

# Haze Removal Techniques in Image Processing

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**Abstract**— This paper presents literature survey on varied haze removal techniques. Haze causes issues in varied pc vision and image process primarily based applications because it diminishes the scene's visibility. The air lightweight and attenuation are two main phenomena answerable for haze formation. Haze detection and elimination may be a difficult task for raising the standard of digital pictures. In general, these pictures area unit taken at an extended distance from the visual device to give scene. Some climatical outcomes like haze, fog, smoke, dirt etc lower the excellence of the received image. The aim of the paper is to explore varied strategies used for efficiently removing haze from digital pictures. This paper lands up with the short comings of the prevailing strategies.

**Keywords:** Air Lightweight, Digital Pictures, Climatical Outcomes, Haze Formation

## I. INTRODUCTION

Bad weather conditions like haziness, mist, foggy and smoky degradation within the quality of the outside scene. It's associate annoying drawback to photographers because it changes the colours and reduces the distinction of daily photos, it diminishes the visibility of the scenes and it's a threat to the dependability of the many applications like outside police work, object detection, it conjointly decreases the clarity of the satellite pictures and underwater pictures, therefore removing haze from pictures is an essential and loosely demanded space in image process.[1] Digitization is unquestionably the procedure for ever-changing the photographs, written language, and even sound by analog

selling in to automatic details which will we are tend to facilitate to save, arrange, obtain, additionally to reinstate by digital or automatic devices. Therefore a digital image is made through the complete method of digitisation. A device array is helpful for the acquiring of the image. To form a digital image, we want to convert details of information into associate electronic digital type. This needs sampling and quantisation.

## II. HAZE AND DEHAZING

Haze may be a phenomenon within which the mud, smoke and different particles alter the vision of the sky to cut back the visibility. The out of doors pictures are used on that explicit filters are applied to seek out the haze in image. Hazy pictures contain tiny price in barely one-color alpha channel from Red, Blue, Green RGB channel. The intensity of those pixels is especially given by air lightweight depth map. Estimating these low price points of haze transmission map are helpful to get a top quality dehazed image. Associate in nursing end-to-end encoder-decoder coaching model is used to realize a top quality dehazed image. The approach is valid on datasets that consists of around 1500 out of doors pictures.[2] The strategy additionally offers transmission map of the hazy image which may additional be wont to enhance visibility of the scene. Hazy pictures cause numerous visibility issues for traffic user, tourists all over, particularly in rough areas wherever haze and fog are quite common. The pictures of outside scenes are sometimes degraded by the atmospherical wet, dust, smoke, water drop etc. Thus these all are the explanation to get pollution that referred to as Haze.

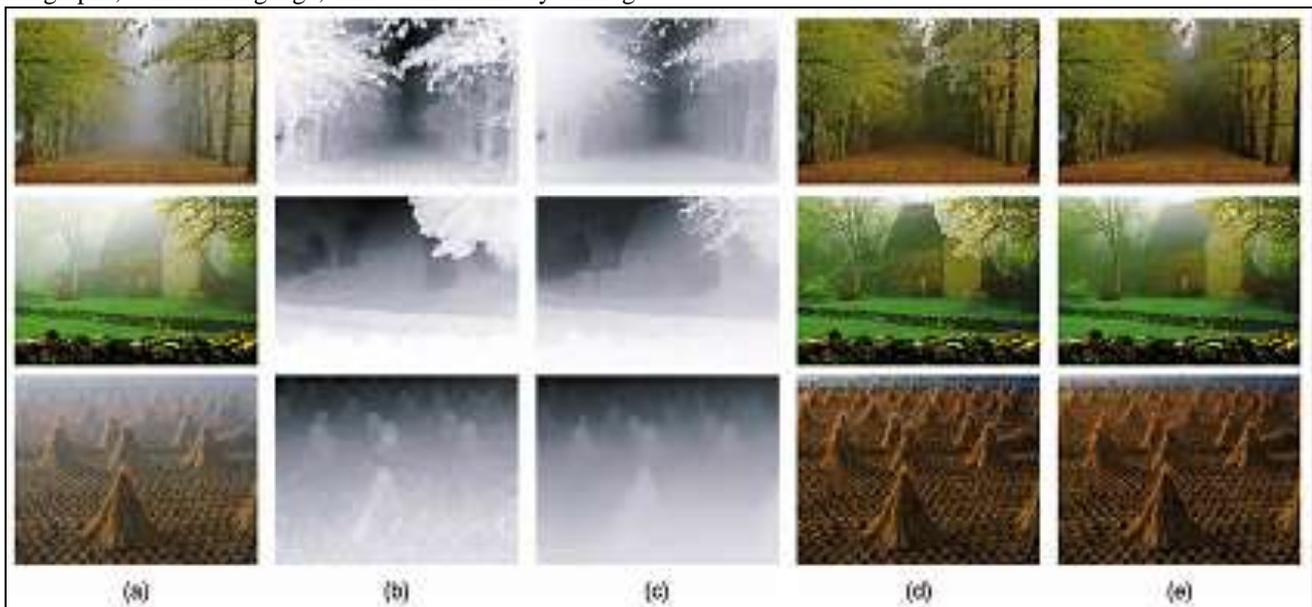


Fig. 1: Haze removal. (a) Input hazy images. (b) Estimated transmission maps before soft matting. (c) Refined transmission maps after soft matting. (d), (e) Recovered images using (b) and (c), respectively.

Haze attenuates the mirrored lightweight from the scenes and blends it with additive lightweight in atmosphere. Haze removal techniques tend to enhance this mirrored lightweight (i.e. scene colors) from mixed lightweight. The constancy and strength of the sensory system also can be improved by exploitation this effective haze removal of image. There are several ways on the market to get rid of haze from image like polarization freelance part analysis, dark channel previous etc. Although taking exterior image throughout inadequate atmospheric condition, the particular radiance received by merely photographic camera from the image is attenuated aboard the series of sight. The received lightweight goes to mixed with the daylight coming back from the assorted different guidance called the atmosphere lightweight. This can bring achromatic colour within the image. And therefore the second Attenuation is that the bit by bit reduction within the intensity. For this reason, there's important decay within the color.[3] Degree of scattering depends on the vary of the scene points from the camera. Image quality is deteriorated thanks to the existence of considerable particles within the environments that have important dimension between 1-10  $\mu$  m. Direct attenuation and Air lightweight is delineated as follow:  $I(x) = J(x)*t(x) + A*(1-t(x))$  (1) wherever  $I(x)$  is that the introduced intensity of the xth picture element,  $J(x)$  are scene radiance vector (the true color that ought to be recover),  $A$  is that the atmospherical lightweight, and  $t$  is that the transmission medium explaining the portion of the sunshine which will not be scattered and reaches direct to the camera. During this equation the one term,  $J(x)*t(x)$  is named the direct attenuation; the opposite term,  $A*(1-t(x))$  is named Air light.

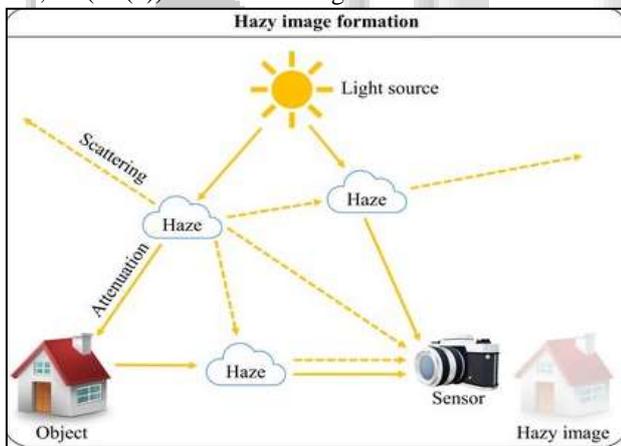


Fig. 2:

### III. DEHAZING

In a trial to eliminate this degradation of the image, various haze removal ways square measure used to improve the excellence of the image. It's very needed in shopper photography and laptop perspective vision application. It will be sorted into 2 classes as delineated below:- [4]

- 1) Multiple img dehazing technique
- 2) Single image dehazing technique

#### A. Multiple Image Dehazing Method:-

During this explicit haze elimination technique, multiple or many pictures of identical well-far-famed variables and avoids

the unknowns. This technique belongs to the class square measure.

#### 1) Method supported totally different weather condition:-

This Specific reasonably work use many pictures obtained from numerous climatic conditions. They take into account the variations of two or a lot of photos of the concerning scene. There square measure many pictures that have totally different properties of the conducive medium. This approach will considerably improve visibility, however its downside is to attend till the properties of the medium amendment. So, this procedure isn't ready to give the results instantly for scenes that have not been satisfy before. Moreover, this method conjointly cannot handle powerful scenes.

#### 2) Technique support polarization:

Polarization-based dehazing technique is that the major a part of the multi-image cluster taken with two differently polarized filters. They sometimes use two input pictures, one after another, to provide one dehaze image. 'Air lightweight is partly polarized' and also the transmission mechanism of the article is un-polarized. To get rid of haze, a minimum of two pictures with totally different polarization filter states square measure necessary.

#### 3) Depth map based mostly method:-

This approach uses depth details for haze removal. It runs on a individual image and presumes that 3D geometrical model of the scene is given by some databases for instance from Google Maps and conjointly assumes the feel of the scene is given. This 3D model then line up together with hazy image and provide the scene depth. It's not automatic and it desires user Interactions. This method utilizes some quantity of interactive adjustment to dehaze image.

#### B. Single image dehazing method:

It depends upon applied mathematics assumption to recovers the scene info supported the continuing info from one image. The varied ways classified square measure explained as follows:-[5]

#### 1) Distinction maximization method: -

Eliminating the haze can improve the distinction of the image as a result of haze diminishes distinction. But, the ensuing pictures have larger saturation values as a result of this technique does not physically enhance the brightness or depth however somehow simply enhance the visibility. Moreover, the result contains halo effects at depth discontinuities.

#### 2) Stanza diffusion: -

It's Associate in Nursing actual technique that minimizes haze from image while not removing necessary elements like edges, lines or alternative details that square measure helpful for the knowing of a picture. Its skilfulness mix smoothing properties with image improvement qualities. Associate in Nursing rule used for aeolotropic diffusion for processing air lightweight map from dark channel previous. It's wont to swish the air lightweight map and It performs okay in significant fog.

#### 3) Atmospherical light:-

It's calculated by dark channel previous with a hard and fast size window. If the minimum filtering is finished victimization too little window, then it should develop further lightweight sources within the image, which might corrupt the estimation. Once employing a window size of fifteen in image, the atmospherical lightweight are going to be

corrupted and if it enhanced to thirty one, the atmospherical lightweight are going to be properly calculable amongst the pixels. The event of a vital interactive method is required to avoid creating a poor guess of the atmospherical lightweight.



Fig. 3:

#### IV. DEHAZING METHODS

This method is considered in cases of non-sky patches with very low intensity at some pixels. The components responsible for this predominant of low intensity are:[6]

- 1) Colourful items or surfaces
- 2) Dark items
- 3) Shadows

Outdoor images in fog condition are considerably brighter compared to images taken in clear conditions, which results in higher dark channel intensity in dense fog regions. In this method, pre and post processing steps are used to get desired outputs. Assume  $J(x)$  is input image,  $I(x)$  is hazy image and  $t(x)$  is the medium of transmission. ( $I_{att}(x)$ ) is Image attenuation which is caused by haze is represented as: The fog is affected by Air light, expressed as:  $J_{dark}(x)$ :Dark channel for the image and is defined as:  $J_c(Y)$  is the RGB format (i.e.) colored image and  $\Theta_x(\Omega(x))$  depicts a local patch with its origin at  $x$ . After this method estimation of transmission  $t(x)$  is required before proceeding further. After estimating the transmission map depth map is generated.

#### V. FUSION BASED DEHAZING

This type of methodology uses solely the inputs and weights derived by original hazy image. [7] The first conception is to merge several input pictures into single one, keeping solely the foremost vital options of them. It wants many pictures of constant scene because of high complication of your time to get rid of haze, multiple image dehazing technique used that takes lesser time and simply one image per scene. This methodology work by mistreatment of three steps to get rid of haze.

- 1) Step1: Generation of two input pictures from original.
- 2) Step2: Process weight measures.
- 3) Step3: Fusion of inputs and weight measures.

#### REFERENCES

- [1] Tan, Robby T, "Visibility in bad weather from a single image" IEEE Conference on Computer Vision and Pattern Recognition, CVPR, pp. 1-8, Year 2008.
- [2] Tarel, J-P. and Nicolas Hautiere, "Fast visibility restoration from a single color or gray level image", 12th International Conference on Computer Vision, pp. 2201-2208, Year 2009.

- [3] Yu, Jing, Chuangbai Xiao and Dapeng Li, "Physics-based fast single image fog removal.",10th IEEE International Conference on Signal Processing (ICSP), pp. 1048-1052, Year 2010.
- [4] Fang, Faming, Fang Li, Xiaomei Yang, Chaomin Shen and Guixu Zhang, "Single image dehazing and denoising with variational method", IEEE International Conference on Image Analysis and Signal Processing (IASP), pp. 219-222, 2010.
- [5] He, Kaiming, Jian Sun and Xiaoou Tang, "Single image haze removal using dark channel prior.",IEEE Transactions on Pattern Analysis and Machine Intelligence, vol.33, no. 12, pp. 2341- 2353,2011.
- [6] Long, Jiao, Zhenwei Shi and Wei Tang, "Fast haze removal for a single remote sensing image using dark channel prior", International Conference on Computer Vision in Remote Sensing (CVRS), pp.132-135, 2012.
- [7] Zhang, Yong-Qin, Yu Ding, Jin-Sheng Xiao, Jiaying Liu and ZongmingGuo, "Visibility enhancement using an image filtering approach", EURASIP Journal on Advances in Signal Processing, no. 1, pp. 1-6, 2012.