Enhancement of Globally Guided Image Filtering Technique using Artificial Neural Network for Dehazing Single Image and Preserving Fine Structure of the Image

Rauki[1], Parmendra Singh[2]
[1]*M. tech Scholar, Sachdeva Institute Of Technology ,Mathura,UP,India*
[2]*Assistant Professor,Sachdeva Institute of Technology ,Mathura,UP,India*

Abstract- In this paper, to improve the accuracy and preserving the real contents of the image in Globally Guided image filtering, it is essential to define proper filtering techniques which will improve the technique. In this papera special technique is applied named as convolutional neural network step of dehazing with GGIF technique together to provide better results. For calculation of results perceptual fog density function will be used. In this technique, a two-step technique is created with combination of image processing filtering and artificial neural network learning system of the original image as hazy image input. Local edge-preserving smoothing techniques such as guided image filtering (GIF) and weighted guided image filtering (WGIF) could not preserve fine structure. The problem with GGIF was that it was unable to detect the amount of dehazing to be applied. In artificial neural network systems, the dehazed image is basically judged as a second step if any haze needs to be removed further. The results of the perceptual fog density calculations show that the improved ANN-GGIF is better technique than the previous version GGIP, WGIF and GIF. Also any new image can be easily added in the database of the system and haze can be removed from the image efficiently by this technique.

Keywords- ANN, GGIF, Dehazing, Image Processing

I. INTRODUCTION

The execution of visual exercises, for example, object discovery and acknowledgment depend vigorously on the impression of outside normal scenes. Tragically, images of open air scenes are frequently debased in terrible climate conditions, for example, fog, haze, smoke, downpour, etc. The light is mixed with surrounding light reflected from different bearings into the viewable pathway by environmental particles. The irradiance captured by the camera from the scene point is constricted along the observable pathway. Generally, the articles caught under the awful climate conditions experience the ill effects of low differentiation, swoon color, and moved luminance. [2] Fog removal can significantly expand the differences of the items, and right the color twisting brought about by the air light. Consequently, dimness removal is required in image processing and PC vision applications. Many single image fog removal calculations were proposed because of their expansive applications. [3] In light of a perception that a murkiness free image has higher differentiation than its fog image, an intriguing single image fog removal calculation was proposed by boosting the neighborhood difference of the reestablished image utilizing markov irregular field. In spite of the fact that the calculation can accomplish outwardly convincing outcomes, it will in general produce over-immersed images which probably won't be physically substantial. A fog image is translated by filter through animage development depicts both surface shading and scene transmission. Moreover, surface shading is locally uncorrelated, the air light equivocalness is settled. [4] The calculation created amazing outcomes with the exception of nearness of substantial fog. Motivated by the broadly utilized dark-object subtraction system, a novel dark channel earlier based murkiness removal calculation was proposed. The dark channel earlier was dependent on a perception that a few pixels of fog free open air images have low power somewhere around one color (RGB) channel. [5] The calculation is physically legitimate and can deal with far away objects even in images with overwhelming fog. In any case, noise in splendid locales including the sky could be amplified by utilizing the calculation and despite the fact that a lower headed was presented for the transmission map. In light of perception that the color of the scene blurs under the influence of the dimness and the splendor increments in the meantime delivering the high estimation of the distinction, a straightforward color weakening was proposed earlier, and a direct model was proposed further to prove the connection between the profundity and brilliance. [6] The direct model was finally embraced to structure a single image fog removal calculation with the assistance of the guided image filtering (GIF). The calculation is basic and it additionally dodges amplification of noise in the sky district. Also, the murkiness is evacuated well on the off chance that it is light. However, the nature of the dehazed images should be improved if the dimness is substantial. This is on the grounds that the coefficients of the straight model and the dispersing coefficient of the environment are fixed for the calculation while their qualities ought to be versatile to the fog level of the information image.

It is intriguing however testing to legitimately decide the coefficients of the direct model and the dissipating coefficient of the air for the calculation. Propelled by a perception that single image dimness removal can be viewed as a kind of spatially fluctuating subtlety upgrade, a flawless system was proposed by presenting a neighborhood edge-saving smoothing based technique to gauge the transmission map of a cloudiness image. In any case, neighborhood edge-saving smoothing methods, for example, the GIF and the weighted GIF (WGIF) could over smooth images, particularly in zones of fine structure. A precedent is given in Figure 1. The GIF and the WGIF are received to ponder single image murkiness removal. As appeared in the zoom-in areas, the hair of the human subject is over smoothed by both the GIF and the WGIF. Subsequently, both the GIF and the WGIF couldn't safeguard the fine structure despite the fact that they are exceptionally fundamental.

GGIF Globally Guided Image Filtering:

In this work, a quick globally guided image filter (G-GIF) is acquainted with improvement in the issue. The existing G-GIF is propelled by the GIF, the WGIF, and the gradient space image processing calculations. Two noteworthy destinations of the GIF and WGIF are: 1) to exchange the structure of the direction image to the improved image with correct information; and 2) to smooth the exchanged image to deliver the yield image. Both the targets are accomplished all the while in the GIF and WGIF. They are accomplished independently in the existing G-GIF. The existing filter is made out of a worldwide structure exchange filter and a worldwide edge-protecting smoothing filter. Contributions of the structure exchange filter are an image to be filtered and a direction vector field. The structure is defined by the direction vector field and it is exchanged to the image to be filtered by the structure transfer filter. Unlike GIF and the WGIF, the structure exchange filter is planned as a quadratic improvement issue. [6][7] Dissimilar to the gradient area image processing calculations and, the structure filter is figured in the half and half gradient and image space. [15] All things considered, the proposed half and half enhancement issue can be effectively settled by utilizing the isolating methodology in despite the fact that it is a worldwide advancement issue while the isolating methodology isn't pertinent to the gradient space image processing calculations and the speed of the structure exchange filter is consequently similar to those of the GIF and the WGIF, and is a lot quicker than the gradient area image processing calculations. [8][9]The proposed edge-safeguarding smoothing filter is enlivened by the weighted least square (WLS) filter and the detail extraction issue.[11] Contributions of the smoothing filter are an image to be smoothed and the direction vector field.[12][13] Like the structure exchange filter, the smoothing filter is additionally planned as a quadratic streamlining issue. [10][14] It is important that the WLS filter is an exceptional instance of the proposed edge-safeguarding smoothing filter. Because of the isolating methodology, the speed of the smoothing filter is likewise tantamount to those of the GIF and the WGIF. As represented in Figure 1, the existing G-GIF jelly the fine structure superior to the GIF and WGIF.

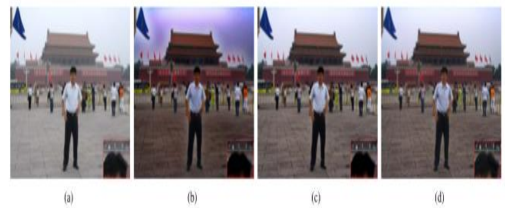

Fig.1: Comparison of techniques, GIF, WGIF and GGIF

Implementation of CNN based Dehazing:

In this section, we present a technique which combines dehazed CNN based neural network and GGIF Technique, and discuss how these designs are related to ideas in existing image Dehazing methods like GGIF, WGIF and GIF. [1] The GGIF method is proceeded by the method for dehazed CNN system which consists of the following steps:

1) Feature Extraction: The important parameters or the required features of the image which detect the haze density are dark channel, hue and color map. These are calculated in this step.
2) Multi-Scaled Mapping- This is a method used for mapping the features based on pixels calculated in the first step.
3) The next step is Local Extremum Calculation function, according to the classical architecture of CNNs, the area most extreme is considered under every pixel to conquer local affectability. Furthermore, the local extremum is as per the suspicion that the medium transmission is locally steady, and it is generally to conquer the commotion of transmission estimation. Subsequently, we utilize a local extremum task in the third layer of DehazeNet.
4) Non-Linear Regression- Here we calculate the non-linear regression in the image. It is calculated by bilinear rectified linear unit system as taken from Dehazed net cnn technique.
5) Using the training data and loading into the software.
6) After the GGIF step, the gamma variable is adjusted to preserve the fine structure of the image and followed by the step of execution of the system based on net CNN.

II. RESULTS

Fig.2: Original Hazy Image Input 1

Figure 2 shows the original hazy image taken as first input. The Figure 3 shows the result after applying the ANN-GGIF technique applied on an original image. Here, the minimum perceptual fog density in the output image is that of ANN-GGIF. Hence, it is better technique than the other ones.

Fig.3: Output Image of the proposed work (for input image 1)

In Figure 4, the chart represents the perceptual fog density of the first input image.

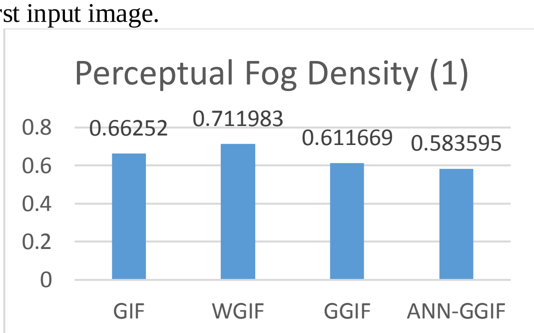

Fig.4: Perceptual Fog Density Graph Input Image 1

Similarly, Figure 5, 6 and 7 represent input and output for the second input image. In this image it is seen that having the less perceptual fog density and also it preserves the color intensity of the flower in the image as shown in below images.

Fig.5: Original Hazy Image Input 2

Fig.6: Output Image of the proposed work (for input image 2)

Below is the perceptual fog density chart of the second input image.

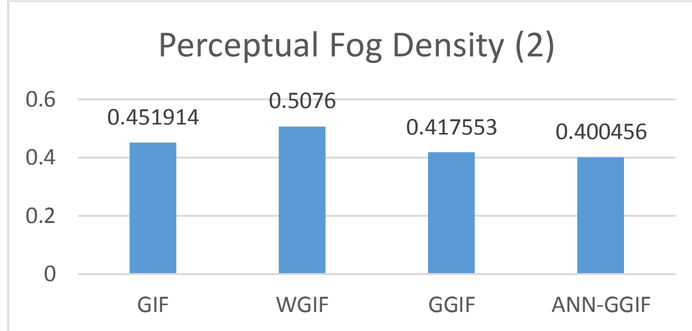

Fig.7: Perceptual Fog Density Graph Input Image 2

In Figure 8, 9 and 10 high hazy image is taken as input 3. The input in Figure 3 provides best result using ANN-GGIF technique and also the structure of the image is preserved for the high hazy image as seen in the Figure 9.

Fig.8: Original Hazy Image Input 3

Fig.9: Output Image of the proposed work (for input image 3)

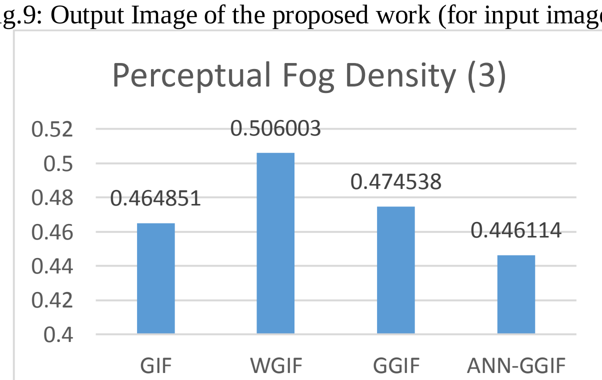

Fig.10: Perceptual Fog Density Graph Input Image 3

The Figure 10 shows the perceptual fog density of the system when given input 3 image is given as input for ANN-GGIF.

Fig.11: Original Hazy Image Input 4

Figure 11, 12 and 13 shows the third input images results for perceptual fog density. Here the minimum is GIF, but it has attenuated the color and structure of the image. And the ANN-GGIF enhances the features and true colors of the image.

Fig.12: Output Image of the proposed work (for input image 4)

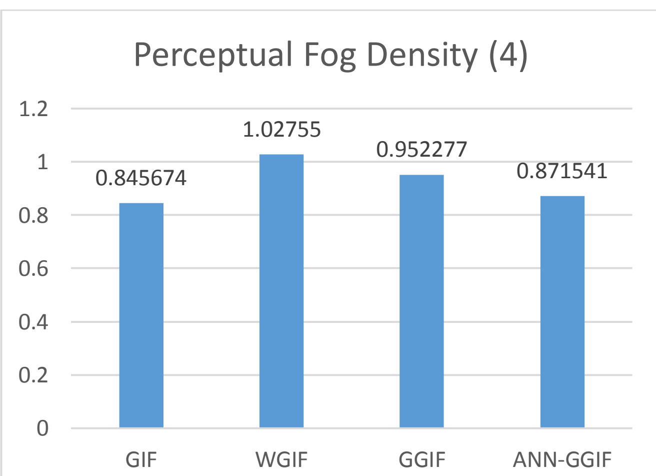

Fig.13: Perceptual Fog Density Graph Input Image 3

Above figure shows the perceptual fog density of the final image.

III. CONCLUSION

As seen in the results section, the new technique names ANN-GGIF has significant advantages over the previous techniques like GIF, WGIF and GGIF. It is seen that in most of the images the results are better in case of ANN-GGIF and it also preserves the fine structure of the image contents. It enhances the colors of the image and it is the best technique for haze removal in a single image. Perceptual fog density is the method used in [1] to check the effectiveness of the dehazed image. The minimum value signifies that the image is fog free. Thereby, the efficiency of the image Dehazing system is improved by using ANN-GGIF technique for single image dehazing methods.

IV. REFERENCES

[1]. Zhengguo Li et al., "Single Image De-Hazing Using Globally Guided Image Filtering" IEEE Transactions on Image Processing, Vol. 27, No. 1, January 2018

[2]. Ximei Zhu et al.," Fast Single Image Dehazing Through Edge-Guided Interpolated Filter" MVA2015 IAPR International Conference on Machine Vision Applications, May 18-22, 2015, Tokyo, JAPAN

[3]. HongyuanZhu et al., "Dehaze GAN: When Image Dehazing Meets Differential Programming" Proceedings of the Twenty-Seventh International Joint Conference on Artificial Intelligence (IJCAI-18)

[4]. W. Uma et al., "Globally Guided Image Filtering Method for Single Image Haze Removal Using An Transmission Map" International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE) ISSN: 0976-1353 Volume 25 Issue 5 – APRIL 2018 (SPECIAL ISSUE).

[5]. Zheng Xu et al., "Strong Baseline for Single Image Dehazing with Deep Features and Instance Normalization" arXiv preprint arXiv:1804.05091.2018

[6]. Huimin Lu et al., "Single Image Dehazing through Improved Atmospheric Light Estimation" in: Proc. of Computer Vision and Pattern Recognition, vol.1, pp.325-332, 2001

[7]. Boyi Li et al., "Benchmarking Single Image Dehazing and Beyond" Journal of L Atex Class Files, Vol. 14, No. 8, August 2015

[8]. Xumeng Chen et al., "A Fast Algorithm for Single Image Dehazing Based on Estimating Illumination Veil" IEEE Computer Society, 2008: 2347—2354.

[9]. Nidhi Sen et al., "Weighted Guided Image Filtering – A Survey "International Journal of Computer Applications (0975 – 8887) Volume 156 – No 10, December 2016

[10]. Wenqi Ren et al., "Gated Fusion Network for Single Image Dehazing" Single image dehazing by multiscale fusion. TIP, vol. 22(8), pp. 3271–3282, 2013.

[11]. Namitha Shajan et al., "Edge Preserving Decomposition-Based Haze Removal in Video Sequence Using Koschmiedars Law" Namitha Shajan et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 7 (3), pp. 1263-1266, 2016.

[12]. G.T.N.V. Satya Sri et al.," Image Visibility Restoration Using Fast-Weighted Guided Image Filter International Journal of

Electronics Engineering Research" ISSN 0975-6450, vol. 9(1), pp. 57-67, 2017.

[13]. Cosmin Ancuti et al., "NTIRE 2018 Challenge on Image Dehazing: Methods and Results" IEEE Transactions on Image Processing, vol. 22(8), pp. 3271–3282, 2013

[14]. Kaiming He et al., "Guided Image Filtering" IEEE Transactions on Pattern Analysis And Machine Intelligence, Vol. 35, 2013

[15]. Jin-Hwan Kim et al.," Single Image Dehazing Based on Contrast Enhancement" Acoustics, Speech, and Signal Processing, ICASSP-88, June 2011