneous and regular and if low value it means few changes.

$$F_1 = {}_{ij}p\,(i; j; d;)^2$$

Contrast: It signifies the luminous comparison of certain pixels with its adjacent pixels.

$$F_2 = {}_{ij}\, j\ i\ \ j\ j^2\ p\,(i; j; d;)$$

Homogeneity: It measures the alteration of images local texture . If different regions texture lack changes the value of homogeneity will be large and vice-versa.

$$F_3 = {}_{ij}p\,(i; j; d;)^2 \quad 1 + ji\ \ jj$$

Entropy: It is the amount of information possessed by an image . The value of entropy will be large if the majority elements of the co-occurrence matrix have the greatest randomness and dispersed distribution.

$$F_4 = {}_{i\ j}p\,(i; j; d;)\ \log p\,(i; j; d;)$$

In this formulas p (i; j; d;) tells difference probabilities in between pairs like in distance d and direction and other values of i and j are basically intensities of pixels of each plane. Color co-occurrence matrix gives spatial information about color images which ignores the intensity information for the image. So CCM is not reliable to the large database which consist both color and gray level images. GLCM provides intensity information of the image. The computational By GLCM is very much reduced when taken for texture feature. Here the features are divided into the RGB plane.

Fig. 3 Query Image

Fig. 4 Query Result of CLCM

1.3 Shape Descriptors

The hue moments: Moment invariant have been fre-quently used as features for image processing, remote sensing, shape recognition and classification. Moments can provide characteristics of an object that uniquely represent its shape. Invariant shape recognition is performed by classification in the multidimensional moment invariant feature space. This technique numerically describes shapes independent of translation, scale and rotation and can be easily applied to topographical data. It is mainly useful to describe the image after segmentation. The main invariant moments taken in consideration as the central moments are Translation in-variants, scale in-variants, Rotation in-variants. The formulation of hue moments known to calculate shape feature vector are as follows:

$$\phi_1 = \eta_{20} + \eta_{02}$$

$$\phi_2 = (\eta_{20} - \eta_{02})^2 + 4\,\eta_{11}^2$$

$$\phi_3 = (\eta_{30} - 3\eta_{12})^2 + (3\eta_{21} - \eta_{03})^2$$

$$\phi_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \eta_{03})^2$$

$$\phi_5 = (\eta_{30} - 3\eta_{12})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03})[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2]$$

$$\phi_6 = (\eta_{20} - \eta_{02})[(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2] + 4\eta_{11}(\eta_{30} + \eta_{12})(\eta_2$$

$$\phi_7 = (3\eta_{21} - \eta_{03})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03})][(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2]$$

In this all equations hue moments are made up of second order, third order of central moment. In Φ_5 tells normal central moment [3].The whole segmentation, edge detection and recognition process in hue moments is normal which sometimes doesn't recognize the image with more objects and takes different edge as one.

Fig. 5 Shape Detection by Hue Moments

1.4 Edge Detection

Edge is important field today where edges define the boundaries between regions in an image, helps in the main object segmentation process and recognition. The main important feature of edge detection methods are they help in showing where shadows fall in an image or any small change in the intensity of the image. As good edges are needed in high level processing it is the main standard to calculating the clear edges [13].Different edge detector have different adaptability to different situations and its quality is highly dependent on lightning conditions as density of their edges in the image, presence of same intensity objects and noise. Though these all can be adjusted by adjusting the value of edge detector and by varying its threshold value for a particular value of edge.

Canny edge detector: Canny edge detector is considerably the most used are preferred edge detector as it defines edges very clear and accurate. It was created by John canny. When given a query image we always get an clear and thin edge that are very well connected to nearby edges.

Image is done smoothened by two dimensional Gaussian. Sometimes 2 one dimensional Gaussions are taken one at x-axis and other at y-axis. Take the gradient of the image which tells changes in intensity and defines about presence of edges and value comes in two parts gradient of x-axis and y-axis. Edges will come at point where the gradient is at maxi-mum and therefore all point which are not at maximum should be suppressed. For this magnitude and direction of each gradient is computed for each pixel. Then for making an edge every pixel magnitude of the gradient should be greater at one pixel's distant away in both directions perpendicular to gradient.

Edge thresholding is done and it is called as 'hysteresis'. Both high and threshold are used ,if the value of pixel is above high threshold it is given name of edge and if its value is above low threshold and is a neighbor of edge pixel it is also set as edge if value is low then it is not taken as edge [13].

Fig. 6. Canny Edge Detector High Threshholod=1

Color Canny edge detector: The methodology we are using with hue moments to fuse to have better results in shape detection is color canny edge detector which uses color information which extends the simple edge detector into the color space,

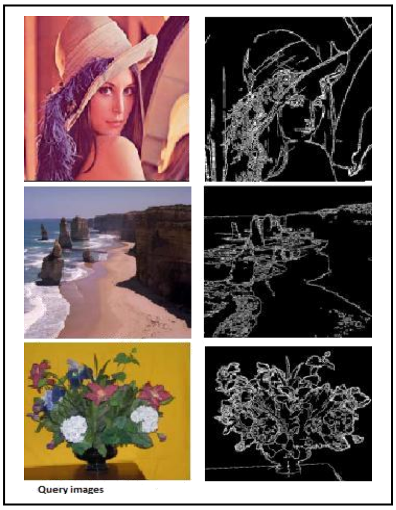

Fig. 7. Color Canny Edge Detector High Threshold=15

Rather then a single intensity level it works on three color channels which extends its opportunity to have more clear edges.

- Read color image ,segment it in to three color channel
- Run each divided image through canny edge detector separately to have a resulting color map with edges.
- We take additive approach to combine all maps of color spaces and the edges which are particular in all color spaces are taken more seriously [13].

2. PROBLEM METHODOLOGY

Here in this paper, our main focus is on shape detection as in earlier result paper less mount of interest was taken in the edge detection procedure on color image so here method proposed is we have added the functionality of color canny edge detector to hue shape detector to increase it performance and each color bin is thoroughly detailed for edges then both hue and color canny edge detector are fused to each other.The color feature extraction is done by CDE and the texture extraction is done by CLCM which also takes in account the color feature.

Captions should be Times New Roman 9-point bold. They should be numbered (e.g., "Table 1" or "Figure 2"), please note that the word for Table and Figure are spelled out.

Figure’s captions should be centered beneath the image or picture, and Table captions should be centered above the table body.

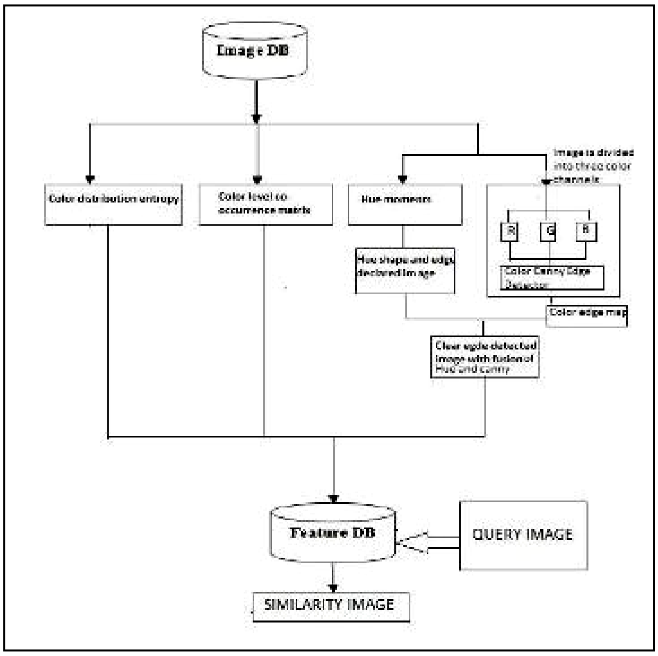

Fig. 8. Proposed Method

Proposed Method:

1. Firstly all the database images are taken to extract its feature.
2. Color feature is taken out by Color distribution entropy,texture feature is taken out by Color level co-occurrence matrix.
3. Shape feature is taken by the fusion of hue and color canny edge detector method ,in which image is fed to both differently ,hue moments segment the image and recognize the edges and color canny edge detector takes the image and divide it into color spaces and each is differently to take out their edges and threshold of 15 is applied to high clear and formed edges.
4. Query image is fed and process is repeated same as other images. feature database is made .
5. Similarity matching is done and similar images are retrieved.

The method gives more accurate result and higher performance than previous given method .As shape module is more focused than previous method ,the fusion of hue moments and color canny edge detector algorithm is used for focused edges and relation between images.

3. EXPERIMENTAL RESULTS

Results are computed by taking 10 classes of the image database. For every classes 10 iterations are conducted to have the average retrieval result for every classes to find how much relevant and irrelevant images come after each iteration for particular class. Retrieval results are based on the different continuous iteration on different set of classes. Different images are retrieved based on query image given each time to the proposed method. Parameters taken are precision and recall where Precision is the number of relevance images retrieved by the total number of image on the screen. Whereas recall is the total number of relevance image retrieved to the total number of relevant images in the database. As for different Query images results are different some has high precision and recall value with overall all matched ,where some retrieved result have less relevancy but still more similar retrieval results than the existing method .

Fig. 9. Retrieved Images of Mountains

Proposed method with combination of Color Canny edge detector method, here more impact is given on color and shape with edge detection feature so results are more accurate from the existing method. Confusion Matrix or Matrix table is made which show the set of classes of database horizontally and vertically in which retrieved result value are shown .An error matrix summarizes the relationship between the sources of information

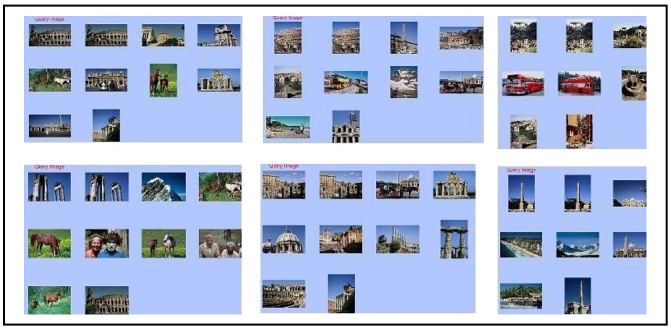

Fig. 10 Retrieved Images of Monuments

Fig. 11 Retrieved Images of Buses

Fig. 12. Retrieved Images of Elephants

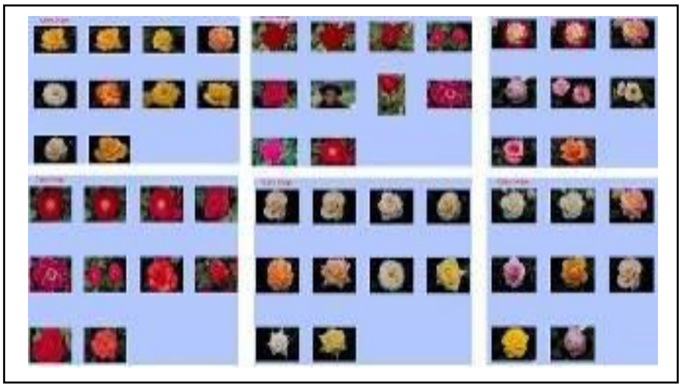

Fig. 13. Retrieved Images of Flowers

Error matrix reveals the images overall accuracy producers accuracy .omission errors ,users accuracy and commission errors . It consist of rows and columns. The heading of the rows and columns are the classes of interest where columns have ground reference data and rows have classified information. Intersection of both summarizes the number of sample units given to particular categories or maybe classes.

For instance, for a query image flower of a class flower during different retrieval, from retrieved images some may be similar some may not be. So it means which images are not similar they are of different class and we have to show in matrix how much percentage of that class images are shown in a particular class retrieval .From this average precision and recall values are obtained and are shown in different graphs.

The performance of the system is increased surely as we have added the edge detection method which detects edges of object clearly and efficiently.

Classes	Africa	Beach	Monuments	Bus	Dianosour	Elephant	Flower	Horse	Mountain	Food
Africa	79	3	7	0	0	5	4	1	1	0
Beach	7	71	9	0	0	7	0	0	6	0
Monuments	4	5	65	6	0	0	3	4	7	6
Bus	0	3	7	76	0	0	0	0	2	4
Dianosour	0	0	0	0	100	0	0	0	0	0
Elephant	3	7	1	3	5	70	0	1	2	0
Flower	5	0	0	3	0	3	87	2	0	0
Horse	0	6	0	3	0	2	0	80	3	6
Mountain	2	4	0	2	0	6	3	0	82	1
Food	9	0	3	1	0	0	5	0	0	82

Fig.14. Confusion Matrix of Different classes of Database

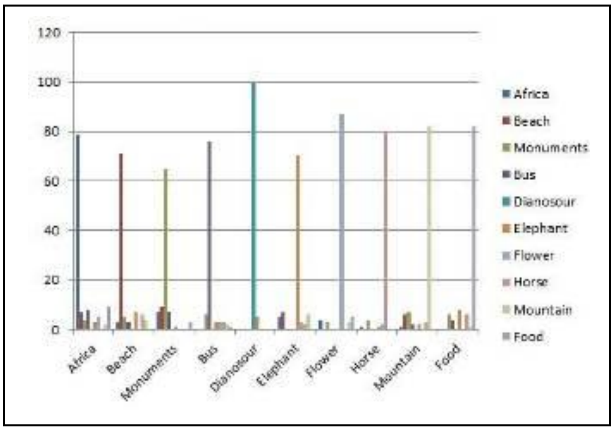

Fig. 15. Confusion Matric Table

4. SIMILARITY MEASURE

Manhattan similarity measure is taken to match the image database features. As it is considered more accurate for natural images or scenery. Database used is Wang database which mostly contain animals, buses, flowers, natural scenery and waterfall images.

Precision and recall: Precision is the number of relevance images retrieved by the total number of image on the screen where as recall is the total number of relevance image retrieved to the total number of relevant images in the database.

Precision(P): Number of relevant Images/Number of retrieved Images

Recall(R): Total number of relevant images retrieved/Relevant images in the database

The average precision table of proposed method of different classes :

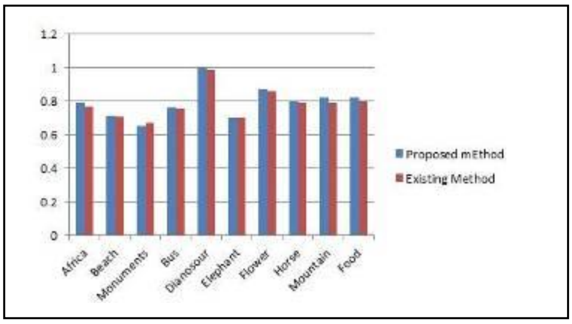

Fig. 16 Average Precison

5. CONCLUSION

A novel approach For CBIR system By combining the low-level features: color ,texture and Shape with Color canny edge detection algorithm is presented .The simulation results Showed more precise value than the previous method and more correctly when targets are clear. The values of different iteration taken together are much accurate and the average precision value is much better. The retrieval results are give us more view about algorithm efficiency. At the same time the fusion of Hue and color canny edge detector work better the hue moments. When more complex object is there with more edges than more efficiency is needed as in monuments and beaches little less accurate retrieval is there so this can be focused on future by taking high level parameters.

6. REFERENCES

[1] J. L. R. Datta and J. Z. Wang, "Image retrieval: Ideas, influences, and trends of the new age [j]," vol. vol. 40, no. no. 2. ACM Computing Surveys, 2008, pp. pp. 1–60.

[2] Y. Y. X. Wang and H. Yang, "An effective image retrieval scheme using color, texture and shape feature." Computer Standards & Interfaces, 2011, pp. pp. 59–68.

[3] H. S. X. J. Zhijie Zhao, Qin Tian and J. Guo, "Content based image retrieval scheme using color, texture and shape features," vol. Vol.9, no. No.1. International Journal of Signal Processing, Image Processing and Pattern Recognition, 2016, pp. pp.203–212.

[4] F. Alamdar and M. R. Keyvanpour, "A new color feature extraction methods based on dynamic color distribution of neighborhoods," vol. vol. 8 Iss. 5, no. no.1. IJCSI International Journal of Computer Science Issues, 2013, pp. pp. 42–48.

[5] H. B. Kekre and K. Sonawane, "Use of equalized histogram cg on statistical parameters in bins approach for cbir." IEEE International Conference on Advances in Technology and Engineering (ICATE), 2013, pp. pp. 1–6.

[6] C. Yang and X. Gu, "Combining pcnn with color distribution entropy and vector gradient in feature extraction." The 8th IEEE International Conference on Natural Computation (ICNC), 2012, pp. pp. 207–211.

[7] M. G. V. S. K. V. Shriram, Dr. P. L. K Priadarsini and R. A. Sivaraman, "Nnovel approach using t.h.e.s methodology for cbir." IEEE International Conference on Signal Processing and Pattern Recognition (ICSIPR), 2013, pp. pp. 10–13.

[8] N. G. W. Khan, S. Kumar and N. Khan, "A proposed method for image retrieval using histogram values and texture descriptor analysis," vol. vol.1, Iss. 2. International Journal of Soft Computing and Engineering (IJSCE) ISSN:2231-2307, 2011.

[9] Y. Y. X. Wang and H. Yang, "An effective image retrieval scheme using color, texture and shape feature." Computer Standards & Interfaces, 2011, pp. pp. 59–68.

[10] V. k. b. Gurpreet kaur, "Improved color edge detection by fusion of hue, pca & hybrid canny," vol. vol.2, no. no. 1. International Journal of Science, Engineering and Technologies (IJSET), June. 2015.

[11] L. Wang and L. Yan, "Edge detection of color image using vector mor-phological operators." In Computer Science and Network Technology (ICCSNT), 2nd International Conference on, IEEE, 2012, pp. pp. 2211–2215.

[12] L. M. Hao, Geng and H. Feng, "Improved selfadaptive edge detection method based on canny." In Intelligent Human-Machine Systems and Cybernetics (IHMSC), 2013 5th International Conference on, vol. 2 . IEEE, 2013, pp. pp. 527–530.

[13] H. H. Ehsan Nadernejad, Sara Sharifzadeh, "Edge detection techniques: Evaluations and comparisons," research gate, 2008.