International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** XI **Month of publication:** November 2023

DOI: https://doi.org/10.22214/ijraset.2023.56682

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

Restoration of Obscured Images

Dr. R. Senkamalavalli[1], Pavan C[2], Sameer Kulkarni[3], Sudeep D M[4], Tahreem Pasha[5]
[1, 2, 3, 4] Department of Computer Science and Engineering, K S Institute of Technology, Bengaluru, India

Abstract: For the aim of exploring the deep undersea world map, a picture of high quality without interfering objects is preferred. However, within the water, the image quality tends to be hampered by light scattering, water density, and light attenuation. effects. Besides, the dynamic interference may affect the important underwater map. during this paper, we proposed a multi-step and all-around underwater image processing system, especially for the underwater images taken in succession to enhance the image quality, remove the dynamic interference, and reconstruct the image. The first step involves utilizing the dark channel approach together with the improved gray world algorithm for brightness adaptation and color correction. Initially, it identifies and removes a dynamic interference regarding image enhancement. Secondly, we applied an upgraded total variation model to patch the blank at the value of resolution. Finally, the super-resolution of the small print is realized by applying an improved BP network. After simulation and experiments, our system proved to realize ideal results of image enhancement and reconstruction.
Index Terms: Maximum Intensity, Light, Image, Contrast.

I. INTRODUCTION

The oceans are home to a variety of enigmatic and unidentified species as well as a vast supply of energy-producing resources, which contribute significantly to the sustainability of life on Earth [1]. Since the turn of the 20th century, high-tech maritime exploration initiatives have been undertaken globally [2]. Because of its ability to hold large amounts of data, vision technology has received a lot of attention [3]. In several undersea applications, including robotics [4], rescue operations, man-made structural inspection, ecological monitoring, tracking marine life [5], and real-time navigation systems [6], [7], researchers and scholars seek to obtain high-resolution underwater photographs. Academics and researchers are looking for high-resolution underwater photos. However, the underwater environment severely degrades image quality, causing problems that are easier to fix in terrestrial imaging. Images taken underwater consistently exhibit color casts, such as green-bluish hues, which are brought on by varying degrees of red, blue, and green light attenuation. Particles in suspension also have Images with a lot of blur and haze are caused by the fact that submerged objects absorb most photon energy and shift the direction of light before it reaches the camera [8]. Artificial light sources are widely employed in underwater imaging to extend their effective range. However, scattering and absorption have an impact on artificial light [9]. Simultaneously, an uneven lighting pattern is applied, leading to luminous areas in the center of the underwater picture and inadequate lighting in the direction of the boards [10Shadowing is one of the other phenomena that degrades quality. For underwater photographs to yield meaningful details, trustworthy methods for color correction, sharpening, and background scattering removal are therefore required. These are especially difficult because of the complicated underwater environment, where turbidity, light absorption, and scattering—all of which can vary widely cause lower-qualityphotographs.

II. UNDERWATER IMAGE ENHANCEMENT METHODS

We approach the handling of specific problems in specific images using different algorithms. Many things are not perfect in the images taken underwater like the color attenuation, dark channels, intensity of the image, and adequate light to capture the image. We propose to use different algorithms for different problems to get the desired results. Underwater image enhancement is crucial to improve the visibility and quality of images in aquatic environments, where factors like attenuation, color distortion, and poor lighting significantly degrade image quality. Several methods and techniques are employed for underwater image enhancement

A. Contrast Limited Adaptive Histogram Equalization

Contrast Limited AHE (CLAHE) is a kind of adaptive histogram equalization designed to lessen the issue of noise amplification by limiting contrast amplification. In CLAHE, the modification of discrepancy in the vicinity of a pixel value is given by the pitch of the metamorphosis function. The value of the histograms at this pixel value, which is connected to the value of the pixel in this picture, equals the pitch of the original CDF. CLAHE restricts amplification by cutting off or “clipping” the histogram, setting its highest point before computing the CDA.

Additionally, it limits the CDF's slope, which suggests the transformation function's slope. Therefore, it relies on the neighborhood window's size and how the histogram is normalized, or more specifically, its clip limit. The ensuing amplification is limited to no more than three or four times by common values.

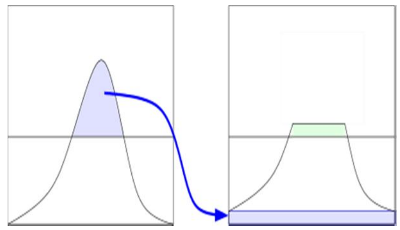

Fig. 1. Redistribution of Histogram

Redistributing equal amounts of the histogram that exceeds the limit within the entire set of histogram bins may be more efficient, than rejecting this part entirely. The redistribution, however, will move some bins over the clip limit as illustrated by the region shaded with blue in the figure leading to an effective larger clip limit that deviates from the specified one and the concrete one which depends on the image itself. Redistributing the excess can then be done recursivelyuntil it becomes inconsequential.

```
1. DIVIDE THE INPUT IMAGE INTO NxN MATRIX OF SUB-IMAGES

2. FOR EACH SUB IMAGE DO:
   2.1 COMPUTE THE HISTOGRAM
   2.2 COMPUTE THE HIGH PEAK VALUE OF SUB-IMAGE
   2.3 CALCULATE THE NOMINAL CLIPPING LEVEL 0 TO HIGH
   2.4 FOR EACH GRAY LEVEL IN HISTOGRAM DO:
       A) IF THE HISTOGRAM BIN GREATER THAN CLIP LEVEL,CLIP THE HISTOGRAM
          TO NOMINAL CLIP LEVEL
       B) COLLECT THE NUBER OF PIXELS INT HE IMAGE THAT CAUSED THE HISTOGRAM
          TO EXCESS CLIP LEVEL
   2.5 DISTRIBUTE TE CLIPPED PIXEL UNIFORMELY IN ALL HISTOGRAM BINS
       TO OBTAIN NORMALIZED HISTOGRAM
   2.6 EQUALIZE THE HISTOGRAM TO OBTAIN CLIPPED HISTOGRAM EQUALIZE FOR
       SUB IMAGE

3. ADJUST THE BORDER PIXELS BY BILINEAR INTERPOLATIION
   (DISTANCE WEIGHTED AVERAGE OF FOUR NEAREST PIXEL VALUES)

4. RETURN THE CLAHE IMAGE
```

Fig. 2. CLAHE Algorithm

Fig. 3. Result Analysis of CLAHE

B. *Rayleigh Stretching and Averaging*

Underwater image generally consists of bright and dark areas. Overall image discrepancy can be increased by the global stretching of the image. The discrepancy of the image needs to be increased to increase the brilliance of darker areas still, global stretching also leads to an increase in the brilliance of the bright areas, leading to the over-improvement of the bright areas. Too bright, performing in loss of details. The same case occurs when global embroidering is applied to the darker areas because it produces under-meliorated areas that reduce image details. The proffered system, which uses two nonidentical image contrasts, addresses these effects. The eidolon of the proffered system is to produce two images with nonidentical contrasts one as an under-meliorated image and another as an over-enhanced image. The ensuing expressway curtly explains the system of producing two images from a singlechannel in the RGB color model. These expressways are appliedto other channels.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

```
1.ALGORITHM RD

2.GET IMAGE FILE

3.GET height and width of the image

4.CALL RGB_EQUALISATION method with arguments height,width and the image itself
  a. Read the image as an Numpy array.
  b. Split the image into 3 channels(r,g,b(red,green,blue)).
  c. Find the AVERAGE of each channels.
  d. Convert those AVERAGE into numpy array.
  e. Find the MAXIMUM value and the MINIMUM value in the array.
  f. Find the MEDIAN among the array
  g. Set A=MEDIAN/MINIMUM
  h. Set B=MEDIAN/MAX
  i. IF MINIMUM VALUE EQUALS AVERAGE of each channel i.Multiply A with each channels
  j. IF MAXIMUM VALUE EQUALS AVERAGE of each channel i. Multiply B with each channels
  k. Create new Numpy array
  l. Append those new r,g,b values m.Return it

5. CALL STRECHING method with argument new array
   a. Get the maximum and minimum channel using the height and width
   b. For each pixel of the image[i,j,k] do i.
      (img[i,j,k] - Min_channel) * (255 - 0) / (Max_channel - Min_channel)+ 0 c.
   Return the image

6. CALL RAYLEIGH_STRECHING method with arguments the new image,height,width
   a. Find the upper and lower histogram stretching of each color channels r,g,b.
   b. Create an Numpy array of size of image,and append the lower histogram
      stretching values of each channels
   c. Create an Numpy array of size of image,and append the upper histogram
      stretching values of each channels
   d. Return both arrays

7. Sum these arrays and divide it by two and store it in sceneradiance

8. Call HSV_STRECHING and pass sceneradiance
   a. Read the height and width of this array
   b. Convert it into HSV using rgb2hsv package from skimage library
   c. Do global_streching and pass hsvimage,its height and width and return it
   d. Convert it back into rgb using hsv2rgb
   e. Return the image

9. Call SCENERADIANCERGBRD method and pass this image
   a. Clip the array
   b. Change the format into int
   c. Return the image

10. Output the image
```

Fig. 4. Rayleigh Algorithm

Fig. 5. Result Analysis of Rayleigh Algorithm.

The two produced images are piled together, and the average value between the two images is calculated. The image and the S and V factors of the HSV color model are stretched within the dynamic range of 1 percent from the minimum to the outside values. The final image is attained by converting. After applying these processes to the corresponding channels, all lesser-stretched histograms are formulated to produce an image, and all upper-stretched histograms are also formulated to produce another image. This process produces two nonidentical images with nonidentical contrasts. The lesser region of the histogram produces an under-meliorated image, whereas the upperregion produces an over-meliorated image.

C. *Relative Global Histogram Stretching*

RGB channels. Astride the fact that the characterized histogram is ignored over different channels and images. Upon application of fixed values say 1,244, the resultant may stretch over both extremes, i.e., overstretch or understretch for specific color channels and spoil the original image specifics. It is to be observed that the law of propagation of light beneath water dictates we apply the contrast correction method for the modification of deformed images. Also, the distribution rule of histograms over colored channels viz RGB, notes the following observations in images that are from shallow water: Majority of shallow-water images, the red light histogram lies invalues [50, 150], whereas, the G channel and B channel areidentically concentrated in the range [70, 210].

Fig. 7. Result analysis of RGHS algorithm

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

```
1.ALGORITHM RGHS

2.INPUT image file.

3.SET image as SceneRadiance.

4.CALCULATE STRETCHING on SceneRadiance
    a.GET image HEIGHT
    b.GET image WIDTH
    c.GET MAX_CHANNEL and MIN_CHANNEL
    d.PERFORM STRETCHING
        d1.img[i,j,k] = (img[i,j,k] - MIN_CHANNEL) * (255 - 0) / (MAX_CHANNEL - MIN_CHANNEL)+ 0
    e.RETURN image

5.CALCULATE LABSTRETCHING on SceneRadiance
    a.GET image HEIGHT
    b.GET image WIDTH
    c.CONVERT RGB image TO CIELAB(L*a*b) COLOR SPACE
    d.SPLIT image TO "l", "a", "b" CHANNEL.
        d1.PERFORM STRETCHING ON "l"
        d2.PERFORM STRETCHING ON "a"
        d3.PERFORM STRETCHING ON "b"
    e.CONVERT image BACK TO RGB COLOR SPACE
    f.RETURN image

6.RETURN  SceneRadiance AS FINAL OUTPUT.
```

Fig. 6. RGHS Algorithm

This is an indication of the fact that stretching of histograms should be sensitive to all channels. The Adaptive parameter obtained for a stretch range: From the distribution in the histogram for various images from shallow water, it can be observed that the distribution over the RGB channel which is similar to the change in Rayleigh distribution, is a continuous probability distribution over positive random variables. Also, a point of interest is that the channel distribution shows normalcy, and its mode and midpoint almost being same. Hence, we take the mode value as a divider for the individual decision of intensity level extremes, that is maximum and minimum, for the input image in stretching of histogram. The images from underwater are influenced by many factors, the need to decrease the impact of a few extreme pixels on the stretching of the relative global histogram, usually the stretching range lies between 0.1 percent and 99.9 percent of the histogram. But, in case the histogram is not normally distributed, this method which removes equal pixels is not feasible. Therefore we partition over upper and lower rates of the intensity values to enable the calculation of the I_[min] and the stretching of the histogram.

D. Underwater Light Attenuation Prior

Light attenuation refers to reduced intensity of light due to scattering and absorption of light by particles underwater when it travels from one medium to another. Restoring a hazy Underwater image is a tedious task when done using computer vision.

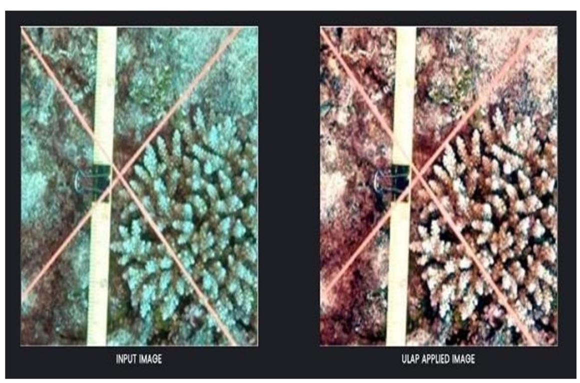

Fig. 9. Result Analysis of ULAP Algorithm

Humans can rapidly perceive the scene depth of the underwater image with no additional information. The furthest point within the depth map resembling the original underwater image is commonly considered because of the background light. With the weakening of sunlight underwater, depending on the wavelength, the energy of red light is absorbed more than that of green and blue lights, the highest intensity difference between Red light and Green-Blue light is employed to determine the background light within the underwater image. it's often considered a background light candidate. After examining an outsized number of underwater images, we discover the Underwater Light Attenuation Prior (ULAP), which is the difference between the most value of G-B intensity and therefore the value of R intensity in one pixel of the underwater image is extremely strongly associated with the change of the scene depth

```
1.ALGORITHM ULAP.

2.INPUT image file.

3.CALCULATE DepthMap FOR image.
    a.DepthMap = 0.51157954 + 0.50516165 *(MAX(img[:, :, 0], img[:, :, 1])) + (-0.90511117) *(img[:, :, 2])
    b.RETURN DepthMap.

4.PERFORM GlobalStretching on DepthMap
5.CALCULATE AtomsphericLight
    a.PERFORM BackLightEstimation using image and DepthMap.
    a.AtomsphericLight = BackLightEstimation * 255

6.GET MIN_DEPTH FROM input_image and AtomsphericLight

7.ESTIMATE TRANSMISSION FOR R, G, B CHANNEL INDIVIDUALY.
    a.transmission_B = 0.97 ** ( 8 * (DepthMap + MIN_DEPTH(img, AtomsphericLight)))
    b.transmission_G = 0.95 ** ( 8 * (DepthMap + MIN_DEPTH(img, AtomsphericLight)))
    c.transmission_R = 0.83 ** ( 8 * (DepthMap + MIN_DEPTH(img, AtomsphericLight)))

8.GET REFINED transmission.
    a.FILTER transmission_R, transmission_G, transmission_B WITH GUIDED FILTER
    b.RETURN REFINED transmission

9.CALCULATE SceneRadiance
    a.SceneRadiance = (img - AtomsphericLight) / transmission[:, :, i]  + AtomsphericLight
    b.Limit the transmittance between 0~255
    c.RETURN SceneRadiance

10.RETURN SceneRadiance AS FINAL OUTPUT.
```

Fig. 8. ULAP Algorithm.

The background light BL is usually estimated because the brightest pixel in an underwater image. The background light candidate is chosen from the furthest point of the input image, i.e., the position of the maximum value within the processed depth map corresponding to the input image is that of the background light candidate values. Instantly choose the furthest point because of the final background light candidate value, some suspended particles can impede the valid estimation result.

E. Dark Channel Prior

The Dark Channel Prior (DCP) technique is considered to be a very promising defogging technique as it provides very good images without homogeneous regions. Nonetheless, the recovered photos suffer from block effects and color distortion due to a relatively wide homogenous patch in the sky.

```
1.ALGORITHM DCP

2. INPUT image file.

3. GET MINIMUM VALUED CHANNEL INTO ARRAY imgGrey
      IF IMAGE IS COLOURED AND TWO DIMENSIONAL THEN
          ACCEPT THE IMAGE
          GET THE GRAY SCALE IMAGE
      ELSE
          DISPALY "bad image, no color found"
          DISCARD THE IMAGE and STOP ALGORITHM
4. GET DARK CHANNEL INTO VARIABLE imgDark from the greyscale image
      IF IMAGE IS IN GREYSCALE
          ACCEPT THE IMAGE
          GET THE DARK CHANNEL IMAGE
      ELSE
          DISPLAY "bad image shape, input image must be two demensions"
          DISCARD THE IMAGE and STOP ALGORITHM

5. CALCULATE ATMOSPHERIC LIGHT
      GET SIZE, HEIGHT, WIDTH OF DARKCHANNEL
      SET atmosphericLight  as 0
      CALCULATE GREATEST INTENSITY VALUE FOR EACH CHANNEL
    RETURN atmosphericLight
6. CALCULATE TRANSMISSION
    CONVERT imgDark TO FLOAT
    transmission = 1 - omega * imgDark / atomsphericLight
    FILTER transmission WITH GUIDED FILTER
    CONVERT IMAGE TO FLOAT
    SET ARRAY sceneRadiance AS ZERO

7.CALCULATE SCENE RADIANCE
    sceneRadiance= (img - atomsphericLight) / transmission + atomsphericLight
    CONVERT sceneRadiance TO INTEGER TYPE

8. RETURN Image
```

Fig. 10. DCP Algorithm.

The two produced images are piled together, and the average and underwater images look similar, DCP is widely used in undersea picture repair. On clear days for natural images, the DCP channels exhibit mostly dark intensities when considering a square patch in the picture. The pixels yielded from dark channels obtained from hazy images usually have values far above zero. The atmospheric light usually tends to be monochromatic. The effectiveness of DCP in image de-hazing is supported by successful de-hazing results from de-hazingalgorithms.

Fig. 10. Result Analysis DCP Algorithm.

In underwater photos, a few pixels in at least one color channel have an intensity that is almost zero. The low intensity might be attributed to the shadows. Independent wavelength assumption does cause issues, even when the Dark Channel assumption is correct. In many real-world scenarios, the red channel is either completely black or almost completely dark. In this case, DCP corrupts the transmission estimation. The absorption of light by the medium causes the red channel to become nearly nil, even in shallow seas. The data gleaned from the red channel can't be trusted. UDCP, which takes into account the green and blue channels rather than the red channel, is utilized to get around the aforementioned problem.

F. Maximum Intensity Projection

R channels of subaquatic cinema, Carlevaris- Bianco, set up an expressway wherein an excellent difference between the immersion of RGBwavelengths was discovered. supported this former data, calculation of the depth of the scene is administered. The proffered algorithm is therefore called. The variation between two extreme valuations of R- R-channel vehemence and BG-channel emphasis is assumed for medium-transmission estimation. The trial substantiated that MIP can reckon rough distance maps of submarine cinema. The proffered algorithm is constantly utilized for atmospheric-light estimation further. Wen proffered the bettered interpretation of MIP(i.e. new optical model(NOM))to cipher the a

```
1.ALGORITHM MIP

2. INPUT image file.

3.CALCULATE DEPTH MAP
  GET MAXIMUM INTENSITY VALUE OF BLUE, GREEN CHANNEL
  GET MAXIMUM INTENSITY VALUE OF RED CHANNEL
  CALCULATE THE LARGEST DIFFERENCE OF MAXIMUM INTENSITY
    largestDiff=REDchannel INTENSITY- {BLUE,GREEN}channel INTENSITY

4.CALCULATE TRANSMISSION
  transmission = largestDiff + (1 - max_of(largestDiff))
  5.CALCULATE REFINED TRANSMISSION
  REFINE transmission WITH GUIDED FILTER

6.CALCULATE ATMOSPHERIC LIGHT
  atmosphericLight IS PIXEL WITH HIGHEST INTENSITY VALUE IN
  REFINED TRANSMISSION

7.CALCULATE SCENE RADIANCE
  sceneRadiance= (img - AtomsphericLight) / transmission  + AtomsphericLight

8.RETURN sceneRadiance
```

Fig. 12. MIP Algorithm.

The assumption used was that the intensity of the R wavelength is relatively smaller than the intensity of the green-blue wavelengths within the area within the background. Zhao proposed a technique for the estimation of BL using MIP and DCP. Upper 0.1 percent of the highly bright pixels present in the dark channel were selected first, then peel with the best variation selected, estimated the atmospheric light by selecting the pixels with the best difference. employing a mixed method in [80, 81], they picked only one flat area of the background using quad-tree, then selected upper 0.1 percent highly bright panels within the dark channel from the chosen region. Finally, one of all these pixels with the best variation in RB wavelengths within the original picture is chosen as a world ambient light. Using the difference between the utmost intensities of Red, Blue, and Green channels, we calculate the transmission. because the atmospheric light within the background is blurred, we use MIP to truly get the simplest atmospheric light and acquire the ultimate scene radiance with maximum intensity.

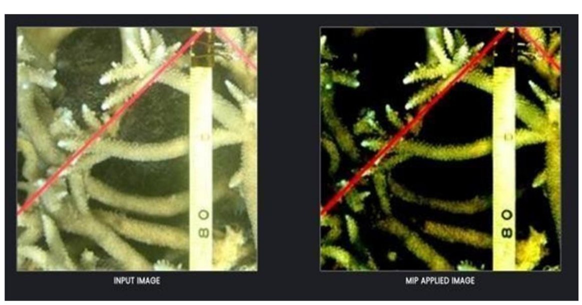

Fig. 13. Result Analysis of MIP Algorithm.

REFERENCES

[1] Lu, T. Uemura, D. Wang, J. Zhu, Z. Huang, and H. Kim, "DeepSea Organisms Tracking Using Dehazing and Deep Learning," Mob.Netw. Appl., Oct. 2018.
[2] X. Guo, Y. Li, and H. Ling, "LIME: Low-Light Image Enhancement via Illumination Map Estimation," IEEE Trans. Image Process., vol. 26, no. 2, pp. 982–993, Feb. 2017.
[3] Shallow-Water Image Enhancement Using Relative Global Histogram Stretching Based on Adaptive Parameter Acquisition Dongmei Huang, Yan Wang1, Wei Song, Jean Sequeira, and Sébastien Mavromatis.
[4] Single Image Haze Removal Using Dark Channel Prior Kaiming He, Jian Sun, and Xiaoou Tang.
[5] Initial Results in Underwater Single Image Dehazing Nicholas Carlevaris