WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Method for Enhancing Underwater Images using a Neural Network that Dynamically Combines Diverse Features.

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ABSTRACT—

Recently people have been using fractional calculus to solve problems with images. These problems include gray-scale loss. Fractional calculus helps solve this problem. First, you do a type of math on the gray scale image to make it better. Then you use a type of math that is like a learning machine to make the image better. The relationship between various color picture channels is found using the style cost function, which is also used to improve the model's ability to compensate for colour distortion in underwater images. Brightness blocking and colour distortion in the better image have been fixed. The texture data of the image is successfully retrieved. The improved image's brightness distribution can faithfully reproduce the brightness distribution of the shooting environment, proving the algorithm's increased resilience.

Keywords—Convolution Neural Network, Feature Fusion, Image Content, Color Distortion.

1. INTRODUCTION

Light field photographs, as opposed to conventional 2D photographs, capture the light's incidence and location of incoming light in tri-dimensional situations and had been extensively employed inside computerized vision tasks including target recognition, reflection removal, and 3D reconstruction. However, poor contrast, fuzzy features, and noise are common issues that might affect the quality of images that are captured in low-lighting circumstances. One of the main areas of study in computer vision has traditionally been developing techniques to improve the quality of images taken under low-lighting conditions.

There have been numerous experiments conducted by experts from various fields on ways to improve the color in grayscale images, known as chroma enhancement. Some of the most usually used methods include the layering of density technique, the gray-scale color(GS) conversion method, self-materials based on pixel design, the rainbow coding method, the metal coding method, and the frequency domain-based pseudo color improvement algorithm.

he improved picture in this research, which deals with the problem of noise amplification during the enhancement process, is put through with an image noise filtering network to provide the desired enhancement outcome. The following is an illustration of this project's innovative work:

(1) A proposed model for improving low-light images utilizes a progressive dual network. This model incorporates the principle of progression to address the challenges of low brightness and noise amplification in low-light image enhancement.

(2) The network framework for the model's two modules and the process of picture restoration from coarse to fine are implemented using the principle of progression, resulting in better enhancement outcomes.

(3) A bidirectional constraint loss function is suggested for learing the network based on the theory of reversible image degradation. This obtained loss is hence calculated from both the possible positive and negative directions of the image degradation model to ensure more comprehensive learning of the information.

2. LITERATURE SURVEY

The purpose of a literature survey or review in a project report is to examine the existing research and published findings on the topic of the project, taking into consideration the various constraints and scope of the project. The goal of this review is to evaluate the background of the project and identify any weaknesses or problems in the current system, and to offer suggestions for addressing these issues. The literature survey covers the following areas:

A summary of the previous studies and research on the topic The published findings and conclusions of these studies

An assessment of the current state of knowledge on the topic, including any gaps or deficiencies

A discussion of the limitations and constraints of the existing research, including its scope and focus

The reasons and motivations for conducting the project, including any outstanding problems or issues in the current system.

Ideas for future research or methods for improving the current system.

Published books on the topic, both broad and specific.

A chronological review of research in the field, from oldest to most recent.

Any challenges or current work related to the topic.

Objectives of Literature Survey

- Gaining an understanding of the meanings of the ideas or principles being discussed
- The opportunity to learn and access about or utilize the most current or up-to-date ideas, techniques, and principles in a particular field.
- Determining new research areas based on existing research
- Focus on your area of expertise – even if another field uses the same terminology, the meanings may be completely different.
- Enhancing the literature survey by eliminating sidetracks.

2.1 Title: An In-Depth Survey of Underwater Image Enhancement and Restoration

Author: *Miao Yang; Jintong Hu; Chongyi Li; Gustavo Rohde; Yixiang Du; Ke Hu*

Images taken underwater typically have issues with quality degradation, such as low contrast, blurred features, off-color hues, uneven lighting, etc. The repair and improvement of underwater images is essential for several practical applications and represents a significant challenge in image processing and computer vision.The effects of the typical underwater image enhancement and restoration methods on blueish, greenish, yellowish, offshore, and deep- sea images are compared here which has provided a reference for the selection of most suitable method for underwater image enhancements under various cases. Also the limitations and accuracy of the widely-used underwater image quality evaluation are analyzed. Finally, we explore the potential difficulties and unresolved problems associated with underwater picture augmentation

2.2 TITLE: COLOR BALANCE AND FUSION OF UNDERWATER IMAGE ENHANCEMENT

Author: Codruta O. Ancuti , Cosmin Ancuti, Christophe De Vleeschouwer , and Philippe Bekaert

This approach is able to enhance a wide variety of underwater images (e.g., different cameras, depths, and light conditions) with high accuracy, being able to recover significant faded features and edges. It is based on blending two images to fusion along with their weight maps respectively to promote the transfer of edges and colour contrast to output image and also improves the accuracy.

2.3 Title: Single underwater Image enhancement using Depth estimation based on blurriness

We utilize the degree of image blurriness to approximate the depth map for improving the quality of underwater images. By utilizing various techniques, such as calculating the amount of image blur present, we can determine the relative distance of objects in the image and adjust the image accordingly to enhance its clarity and detail. This allows us to more accurately depict the underwater environment and improve the overall visual appeal of the image. Through observations, we have found that objects located further away from the camera appear more blurry in underwater images. By utilizing the image formation model, we are able to estimate the distance between specific points in the image and the camera. This information allows us to recover and improve the quality of underwater images so, use of this image formation model enables us to more accurately depict the underwater environment and enhance the overall visual appeal of the images.

2.4 Title: Single backlight image enhancement based on virtual exposure method

Author: *Thaweesak Trongtirakul, Phra Nakhon, Sos Agaian* This study presents a full-piecewise, non-linear automated stretching approach for improving the quality of backlit images without requiring any human input, such as gamma or other parameters. The goal of this method is to reveal hidden information in the dark regions of the image, preserve the characteristics and colors of both the well-lit and over-brightened regions, and enhance the local contrast in the dark areas. The proposed method was evaluated using both commercial backlit images and a collection of backlit images, and the results of the simulation demonstrated its effectiveness and superiority over other advanced techniques for backlit image enhancement in terms of visual quality.

2.5 Title: Research on design and implementation of medical image enhancement based on wavelet analysis

Author*: Y. Yang. Zhixun Su, L. Sun*

At first the low contrast and poor quality pictures are analyzed by wavelet transform and then using the haar tranform the high frequency sub images are divided.in the next Step noise was decreased through soft threshold approach. The enhanced picture was then produced using the inverse wavelet transform and inverse Haar transform.

Finally, the image's histogram was lengthened using nonlinear histogram equalisation. Studies have shown that this method is quite good at both increasing the details in a picture and successfully keeping its edge characteristics

2.6 Title: An image enhancement method based on gabor filtering in wavelet domain and adaptive histogram equalization

Author: *Jeevan K M, Anne Gowda A B ,Padmaja Vijay Kumar*

Sometimes, the pictures don't do the information justice. The picture may occasionally be extraordinarily bright or very black, with low or high contrast. Image enhancement is crucial to digital image processing for these reasons.

In this research, we suggested an image enhancing method that combines wavelet-domain Gabor and median filtering with spatial-domain adaptive histogram equalisation. The two characteristics utilised to evaluate the performance of the suggested strategy are brightness and contrast.

2.7 TITLE: AN IMPROVED ALGORITHM FOR LOW-LIGHT IMAGE ENHANCEMENT BASED ON RETINEXNET

Author: Hao Tang, Hongyu Zhu, Huanjie Tao

Incorporating the ycbcr color channels and RetinexNet into the brightness channel to reduce distortion and supress noise in enhanced images and later the original color and enhance brightness are recombined in the channel directory. the image is decomposed to y, cb, cr channels where y will be the input to noise reduction model and other channels are combined during the enhancement process

2.8 TITLE: RESEARCH ON LOW QUALITY IMAGE ENHANCEMENT TECHNOLOGY OF AIRPORT MONITORING BASED ON A PRIORI ANDDEPTH NEURAL NETWORK

Author: *Shoulin Yin , Hang Li, Lin Teng*

The advancement of airport detection has been substantially aided by the extensive capture and use of high-resolution remote sensing pictures. However, the real-time and accuracy of airport recognition are also facing significant difficulties as a result of the complicated form, backdrop, and various scales of the airport site. Faster RCNN and multitask loss function are used for multiscale training and identification of airports. Next all the duplicate examples are discarded through non-maximum suppression approach. Finally, tested using the Google Earth airport data to compare our results to the most recent airport recognition techniques. The findings demonstrate that the suggested technique can quickly and effectively identify various airports against a variety of complicated backgrounds, with high detection rates and low false alarm rates..

2.9 Underwater image enhancement based on fusion technique via colour correction and illumination adjustment

This study explains why it is essential to improve the image before beginning any restoration technique. There is an introduction of a fusion-based technique that employs wavelet decomposition. Two enhanced underwater images are used as inputs in the method we're using; one is the corrected image and the other is the lighted adjusted image. It is suggested to use adaptive and histogram equalisation. It's a really straightforward process, and the resulting image is clearer than the original. Based on their greatest coefficient values and the output, the updated pictures are merged.Single underwater Image enhancement using Depth estimation based on blurriness

2.9 Single underwater Image enhancement using Depth estimation based on blurriness

Here, they have used image blurriness to calculate the depth map for improving underwater images. It has been noticed that in underwater photographs, items further away from the camera are more fuzzy. We can infer from this research that we have adopted the image creation model, which allows us to calculate the distance between the camera and the visible locations so that we can enhance and restore underwater photographs. Last but not least, this suggested strategy is superior to other IFM-based improvement methods

2.10 Underwater image enhancement by dehazing with minimum information lose and histogram distribution

The effects of absorption and dispersion frequently result in the degradation of underwater photography.Low contrast and colour cast in underwater photos reduce recognition accuracy for marine biology and underwater object detection. This is a limitation, and systematic underwater enhancement—which improves a dehazing technique and a contrast enhancement algorithm—is done thus to get around it.An efficient underwater image dehazing

technique is employed to restore the visibility, built on the idea of minimal information loss.To assess the effectiveness of the suggested method, simulation experiments, qualitative and quantitative comparisons, colour accuracy testing, and application tests are carried out.

Title of the paper and year	Methodology	Advantages	Disadvantages
Single backlight image enhancement based on virtual exposure method-2022	Logarithmic weighted Bi-Histogram Equalization Function	It does not require specialized hardware or knowledge about the backlit image scene structure	It is not suitable for underwater image quality improvement. It is considered to enhance only dark place.
An improved algorithm for low-light image enhancement based on RetinexNet-2022	RetinexNet Algorithm	It avoids color distortion it preserves image details as much as possible. It is used to denoise the image.	It is not suitable for underwater image quality improvement. Accuracy is less then 70%.
Research on design and implementation of medical image enhancement based on wavelet analysis-2022	Conventional First Fourier Transform(FFT)	It is used for enhancing the quality of x-ray,MRI and CT scan images.	It is not suitable for color images.
An in-depth survey of underwater image enhancementand restoration- 2019	Filtering Based Methods	This paper describes the various image enhancement techniques.	It is suitable only for specific dataset.
An image enhancement method based on wavelet domain-2021	Gabor Filtering and Median Filtering along with AHE	It avoids color distortion it preserves image details as much as possible. It is used to denoise the image.	It is not suitable for underwater image quality improvement. Accuracy is less than 60%.
Research on low quality image enhancement technology of airport monitoring based on a prior and depth neural network- 2021	GoogleNet in Deep Learning	It is giving 90% accuracy.	It is not considering image content. Content loss is there.
An image enhancement method based on gabor filtering in wavelet domain and adaptive histogram equalization year-2021	Aadaptivehistogram equalization(AHE),	Useful for the contrast enhancement of natural images as well as medical images.	They are low speed and over enhancement of noises
Color Balance and Fusion for underwater image enhancement	Underwater Dehazing and white balance evaluations	It avoids color distortion it preserves images details.	Doesn’t exactly show best results with different datasets.
Low-Light Image Enhancement with regularized illumination optimization and Deep Noise Suppression.	Regularized illumination optimization and deep noise suppression.	The main aim is to enhance the image using these two methods.	Images captured under low-light imaging condition easily suffer fromlow visibility and unexpected noise leading tp negative effects.

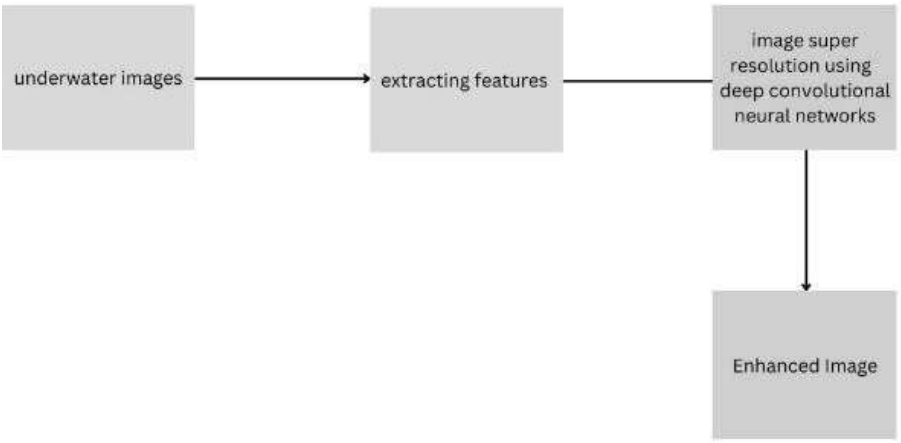
3.OBJECTIVES

- To collect and pre-process the data that is needed for the implementation
- To survey about different techniques implemented that uses neural network in the image enhancement methods
- To enhance image quality using deep learning model
- To create an user interface to enhance underwater image without image content loss and accuracy over 80%.

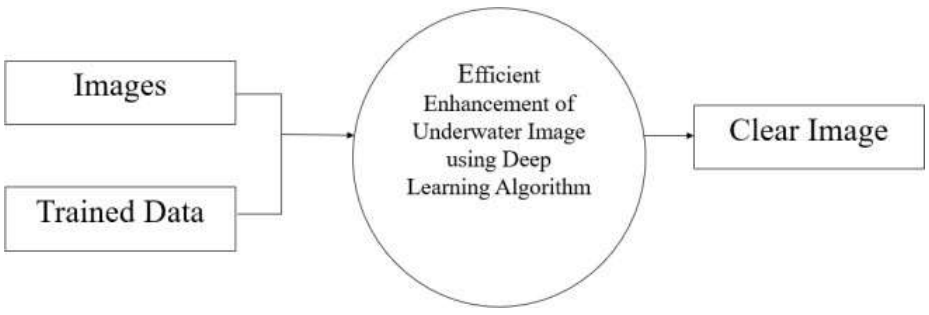
4. PROPOSED METHODOLOGY

In order to address the significant issue of gray-scale loss in current pseudo color techniques for enhancing high gray-scale images, we propose an alogorithm for pseudo color enhancement that is desirable for use with a dynamic heterogeneous feature fusion neural network(DHFFNN). This algorithm also includes improvements to traditional conventional jet, hue saturation value(HSV) methods. The goal of this approach is to improve the effectiveness of pseudo color techniques in enhancing high gray-scale(GS) images.The initial step in the process is to apply bit depth quantization to the high-level gray image. As a follow-up to the initial step of bit depth quantization, our proposed technique utilizes the specialized high gray-scale enhancement algorithm to improve the color of the specified image. This algorithm has been specifically designed to effectively improve the color of high gray-scale images, resulting in a more vibrant and detailed final image.

Next, the compact learning method, which utilizes a convolutional neural network(CNN), is used to obtain the multi-scale image characteristics and prevent gradient dispersion through the use of jump connections. This helps to mitigate the fog blur effect often seen in underwater images.



System Design: The system architecture shows the underwater image enhancement in two steps. First our system takes an underwater image as input, then it will identify the color co- relation in every pixels, then it will remove the fogging using the image processing techniques. In second step our system will apply Deep Learning Algorithm to enhance the underwater image without any data loss and noise.



Data flow Diagram: Describes the Overall Process of the project. Images and Trained Data is inputed. By using the Deep learning

Algorithm it will efficiently enhance the quality of the underwater image**.**

4. CONCLUSION

This study suggests a solution to the issue of poor lighting in images by introducing a technique that utilizes attention-based processes, residual dense blocks, countermeasuregeneration to effectively enhance the particular clarity of images with low illumination.

To begin with, the method employs global exposure attention map(giem) to follow the following steps in enhancing the lighting. In order to gain a more thorough understanding, the method combines different levels of characteristics extracted using convolution residual module(CRM) and channel attention residual dence module(cardm).

Hence to make the transformation of an underwater image into a realistic representation of an underwater environment as accurate as possible, this method introduces a generative countermeasure network.

The results of the experiment demonstrate that the model's synthesis of underwater images can capably guide an underwater image enhancement model, and offer a different approach for increasing the dataset of underwater images.

In this paper, we present a groundbreaking approach for enhancing the visibility of underwater images, which relies on the integration of a multi-scale convolutional neural network (mwcnn) and a style cost function. Our proposed model represents a significant advancement in the field of underwater image enhancement.

5. REFERENCES

[1]. Z. Zhaominghua, D. Shuangli, and S. Zhenghao, ‘‘Single backlight image enhancement based on virtual exposure method,’’ Comput. Sci., vol. 49, no. S1, pp. 384–389, 2022.

[2]. W. Yan, ‘‘Research on design and implementation of medical image enhancement based on wavelet analysis,’’ J. Central Univ. Nationalities, vol. 31, no. 2, pp. 52–56, 2022.

[3]. Jeevan K M, Anne Gowda A B, Padmaja Vijay Kumar, ”An image enhancement method based on gabor filtering inwavelet domain and adaptive histogram equalization,” Indonesian Journal of Computer Science Vol. 21, No. 1, January 2021, pp. 146~153

[4]. miao yang jintong hu1, chongyi li, gustavo rohde, yixiang du1, ke hu1, “An In-Depth Survey of Underwater Image Enhancement and Restoration,” School of Electronic Engineering, Jiangsu Ocean University, Vol 7,August 2019

[5]. Tang, H.; Zhu, H.; Tao, H.; Xie, C. “An Improved Algorithm for Low-Light Image Enhancement Based on RetinexNet.” Appl. Sci. 2022, 12, 7268.

[6]. Shoulin Yin , Hang Li, Lin Teng, “Research on low quality image enhancement technology of airport monitoring based on a priori and depth neural network, ”2021.

[7]. Ekin D. Cubuk, Barret zoph, Dandelion Mane, Vijay Vasudevan, Quoc V.Le, “ AutoAugment: Learning Augmentation Poilicies from Data”2018.

[8]. codruta o. ancuti , cosmin ancuti, christophe de vleeschouwer , and philippe bekaert, “color balance and fusion for underwater image enhancement”, vol. 27, no. 1, january 2018

[9]. M. T. Malone, ‘‘Overview of low illumination image enhancement algorithms,’’ Chin. J. Image Graph., vol. 27, no. 5, pp. 1392– 1409, 2022.

[10]. J. Gujoseph and G. W. Shaofeng, ‘‘Quality evaluation data set for real underwater image enhancement,’’ Chin. J. Image Graph., vol. 27, no. 5, pp. 1467–1480, 2022.

[11]. M. F. Pangyingna, ‘‘A non reference optical remote sensing image enhancement algorithm based on lightweight depth network,’’ Aerosp. Return Remote Sens., vol. 43, no. 2, pp. 74– 81, 2022