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DEHAZING TECHNIQUE APPLICATION USING ADAPTIVE FILTERING

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Abstract— Through suspended particles in the atmosphere, light is scattered. Atmospheric scattering drastically lowers the image quality. Based on the kind, size, and concentration of the particles, different meteorological situations, such as haze, fog, and smoke, are recognised. The term "haze" is used to avoid confusion between the comparable meteorological situations. Haze blurs, attenuates colour, weakens contrast, and fades scene elements. Furthermore, hazy photos lose depth information. As a result, haze reduction is frequently employed in various areas of image processing. Image contrast and visibility can be improved by removing hazy interference and colour distortion. Histogram equalisation, approaches based on the retina, multi-image dehazing, and other previously proposed methods can all be categorised in this way. each of the earlier designs.

Keywords— Image processing, hazy pictures, and adaptive filtering

I.INTRODUCTION

The goal of haze removal is to eliminate haze from photographs and restore the high quality that has been lost due to a variety of factors, including atmospheric scattering. Currently, there is a growing need for embedded intelligence systems in unmanned aerial vehicles, improved driver assistance systems, and outside surveillance systems. Haze significantly reduces image quality owing to air dispersion. The intelligent systems may not function if there is insufficient visibility of foggy pictures. Therefore, in such real-time systems, a sufficiently quick pre-processing for dehazing is required. Therefore, the main focus of this study is on the process of dehazing, or removing haze using a variety of ways based on earlier research, comparing them appropriately based on some quantitative indicators, and ultimately coming to the conclusion that the most effective method. [1]

Poor weather conditions including haze, mist, fog, and smoke reduce the quality of the surrounding environment. It's a bothersome flaw for photographers because it alters colours and reduces contrast in everyday photos, diminishes visibility of scenes and threatens the dependability of numerous applications like object detection and outside police work, and it also reduces the clarity of satellite and underwater photos. As a result, removing haze from photos is a crucial but rarely used step in image processing.

To improve visibility, numerous haze removal algorithms have been developed. The causes of the image degradation are not taken into account by approaches based on image processing. They improve contrast and storage, but they also reduce visibility and stop the automated recognition of blood vessel borders based on depth. If any characteristics are lost during segmentation, the image classifier can still be used to identify them with an accuracy of up to 93.33% [3] by region merging once again. Retinal permeability, ischemia, and other problems that progress over time are all a part of DR.

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II.EXISTED WORK

2.1 IMAGE:

An image is a depiction of something visually, such as a resemblance of an object captured on photographic film or one created on an electronic display (such a computer or television screen). The optical replica of an object created by an optical device (such a lens or mirror) or an electrical device is also referred to as an image.

2.2 HAZY IMAGE MODEL

The quality of images taken by visible camera sensors is diminished by atmospheric haze. Attenuation diminishes contrast while airlight boosts the amount of white in the scene's brightness, resulting in the production of haze. Remote sensing photos captured in cloudy settings frequently have poor visibility because they lack aesthetic appeal and vividness.

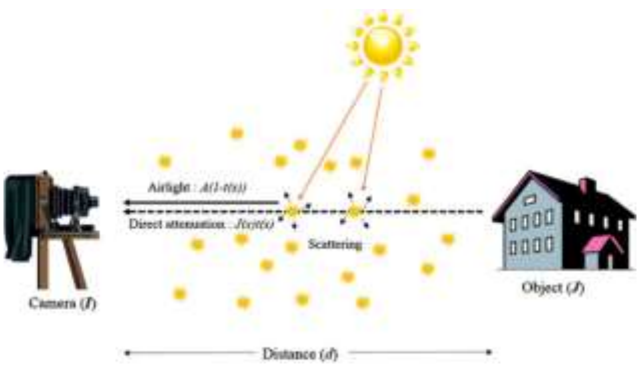

Figure 2.1: fuzzy photo model

The model for the hazy image looks like this. It includes the Airlight and Direct attenuation parameters. As a result of light scattering, the image quality could degrade. Haze is a phenomenon that diminishes the quality of images and is commonly caused by small airborne particles (such as dust, smoke, and water drops). Since dehazing techniques were viewed by researchers as an image processing tool to recover visual information, they were previously only applied in a limited number of applications. However, the rapid development of autonomous systems, artificial intelligence, and the requirements of high-level computer vision applications have motivated new research into more efficient image dehazing techniques. As a result, one of the most crucial uses for computer vision is the development of dehazing algorithms.

2.3 IMPLICATIONS OF HAZY IMAGE

As digital imaging and computer vision technology are used in an increasing number of application industries, dehazing has drawn more attention in recent years. Dehazing is highly important in applications where the environment significantly degrades the images. For use in further processing, dehazing techniques enhance or restore the quality of images taken in hazy, foggy, or smoke-filled conditions.

The availability of digital imaging technology and computer vision for use in a variety of fields, such as underwater exploration, tracking, and 3D reconstruction of underwater objects, underwater archaeology, or marine biology, has recently drawn special attention from academics to the problem of dehazing.

The quality of the photos is significantly reduced by atmospheric scattering, which colourizes photographs captured in low-visibility situations like haze and fog, reduces contrast, and makes it challenging to discriminate between object attributes. The different optical imaging-based instruments that are impeded by poor weather include aerial photography systems, satellite remote sensing systems, outdoor monitoring systems, and object identification systems, to name just a few. In addition to altering the visual impact of the image, bad weather also affects the equipment' ability to function. They require augmentation and restoration for the ease of post processing as well as the development of the visual effects.

2.4 DEHAZING

In order to reduce the negative effects of some approaches, additional processing must be used. For example, some methods are particularly sensitive to artefacts that may emerge in photos and videos shot in uncontrolled conditions, such as noise, low contrast, colour distortions, or a lack of light in the scene. [2]

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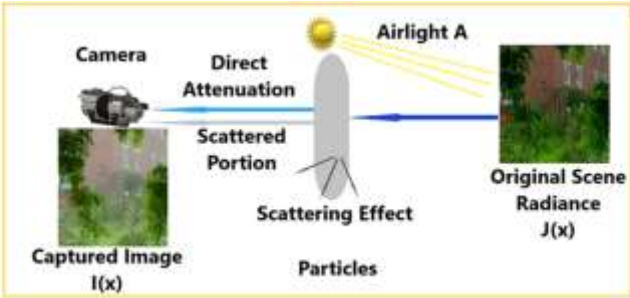

Fig 2.2 DEHAZING

III DEHAZING TECHNIQUES

3.1 DEHAZING

Image dehazing is a technique that is gaining popularity for restoring images of the natural world that have degraded due to low visibility weather, dust, and other factors. The advancements in autonomous systems and platforms have increased the requirement for low-complexity, high-performing dehazing solutions. Since current learning-based picture dehazing systems frequently added complexity at the expense of dehazing performance, which has lately increased, the employment of prior-based approaches persists despite their poorer performance. As light travels from the scene of interest to the camera, bad weather conditions including fog, haze, smog, and aerosol particles suspended in the atmosphere typically affect outdoor

photos. This results from air light scattering.

Fig 3.1 HAZY IMAGE Fig 3.1.2 DEHAZED (restored) IMAGE

3.2 EXISTING METHODS:

One of the most popular prior-based dehazing techniques, the DCP is discussed in practically every article in this area. The DCP was compiled using countless observations of haze-free photos as a prior-based method. He et al.'s discovery that every non-sky local patch has a value near to zero for at least one colour channel was expanded to include the transmission estimation.

In order to establish a link between the DCP, haze level, and transmission, the DCP was extended from clear to hazy circumstances. This means that the hazy condition of a location is conveyed by a change in the value of the DCP.The derivation from is not reprinted here due to the intricacy of the mathematical formulation, but a flowchart of the DCP algorithm is presented in Fig. 2. The fundamental flaw of this algorithm, which was utilised to refine the gearbox, is its low efficiency as a result of the soft matting action. According to one trial, the processing time for a 400 600 image was more than 20 seconds. Instead of using the soft matting to refine, morphological techniques can be employed to lessen this complexity.

IV PROPOSED WORK

In actuality, it might be challenging to remove haze from computer-generated images. The human brain can far more easily recognise the hazy areas without the need for further information. Then, we looked through hazy pictures to develop a previous for a single hazy image. According to our research, the brightness and saturation of the hazy input image vary based on the amount of haze present.[4]

4.1AdaptiveFiltering

The DCP method works well. But the halos cannot be effectively handled by this way. AF is utilised in this study to enhance the gearbox map. The input hazy image is used to compute the adaptive SEs (structuring element), the minimal channel (MC), and the bright channel (BC). The MC is then subjected to adaptive minimum filtering. The air light is being done in the background. Images from ADC and BC are used to calculate the two medium transmissions, tdc and tbc, respectively. The final transmission, or the maximum between the dark and bright channels, is tdc and tbc. Unsuitable SE image processing operators have the ability to quickly alter or destroy crucial data. Given the various image qualities, such as spatial distances, gradient, and noise, ASEs should adjust to the image structures. Numerous research have addressed with mathematical morphology that adapts. We adopt the "amoebas" method in contrast to current research to improve the transmission. An adaptive process uses an ASE computational pseudocode.

The grey picture of the input hazy image is used as the pilot to compute ASEs during the dehazing operation. ASEs apply a minimum filter to the MC. The filtered image is then the ADC. In order to prevent halo effects, the ASE filter keeps edges and eliminates fine texture.

4.2 DESIGN FLOW

4.2.1Introduction:

This method was discovered by He et al.. Dehazing, the process of removing haze, is frequently carried out using the physical deterioration model, which calls for an answer to an inverse problem. The Dark Channel Prior (DCP), a novel prior, is used to solve this inverse problem.The DCP is determined by the outdoor natural image characteristic where at least one colour channel's intensity value is close to zero. Dark channel previous (DCP), a unique prior, was suggested by "He" after seeing the characteristic of haze-free outdoor photographs. The DCP is based on the characteristic of "dark pixels," which, with the exception of the sky area, have a very low intensity in at least one colour channel.The four main processes in this dehazing process are: atmospheric light estimation, transmission map estimation, and transmission map reconstruction of the image and refinement.[5]

4.2.2 Algorithm:

Take the foggy input image as step one.
Get the dark channel for the specified input image in step two.
Finding the ambient light is step three.
Finding the transmission map is step four.
Step 5: Using the calculated parameters, obtain the haze-free photographs.
Step 6: Utilise a guided picture filter to find the refined gearbox.
Step 7: Using refined transmission, locate the refined output image.

4.2.3 Detailed flow:

Enter a fuzzy picture:

Utilising the middle bury stereo dataset, this dehazing is carried out. In order to identify the dark channel, dark pixels inside an image patch whose intensity values are very close to zero for at least one colour channel are selected as the dark channel. The DCP value can be used to infer transmission and estimate haze concentration in this area. Since the dark channel's pixel values are all close to zero, it is also known as DCP.

The discovery of ambient light

Estimate A using the pixels that are most haze-opaque.Haze density and the dark channel's pixel value have a strong correlation. The colour with the highest intensity value among the chosen pixels is then utilised as the value for A. As a result, the top 0.1% of the dark channel's brightest pixels are first chosen.

Finding transmission map:

Here, it is assumed that transmission in the immediate patch is constant and is denoted by the number t. After dividing by airlight, the minimum intensity in the local patch of each colour channel is determined from the degradation model. The three colour channels' min operator can be used.

4.3 Dehazing using Adaptive filtering:

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To improve the effectiveness of haze removal and optimise the transmission map, adaptive filtering—which is simple—is added.The transmission map is improved and halos are eliminated via adaptive filtering. The results of the experiments demonstrate that the proposed technique may be used with any blurry image. The effects of this technique on halo reduction are outstanding.[6]

The majority of current works rely on patch processing. The primary presumption in these works is that the gearbox is a constant in a patch. The assumption is not precise, though. The transmission in a patch changes when a depth edge is present. Halos are therefore seen in the depth edge.

4.3.2 Algorithm:

Step 1: enter the fuzzy picture

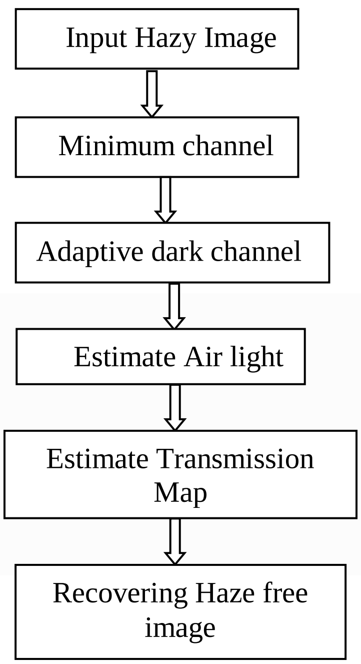
Obtain the minimum channel in step two.

Step 3: Utilise the adaptive minimum filtering to obtain the adaptive dark channel.

Estimate the airlight in step 4

Estimate the transmission map in step 5

Step6: recovering haze free image



4.3.4 Detailed flow:

Input hazy image:

Obtain minimum channel:

The R, G, and B colour image's minimal intensity pixels from each colour channel are used to create the minimum channel image.

Obtaining adaptive dark channel:

Then, the Minimum channel is subjected to adaptive minimum filtering. It adheres to the next algorithm. After the implemented algorithm, a minimal filter is applied. In order to prevent halo effects, this filter keeps borders and eliminates fine texture.

1: $j = 1$
2:do
3: for each pixel i in Ω_k, compute all the $L(\sigma)$
4: $d_\lambda(x, y) = minL(\sigma)$
5: $r_{limit} = \frac{\sum d_\lambda(k,x)}{M}$
6: $y^k_{ASE} = 1, when \ d_\lambda(k, y) \le r_{limit}$ or
$y^k_{ASE} = 0, when \ d_\lambda(k, y) > r_{limit}, y \in \Omega_k$
7: $j = j + 1$, move k to the next pixel
8:while($j = N$) % N is the total of pixels in p
end while

Observed

image:

Estimate airlight:

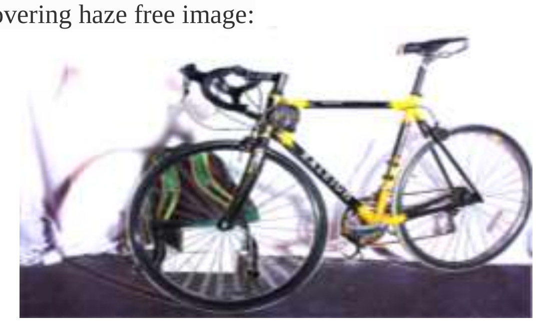
From the DC, the top 0.1% brightest pixels were chosen. These pixels were chosen, and the ambient light was chosen as those having the highest intensity in the input image I.

Estimate transmission map:

Formulae for t

- t = 1-w*(ADC/A)
- w represents the tolerance value.
- Here, 5% tolerance is taken.
- Hence, w=0.95

Recovering haze free image:



V RESULTS

As we can see, the two suggested methods—Dark Channel Prior, Colour Attenuation Prior, and Adaptive Filtering—each produced dehazed output photos. Here, it is obvious that the approaches of contextual regularisation, boundary restriction, and colour attenuation prior are not producing the intended results, leaving only the comparison of dark channel prior and adaptive filtering methods. When comparing the two methods, the dark channel prior method performs worse than adaptive filtering for images of the sky region and has less refined transmission maps and halos. knowing that adaptive filtering is the most effective most effective approach of all.

Fig 5.1.1 Hazy image

Fig 5.1.2 Dark channel prior

Fig 5.1.3 Adaptive filtering

By employing adaptive filtering, the haze is eliminated. The speed of operation is increased by employing this strategy. Effective performance is achieved.

VI CONCLUSION AND FUTURESCOPE

Conclusion:

The goal of this project is to use a variety of suggested ways that are based on previous research to obtain a haze-free image that is closer to the actual ground truth image. After finishing and putting the entire project into practise, we came to the conclusion that, out of all the approaches tested, only two—Dark Channel prior and Adaptive filtering—performed with complete explanations of their algorithms and flowcharts. Adaptive filtering produces outcomes that are effective and quite good.

Future scope:

Future technologies like other CNN-based networks may be developed that are even more efficient, quick, and precise.

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