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Improved Graph-based Visual Saliency High Dimensional Image Retrieval System

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***Abstract*— Salient features are the most important part of high dynamic range (HDR) images. High dynamic range is the technique which has been widely used around the world. People are intended to get brighter and clear images. In this paper, the new method of Graph-Based Visual Saliency (GBVS) has been used to extract the images promptly and accurately. Along with it, the comparison has been done with the help of different statistical parameters. High dynamic range images have converted into the Joint Photographic Experts Group (JPEG). The main objectives of this research is to check the performance of improved Graph-Based Visual Saliency using various technical and engineering parameters such as Mean square error (MSE), peak signal-to-noise ratio (PSNR), Kullback Leibler divergence (KLD), The number of changing pixel rate (NPCR) and unified averaged changed intensity (UACI) etc. These parameters have been used to show the exact result of the experiment. This research also shows the salient features of the HDR images in an accurate manner.**

***Index Terms*— HDR, Image retrieval, UACI, KLD, CBIR and Saliency detection.**

I. INTRODUCTION

The document is an introduction to image retrieval mainly with HDR images. Extraction of features from HDR images. Conversion of HDR to JPG and vice versa. In preexisting base method, we reviewed the papers and we found that GBVS can be used to elaborate the High-definition images and highlights the salient part of HDR images. GBVS is the method that develops the significant features in a very accurate and in an described way. It develops the data in the activation map and then extracts the features from the given image. In this research, a few different images have been used. The proposed method is used to represent the results in a graphical and realistic way. The main objective of this research is to focus the features of an image in a good manner. Graph is the most representative model, which recognize complex and connected data like multimedia document. If two documents are compared structurally, it means we compare two graphs that produces them.

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The paper shows the comparison between the base method and the proposed method. We have showed the images from our base method so that one can understand that the results easily. We also used additional parameters to provide wide range of acceptance of our derived result. The paper conceived the idea of demonstrating the results using MSE, PSNR, NPCR, UACI and KLD values to elaborate the compared results. In addition, HDR images are introduced into the research. The difference between HDR to JPG and HDR images itself provides a good amount of information regarding the impact of changing values. In the field of image retrieval how does the change affect the images and how to extract the exact data while recognizing the image through the values calculated. The paper also sprouts the different aspects of retrieval using HDR and JPG images. The experiment is to improve the GBVS in order to retrieve the HDR images [1][2].

II. Background

A. Content based image retrieval

Content based image retrieval can be defined as a software or a tool or an image retrieval technique which produces the output as per the query of the user and uses the visual contents i.e. color, texture, shape or spatial information of an image. The technique and the software of the content based image retrieval has grown drastically as per the usage in the modern world. We are coming across the new challenges every now and then and to meet the expectations of the users, the software developers are adding more and more vigilant features in CBIR. Though, it is not completely perfect in context of user's feedback it has been entered our life and now it is basically being used everywhere. Now, in medical science or satellite images, school's auditorium or secret cameras, the CBIR works profusely and gives the desired result.

B. High-dynamic-range imaging (HDRI)

High-dynamic-range imaging method produces an image which is highly attractive and brighter than the normal images i.e. JPG, JPEG or any other technique. With the advancement of techniques in the area of image processing and image management and more development in the field of photography, the need of high dynamic range images put on paper and the method then started growing to produce the technique to get the images which can equalize the human neurological system. Through this technique, it is easier to get high dimensional images [3].

C. Saliency detection

It can be defined as the process of identifying some specific visual contents of an object. Saliency detection is a function which consists of two important words. One is saliency which means specification of something and the other one is detection which means identification of some part or content of an object. It supports researchers and employment which recognizes how marked and knowing factors effect approach, engagement, and decision-making. By observing eye movements, brain activity, or computational forecasting, saliency detection informs about the elements in communication, a website, a product design, or even a physical-world environment.

D. Visual saliency

It is a process of identifying specific features or importance of an object. With the passage of time, visual saliency technique has been thoroughly advanced. In the engineering field, more and more developers are coming up with their techniques to improve the existing techniques. Visual saliency is most important technique in our modern life. In this paper, we are also trying to improve our GBVS technique so that we can extract the feature using HDR images.

III. Literature Review

According to Ref. [4], Authors discussed a content-based image retrieval system (CBIR) based on adaptive ground truth. It is said that in order to enhance the positive result of the method it is imperative to get the proper feedback of the method. Feedback tends to measure the limitations of the technique and then notifies the areas where the chances are more to improve the technique. CBIR is the technique to get the specific result out of a large amount of data. So, it is highly recommended to use the technique in a correct way. There is a method in Ref. [5] in which authors studied and showed that the saliency techniques to connect the features to show an image as thought a human can build an image. Human has the ability to capture the salient features and then implement those to produce the exact image. Saliency techniques are far behind from the reality however it is being developed and more are to come in this field. In Ref. [6] they proposed that the saliency detection is a challenging task to present the salient features of an image and it is become challenging because now we are

trying to match the actual and real result as though the human has notified the features. The paper tried to introduce a new method of novel salient detection method and said to be simple and effective.
According to Ref. [7], Authors discussed the paper which has the title "Hierarchical Saliency Detection" studied and found that the saliency detection has a great challenge when it comes to complex and compiled pictures. In normal images, it works superbly well and notes the salient portion but in pictures where the dimensions are most likely complex it fails to derive the actual and intentional result. The paper studied that the previous methods has this challenge to get salient features on the complex images and it's natural. So the experiment is done for the hierarchical method. In Ref. [8] Authors showed the process in which the features of an image get extracted through the special saliency detection method so that it doesn't correlate with the nearby feature and every feature gets highlighted. The saliency detection regional method applied to get the most salient and specific part of an image and abstract the image for better presentation with keenly highlighted features. It used the image pixels to derive the result.
According to Ref. [9], Authors tried to evaluates the methods which are highly used to produce the results related to image retrieval. Graph based visual saliency, scale invariant feature transform, speeded up robust feature are some of the methods being used to collect the salient result. In Ref. [10] saliency detection method has been improved. The paper tried to show the drawback of saliency detection and showed as to how the saliency detection fails to produce the intentional results and they are successful in terms of producing the desired result.
According to Ref. [11], Researchers studied to show the limitations of the CBIR and in order to overcome those limitations we should focus on the results and the feedback given by the user. The feedback works as the most effective source of improvement and thus it provides the base to the method. Feedback method is used in modern world to save the time and improve the technology.
According to Ref. [12,13], Authors produced an Improved Image Retrieval Method Based on SIFT to extract the features using the SIFT algorithm but with less consuming time and in an accurate manner. It showed how to reduce the time and at the same time get the accurate result. The algorithm used to highlight the visual features of an image and match the features as well.
In Ref. [14] researchers developed a method that use dimensionality reduction algorithm for measuring the local and global features and they are successful in terms of producing the desired result.

IV. METHODOLOGY

A. Graph based Visual Saliency

In the field of image retrieval, there are lots of other techniques which are produced to get the desired result upon performing a certain task on it. It is considered that the result would satisfy the user's need at a given time and situation. A number of techniques are already developed and being developed to satisfy the need of the user as per their interest and requirement and with passage of time, out of them a few techniques are being improved subsequently. In this paper, I have also tried to improve the most usable technique in our image retrieval era. Graph based visual saliency, as the name itself has the great features, still the technique had to go through a random series of improvements and challenges time to time. GBVS actually presents the features in such a way that it is highly accurate and the result always derives fast. It had total four steps and on each step it takes such a less time that the result is user friendly.

B. Algorithm

The new algorithm for HDR images retrieval and their features has been developed. From the beginning to the end it describes how to use the method to populate the relevant result. The method chooses the HDR images and then read the features of the image thoroughly. It verifies the format and then begins the process. it gets the illuminates of the images and gathers the illuminants wavelength and spectral density.
Algorithm CBIR using Saliency over HDR image Setup:
Initialize required variables
Step 1. Select an HDR image folder Read an image
Step 2. Get sensor information, wavelength and spectral density
Step 3. Get illuminant wavelength and illuminant spectral density
Step 4. Get raw feature map from image pyramid and prune levels if pyramid levels get too small, update previous frame estimate based on new frame. New frame gets weight flicker New Frame Weight compute feature map.
Step 5. Get channel functions in feature Channels/directory

Parse the channel letter and name from file Call the channel function for each desired image resolution (level in pyramid) and for each type index for this channel. Save raw feature map structure
Step 6. Compute activation map from feature map
Step 7. Normalize activation map
Step 8. Compute average over maps enclosed by each feature channel
Step 9. Split each feature channel by number of maps in that channel
Step 10. Sum across feature channels
Step 11. Recover identifying, rescaled (0-255) output for use
Step 12. CBIR
Step 13. Repeated steps 4 through 11 to get feature of each file in the folder.
Step 14. Select a new HDR image and repeat steps 7 to 11
Step 15. If feature found in feature data
Step 16. Display matched image
Step 17. Increment counters by one

V. Results and Analysis

We found that there is a need to develop a method which can meet the requirements of user's where they would like to extract the features of the images which are converted from HDR to JPG or vice versa. Our effort is to produce the highlighted results in an accurate and prompt manner. In this research, proposed method met the users' requirements. As well as we have shown our experiments with the help of various figures and tables. In addition to this, we have used different engineering parameters i.e. NPCR, UACI KLD etc. to show the results in an extensive manner. With the help of different parameters, we could show the extreme and normal situations of an image. The main challenge was to highlight the results of converted images from HDR to JPG.

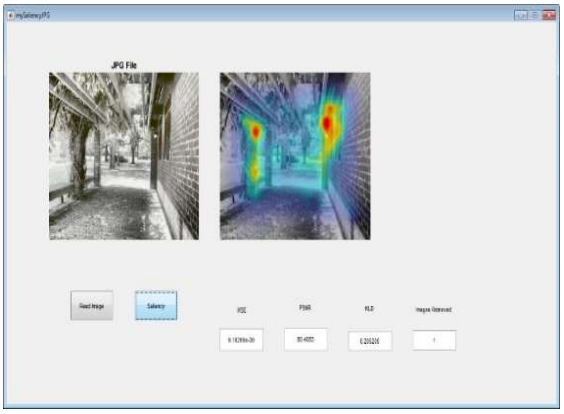

Figure 1. Original image of Saliency Detection

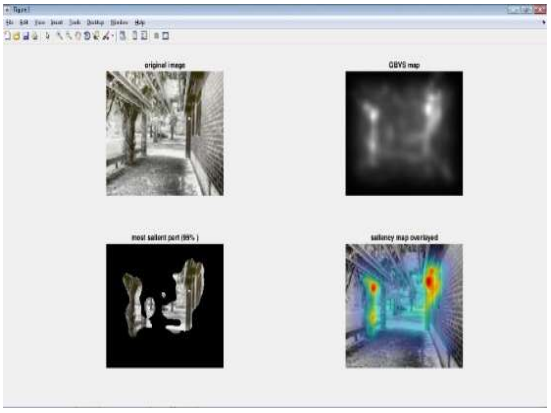

Figure 2. Different results of original image

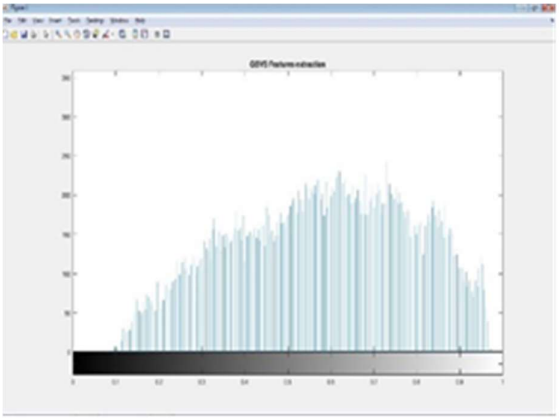

Figure 3. GBVS Feature Extraction Histogram

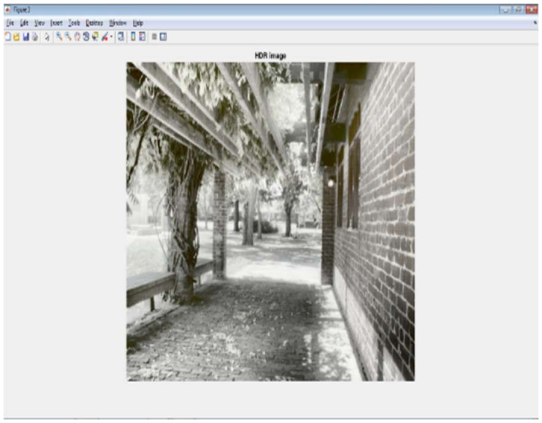

Figure 4. HDR Image

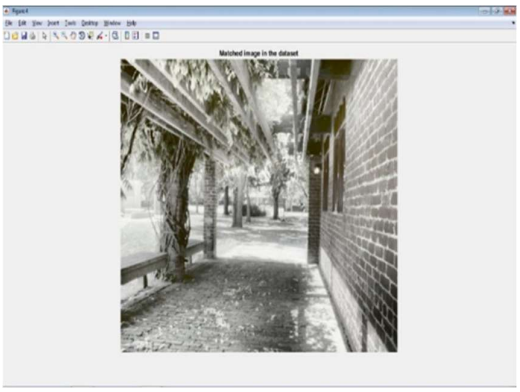

Figure. 5. HDR Image matched image in dataset

A. Bar chart of HDR to JPG images (Proposed Method)

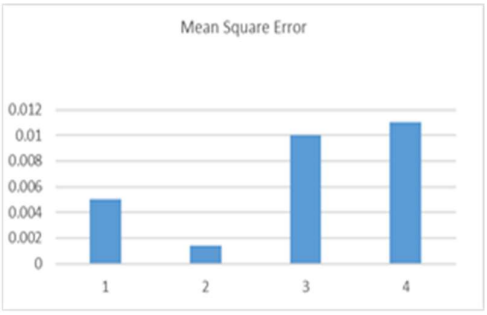

Figure 6. Bar chart of MSE (Proposed method HDR to JPG)

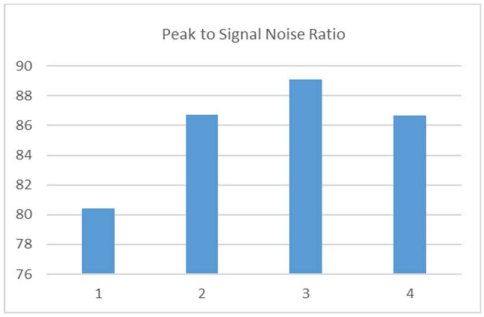

Figure 7. Bar chart of PSNR (Proposed method HDR to JPG)

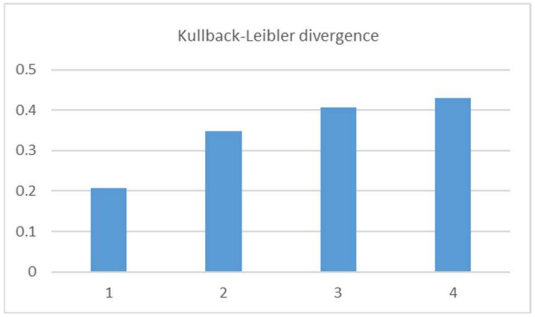

Figure 8. Bar chart of KLD (Proposed method HDR to JPG)

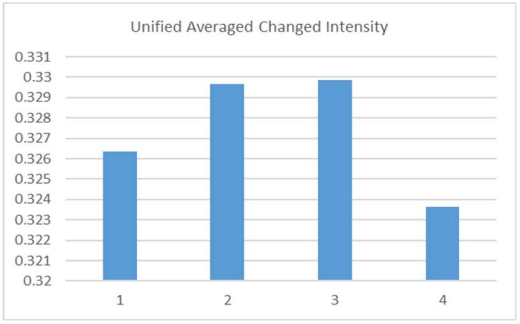

Figure. 9. Bar chart Comparison of UACI

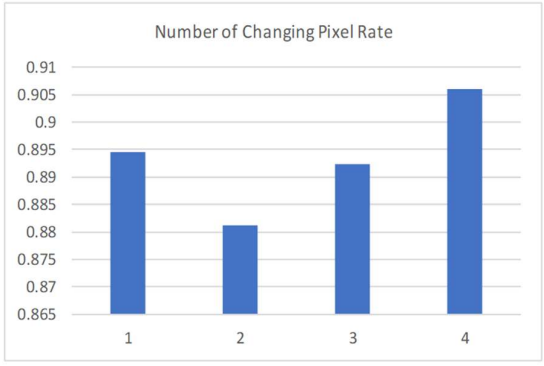

Figure 10. Bar chart of NPCR (Proposed method HDR to JPG)

B. Compare & Analysis

Comparison of base method and proposed method (HDR to JPG image) and HDR image with the help of bar chart –

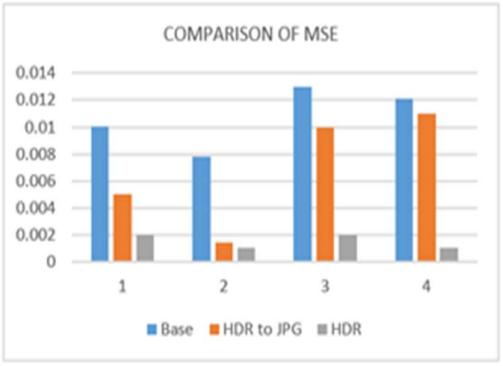

Figure 11. Bar chart Comparison of MSE

Figure. 12. Bar chart Comparison of PSNR

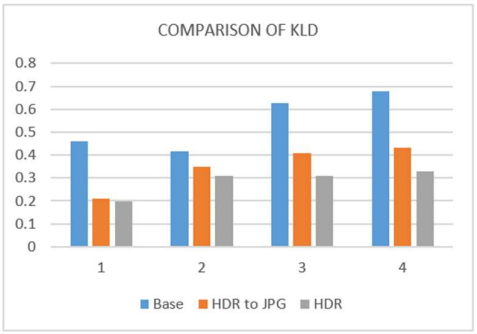

Figure 13. Bar chart Comparison of KLD

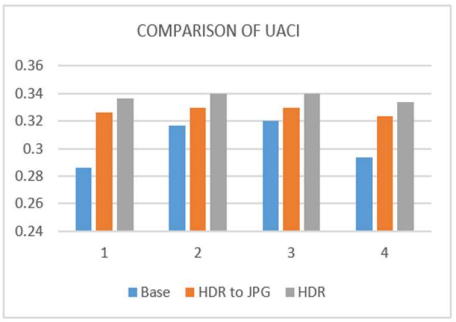

Figure 14. Bar chart Comparison of UAC

TABLE I: COMPARISON TABLE OF BASE AND PROPOSED METHOD USING TEST IMAGE1

Methods	MSE	PSNR	KLD	UACI	NPCR
GBVS Method	0.0.10046	39.9799	0.458318	0.286356296	0.7975356296
Improved GBPS (HDR into JPG)	0.0.005	80.408304	0.208318	0.3263562	0.894532123
Improved GBPS (HDR Images	0.0.002	84.4083	0.198318	0.336356	1

TABLE II: COMPARISON TABLE OF BASE AND PROPOSED METHOD USING TEST IMAGE 2

Methods	MSE	PSNR	KLD	UACI	NPCR
GBVS Method	0.0.0078	40.0401	0.417707	0.31657771	0.796356212
Improved GBPS (HDR into JPG)	0.0.00145	86.72985	0.347707	0.3296577	0.8812345
Improved GBPS (HDR Images	0.0.001	87.72985	0.307707	0.339658	0.994567

TABLE III: COMPARISON TABLE OF BASE AND PROPOSED METHOD USING TEST IMAGE 3

Methods	MSE	PSNR	KLD	UACI	NPCR
GBVS Method	0.0.013	38.702072	0.628098	0.319857	0.7953577
Improved GBPS (HDR into JPG)	0.0.001	89.09553	0.407707	0.329858	0.892345
Improved GBPS (HDR Images	0.0.002	90.09553	0.307707	0.339858	1

TABLE IV: COMPARISON TABLE OF BASE AND PROPOSED METHOD USING TEST IMAGE 4

Methods	MSE	PSNR	KLD	UACI	NPCR
GBVS Method	0.0.0121	39.16685	0.676658	0.293628	0.798958
Improved GBPS (HDR into JPG)0	0.0.011	86.67666	0.430658	0.323628	0.906123
Improved GBPS (HDR Images	0.0.001	92.67666	0.330658	0.333628	0.996789

In all the above given figure, Blue color shows the value of the base method. Red color shows the value of the proposed method (HDR into JPG Image) and Green color shows the value of the proposed method (HDR Images).
Comparison table of different parameters of Base and Proposed method using Test Image 1, Test Image2 and Test Image 3 and test image 4 that is given above.

VI. Conclusion and Future Work

In conclusion, we successfully demonstrated the comparison between the HDR to JPG image conversion and HDR images. With improved GBVS, we retrieved the HDR images in an accurate manner and with the fast speed. We can extract the final review of the paper that an improved GBVS can extract the salient features in a very smooth and efficient way even for the HDR images. Earlier, GBVS were used for normal images. The values could not be compared with the high dimensional images. With this experiment, we could get the results for the HDR images. With the help of the experiment, while making changes in the HDR images, we can focus on the results to get the feasible figures and exact values. Our proposed work based on HDR image and during this experiment and research we felt that the GBVS and CBIR can be implemented in Videos and the salient features of a video can be extracted to highlight the video and reduce the database. As well as, in the field of surveillance, within a day, a secret camera captures lots of images, then how to determine which are most salient and feasible for specific task.

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