# Second Order Median Filtering based Image De-hazing with Color Stabilization

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***Abstract :*** **The foggy weather images are highly degraded in color and visibility measure due the multiple scattering introduced by the different types of fog. Image processing has a branch which deals with enhancement of images under different type of suppressions which reduce their details to a level of reduced self similarity between the original scene and the image taken under fog. The proposed system calculates the fog diffraction by calculating the total area mask under high contrast vision channel designed by using mean values from all the three RGB channels of the image and reducing fog screen masked area intensity to stabilize the brightness in all the three layers. The proposed defogging method reduces running time and hence the processing id also reduced to one third of the base method. Test results demonstrate that the calculation has a high precision on recognizing foggy scenes. The results were compared based on various metric like the sobel powered edge enhanced visibility measure of the original and restored image data, also the mean and standard deviation variance of the HSI analysis is done to shows the robustness of the proposed scheme. All the parameters were tested for a variety of data and were proven to be enhanced by the proposed method.**

***Keywords*** *- Haze, Image Enhancement, Color Restoration, Visibility Metric.*

## I. INTRODUCTION

The procedure of expelling haze from a picture (defogging) requires the information on physical qualities of the scene. One of these attributes is the profundity of the scene. This profundity is measured from the camera sensor to the items in the scene. In the event that scene profundity is known, then the issue of evacuating haze turns out to be much less demanding. Ide-partner, given a solitary picture, two pictures are acquired: a scene profundity picture and a differentiation restored picture.

The expression single picture defogging is utilized to depict any strategy that evacuates air dissipating (e.g., mist) from a solitary picture. When all is said in done, the demonstration of expelling mist from a picture builds the complexity. In this manner, single picture defogging is an exceptional subset of complexity rebuilding strategies.

Here we allude to mist as the homogeneous dissipating medium made up of atoms sufficiently substantial to just as disseminate all wavelengths as portrayed in [18]. Along these lines, the haze we are alluding to is equally disseminated and lackluster. In each daily life situation the light reflected from a surface is scattered in the air before it achieves the camera. This is because of the vicinity of pressurized canned products, for example, tidy, fog, and vapor which redirect light from its unique course of spread. In long separation photography or foggy scenes, this procedure has a substantial impact on the picture in which complexities are lessened and surface hues get to be swoon. Such debased photos frequently need visual striking quality and bid, and additionally, they offer a poor perceivability of the scene substance. This impact may be an inconvenience to novice, business, and creative picture takers and additionally undermine the nature of submerged and ethereal photography. This may likewise be the situation for satellite imaging which is utilized for some reasons including cartography and web mapping, area utilization arranging, prehistoric studies, and natural studies.

Most single-picture defogging systems use priors or depend on suppositions to take care of the poorly postured issue. For instance, Tan's method [1] is in view of the assumption that pictures without mist or murkiness have higher stand out than ones from mist or cloudiness, so mist is evacuated by expanding the picture contrast. Fattal's method [2] is in light of the suspicion that the transmission and surface shading are mainly uncorrelated, so estimating so as to defog is finished the scene albedo and afterward derive ring the transmission map. The strategy for Kratz et al.[3] is in light of the presumption that the scene albedo and scene profundity are measurably free parts, so the picture is factorized into scene albedo and profundity utilizing a Markov arbitrary field model. The technique for He et al.[4] utilizes a dull channel earlier in view of measurements for outside fog free pictures, and cloudiness is uprooted by estimating a coarse transmission guide and afterward refining it. Tarel et al.[5] expected that the air shroud is certain and not exactly the base estimation of the components in I(x), so their system utilizes a middle channel to get the environmental cover.

Among these strategies, He's technique has the most straightforward calculation structure and the best defogging quality. On the other hand, it takes 10–20 seconds to process a 600 × 400 pixel picture on a PC with a 3.0-Hz Intel Pentium 4 processor, so the run time is too yearn for surveillance and in-vehicle applications.



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## II. LITERATURE SURVEY

Veeraraghavan et al. [6] A comparable change is utilized as a part of to re-develop the 4D light field of a scene from a 2D camera.

Yuan et al. [7] given two pictures, one loud and the other hazy, a deblurring technique with a diminished measure of ringing ancient rarities is depicted.

Fattal [8] Resolution improvement with local determination edge sharp-ness in view of a solitary info picture is described].

Liu et al. [9] In power ward commotion levels are assessed from a solitary picture utilizing Bayesian induction.

Tan and Oakley [10] expecting the scene profundity is given, air impacts are expelled from landscape pictures taken by a forward-looking airborne camera.

Schech-ner et al. [11] energized murkiness impacts are uprooted given two photographs. The camera must be indistinguishably situated in the scene and a connected polarization channel is situated to an alternate plot for every photo. This gives pictures that vary just in the size of the energized murkiness light segment. Utilizing some assessment for the level of polarization, a parameter portraying this distinction in sizes, the energized dimness light is evacuated.

Shwartz et al. [12] this parameter is evaluated consequently by accepting that the higher spatial-groups of the immediate transmission, the surface radiance coming to the camera, and the captivated cloudiness commitment are uncorrelated.

Schechner and Averbuch [13] the creators depict a regularization system, in view of the transmission, for smothering the clamor amplification included with dehazing.

Narasimhan and Nayar [14] A client intuitive device for uprooting climate impacts is depicted. This system requires the client to demonstrate districts that are vigorously influenced by climate and ones that are not, or to give some coarse profundity data.

Nayar and Narasimhan [15] the scene structure is evaluated from numerous pictures of the scene with and without dimness impacts under the presumption that the surface brilliance is unaltered.

Oakley and Bu [16] the air light is thought to be steady over the whole picture and is assessed given a solitary picture. This is done in view of the perception that in normal pictures the nearby example mean of pixel intensities is relative to the standard deviation.

Tan [17] picture complexities are restored from a solitary info picture by expanding the differences of the direct trans-mission while accepting a smooth layer of airlight. This system creates convincing results with improved scene contrasts, yet may deliver a few coronas close profundity discontinuities in scene.

## I. Proposed Work Theory

### A. Colour Optimized Image Restoration

The color optimization is an algorithm that takes in a sequence of images of a constant scene taken over time and recovers the scene radiance in the absence of the visual effect of fog and a transmittance map which can be easily converted into a depth map. In this section we will see the results of this algorithm from the perspective of defogging. To account for an inaccurate assumption as movement of the direction of illumination which causes a change in the intensity of the scene radiance, we normalized each image by dividing by the average irradiance over a patch of the scene in the foreground. The reason we chose a patch of the scene in the foreground is that foreground objects are least affected by fog and therefore give us more accurate information on how the scene radiance intensity varies with changes in illumination. Further away objects would be affected greatly by fog and would therefore give inaccurate variations of scene radiance intensity.

### I.1 Visibility and visual range

Fog is a safety hazard because it decreases visibility. In worst cases the visibility in a fog underground may be only a couple of meters. It should be noted, however, that water vapour is invisible. The explanation for the visibility deterioration is that fog is composed of fine liquid droplets that cause light scattering and absorption. Visibility depends upon the transmission of light and the ability of the eye to distinguish an object because it contrasts with the background. For dark colored objects, light from the atmosphere is introduced into the sight path so that the object appears lighter at increasing distances.

On the other hand, for light colored objects, light is lost from the line of sight with increasing distance. In both cases the contrast between the object and the background disappears as the intensity of light from the object approaches the background value. Gaining information about visibility in fog in order to contribute to fog removal purposes is not necessarily practical. The actual visibility parameter gives information about the resolution of the eye of a human in addition to the characteristics of the fog itself. As visibility is said to depend on the transmission of light, let us consider light.

Light is defined in a strict sense as the region of the electromagnetic spectrum that can be perceived by human vision, i.e., the visible spectrum, which is approximately the wavelength range of 0.4 μm to 0.7 μm (Institute for Telecommunication Sciences, 2006). Even if the visibility parameter itself is problematic, attenuation of the visible electromagnetic waves, light, in fog is directly related to the physical parameters of fog.



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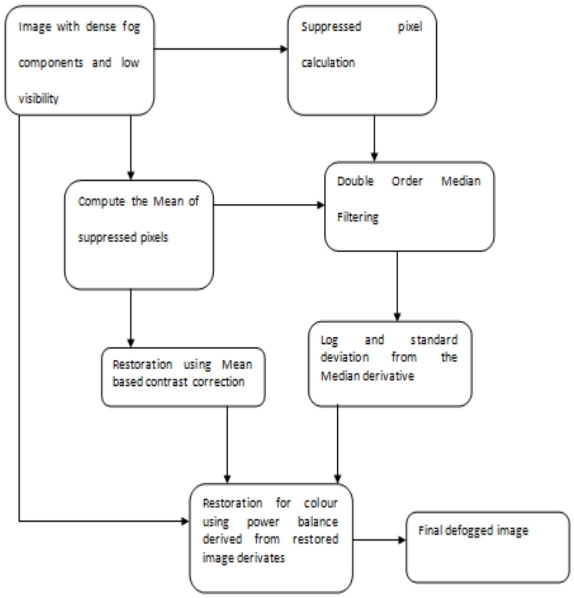
### B. Visibility Enhancement Measure

The metric takes as input a luminance image. The image is blurred by an 'optical' blur function and then blurred again to generate a local luminance image. These are combined pixel by pixel to form a visible contrast image.

## III. Functioning Diagram




## IV. Evaluation of Results for Visibility Metric

### a. Results for Forest Road

Figure 1 Shows (left) the original fogged image and (right) defogged image using base approach

In above figure on the left hand side is the image of the foggy forest road with visibility 70.99 % and on right hand side is the defogged image with base approach giving a visibility measure of 75.23 %.

### b. Image with resolution 448x336 pixels with proposed method

Figure 1 Shows (left) The original fogged image and (right) defogged image using proposed approach

In above figure on the left hand side is the image of the foggy forest road with visibility 70.99 % and on right hand side is the defogged image with proposed algorithm giving a visibility measure of 81.64 %.

### c. Image with resolution 448x336 pixels with base method

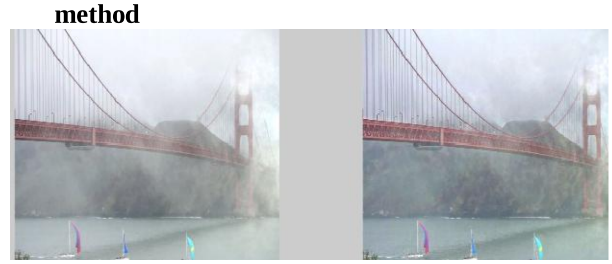


Figure 2 Shows (left) The original fogged image and (right) defogged image using base approach

In above figure on the left hand side is the image of the foggy bridge road with visibility 34.46 % and on right hand side is the defogged image with base approach giving a visibility measure of 39.10 %.

### d. Image with resolution 448x336 pixels with proposed method

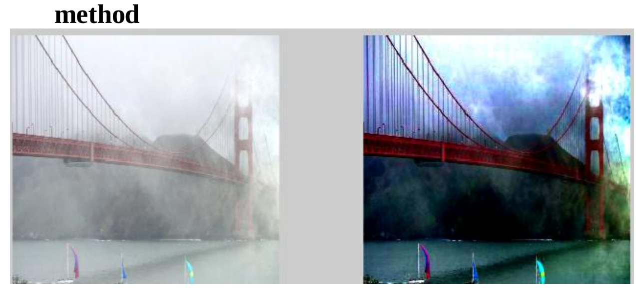


Figure 3 Shows (left) The original fogged image and (right) defogged image using proposed approach

In above figure on the left hand side is the image of the foggy bridge road with visibility 34.46 % and on right hand side is the defogged image with proposed algorithm giving a visibility measure of 40.91 %.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## V. Conclusion

The proposed system defogs the images under foggy weather using median filtering as base for patching the foggy region in order to improve the light condition, this is backed up by the color restoration which is done after the light balance is improved by first step, the color balance was not termed as an important parameter and the proposed system used this as an edge for current restoration, proving the effectiveness of color balance, the proposed system improved the visibility of the foggy images to an average of about 10% more than the previous system, however there was improvement of more than 30% in many images.

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