VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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A PROJECT SYNOPSIS

ON

"Underwater image dehazing and enhancement using Deep learning techniques"

Submitted in partial fulfillment of the requirement for award of degree
of

BACHELOR OF ENGINEERING
in
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by

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ABSTRACT

Underwater imaging is a major concern for all researchers, the main reason for it is the physical properties that are present in the underwater environment affect the images captured by the visual sensors. As a consequence of these properties, the captured image includes non-uniform illumination. This non-uniform illumination causes color distortion, low contrast, white regions, and color casts. An underwater image enhancement method is proposed by combining a color constancy framework and dehazing. A chromatic adaptation technique (CAT) is adapted to correct the color cast caused by the non-uniform illumination. The color-transferred image is then transformed into HSI with gamma correction. This gamma correction enhances the intensity of the color-transferred image. The gamma-corrected HSI image is converted to an RGB image. The dehazing is based on the estimation of artificial background light and transmission map depth. The depth is estimated from the difference of channel intensity prior (DCIP), which is the difference between the maximum and minimum intensity priors. A saturation correction factor is proposed for color correction. This correction factor estimates the artificial background light and solves the non-uniform illumination limitations in the turbid image. A guided and rolling guidance filter is adapted to refine the estimated transmission map depth. Finally, the recovered image is transformed into an HSI image with gamma correction. The gamma-corrected HSI image is transformed into an RGB image. Here in our approach, we assume that the image can be mathematically modeled by an unknown complex function. By doing so we obtain a recovered image that is both dehazed and has better quality.

DRIVING FORCE BEHIND THE IDEA:

In recent years, underwater image enhancement and restoration have received more attention in exploring the ocean and its applications. Some of the applications include marine ecology and sea organisms research. In a recent study, they incorporated underwater blurred image restoration in remotely operated vehicles (ROVs). , they had distorted images and hence proposed a multi-scale underwater image enhancement with image fusion to enhance the sea cucumber images captured by ROV. The underwater images and videos captured by an image acquisition device contain visual information such as color, texture, structure, etc. These images or videos suffer from low contrast, color distortion, and low visibility. The low visibility is due to the turbidity, absorption, and scattering of light in the water. In addition, the low visibility depends on the distance between the camera and the object. Sometimes external factors contribute to hazy images and distorted images. These images have decreased the efficiency of the research. Hence it is necessary to develop a method so that the images captured deep sea can benefit in research and also help in deep sea explorations

LITERATURE REVIEW

PROS

1. Hybrid methods have proven to provide much more accuracy and detailing.
2. Implementations is faster in higher GPU devices.
3. Tested models can be used in real-time.
4. These systems need minimal input.
5. Dark prior systems have been proved best for faster processing.
6. Object detection over the dehazed images has be proven very efficient.

CONS

1. Sometimes the loss function extracts high level functions resulting in increased computing time.
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3. Models often return garbage values in real time as they are only subjected to synthetic images and not real images.
4. Dark prior method has incorrect estimation from transmission map when there are bright objects.
5. Multiple models with same approach are available but due to lack of proper interface, they are not implemented in real time easily.
6. Object detection is efficient but due to loss of actual data from the image, the accuracy gets

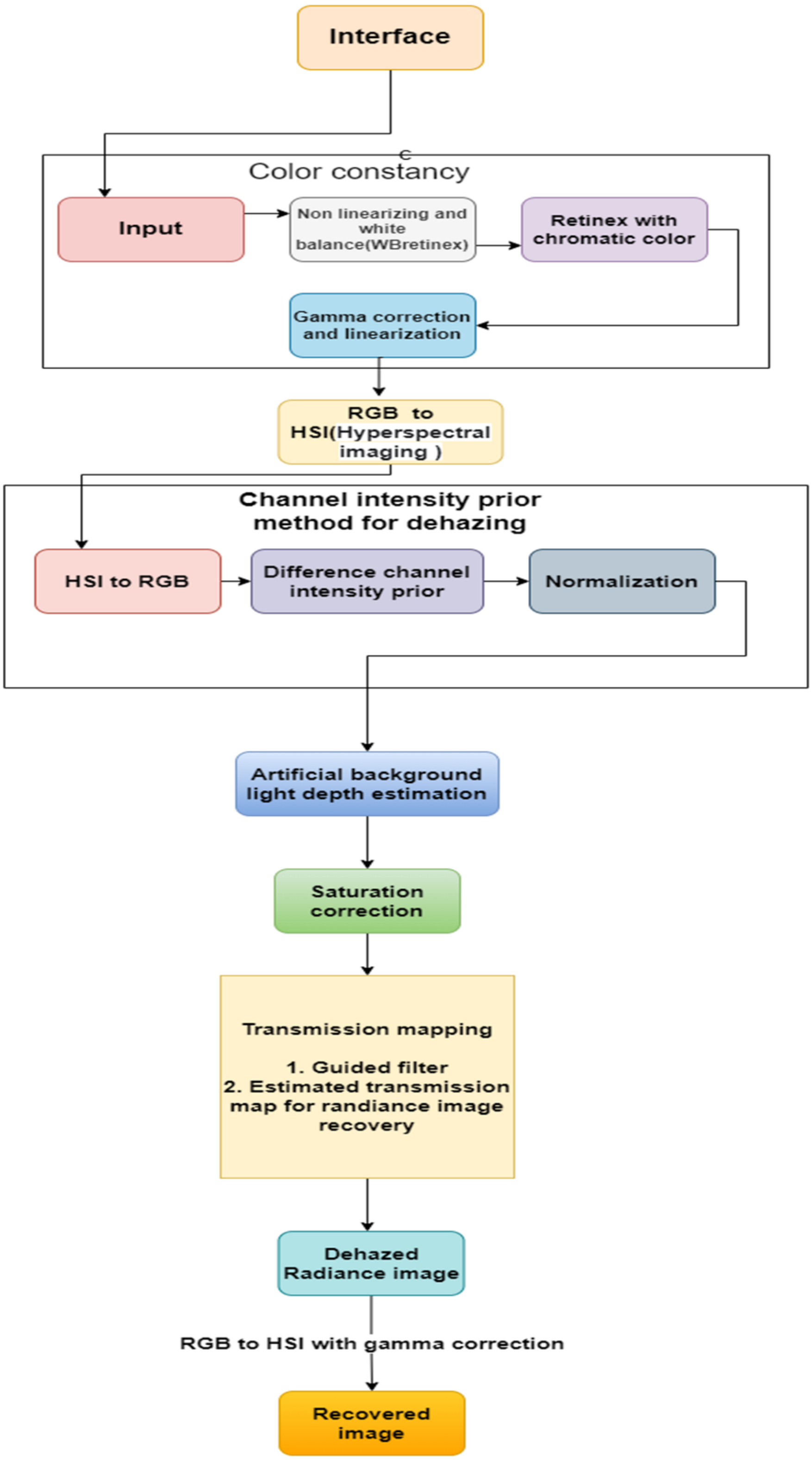
PROBLEM STATEMENT/ OBJECTIVE

Underwater images captured by cameras are plagued with poor contrast and distortion, which results in scattering and absorptive properties of water. Underwater robots play an important role in oceanic geological exploration, resource exploitation, ecological research, and other fields. The other major use of underwater images is to understand marine life, but due to the distorted images, we may encounter a lot of errors in it. The recent advancements in underwater exploration have led people to develop an interest in marine life and underwater photography. This demand has created a huge demand for producing quality underwater images without any distortions but due to the very less availability of methods and platforms to achieve such quality and methods it has people concerned., hence it is necessary to develop a method which can overcome these issues and provide accurate data.

Underwater photography is also a trending field in recent times, recent advancements have led to a dramatic increase in underwater photography, but due to the lack of quality images and the heavy requisites for getting a very less distorted image, the market has compromised quality and has started to decline. Hence we take this opportunity to take up this project to develop a platform where people can get their distorted or hazy images dehazed.

SYSTEM DESIGN

1. ARCHITECTURE:



2. HARDWARE AND SOFTWARE REQUIREMENTS:

Hardware Requirements:

1. **CPU:** Intel core i5-7267U @ 3.50 GHz
2. **Memory:** 8 GB
3. **GPU:** NVIDIA A100 and upwards
4. **Network:** minimum 1 Mbps

Software Requirements:

1. **Operating system:** Windows 7 and above(64bit)
2. **CUDA:** CUDA Toolkit 7.0
3. **OpenCV:** OpenCV 3.0
4. **cuDNN:** cuDNN 8.3
5. **Python:** 3.11.0
6. **Pytorch:** 1.13.0
7. **Frontend:** React native, Html, CSS

CONCLUSION:

In this paper, we combined a color constancy framework with dehazing for underwater image enhancement. Gamma correction, WPR, and CAT is adapted in color constancy method. The color constancy framework illuminates non—hardware-based balanced artificial illumination and corrects the color cast due to nonuniform illumination. The DCIP-based dehazing approach is proposed to estimate the artificial background light and transmission map depth. We also proposed a saturation correction factor for color correction and enhance the intensity in each color channel. This saturation correction factor approximates the wavelength of each color channel. The artificial background light depth is used to estimate the transmission map. The transmission map is refined using the guided and RGF filter. The guided and RGF filter preserves visual information such as texture, and edges, and produces artifacts-free results. The recovered RGB image results in enhanced contrast and brightness. The proposed method retrieves more visual information from the turbid image. According to the visual assessment, the proposed method results are pleasing, with better color restoration, edge-preserving, texture smoothing, and artifacts-free. These images can then be subjected to various other methods to obtain oceanic data. The proposed method can be used for fog, haze, and dust image dehazing too.