Response to Reviewer 2 Comments

Point 1: Concerning the presentation of the contents, the document is acceptable. Nonetheless, it is recommended that authors develop proofreading to avoid common mistakes such as expression error. For example, is the word 'GIS' in line 140 correct ? If it is correct , please explain the abbreviation

Response 1: Similar typos have been corrected in the text.

Point 2: The document contains a total of 23 employed references, of which 12 are publications produced in the last 5 years (52%), 8 in the last 5-10 years (35%), 3 than 10 years old (13%), implying a total percentage of 87 % recent references. In this way, the total number is insufficient, their actuality is high.

Response 2: This paper contains a total of 30 employed references, of which 19 are publications produced in the last 5 years (63%), 8 in the last 5-10 years (27%), 3 than 10 years old (10%), implying a total percentage of 90% recent references.

Point 3: For the core 'Global illumination compensation factor' and 'Dehazing process of the GIC algorithm' of this paper, this paper has carried out A detailed description of the principle. Are they all innovative contents? If they are not, please point out the innovative part; if they are application innovation rather than principle innovation, please point out the prospect of innovative technology.

Response 3: In this study, the shading partition enhancement mechanism and the global illumination compensation factor can be regarded as application innovations. The former can reduce the influence of background on brightness and color before performing a priori analysis on the image. The latter can be combined with guided filtering to optimize the initial transmittance, resulting in a clearer outline of the transmittance map.

Point 4: The abstract is complete and well-structured and explains the contents of the document very well. Nonetheless, the part relating to the results could provide numerical indicators obtained in the research.

Response 4: The Abstract has been modified as follows:

"The GIC approach outperforms other dehazing methods in maintaining the naturalness of the image, and obtains improved PSNR and SSIM indexes." has been modified as "Compared with the average metrics of each method, the peak signal-to-noise ratio (PSNR) and the structural similarity (SSIM) are improved by 3.25,0.084."

Point 5: In the part of the introduction of the research topic, the existing fog removal methods can be summarized into three categories, and the main contributions of this paper are also mentioned. All these are clear, and the novelty can be more highlighted if they can be compared.

Response 5: In Page 2, Lines 45-64. The following sentences have been added

"DCP provides an effective method to estimate model parameters, …". This part mainly introduces three kinds of image dehazing algorithms and the limitations of some of them.

Point 6: Vision technology applications in various engineering fields, should also be introduced for a full glance of the scope of related area. The first paragraph introducing the research topic may present a much broad and comprehensive view of the problems related to your topic with citations to authority references (Binocular vision measurement and its application in full-field convex deformation of concrete-filled steel tubular columns; Seismic performance evaluation of recycled aggregate concrete-filled steel tubular columns with field strain detected via a novel mark-free vision method).

Response 6: In Page 1, Lines 33-35.

"This results in the visual effect of a loss of contrast, …." has been modified as "This results in a loss of contrast, visibility and vividness in images required for vision technology [1-2] due to the scattering effect of light through haze particles.".

Point 7: In chapter 2, the atmospheric scattering model and the principle of the existing fog removal methods are introduced, and the shortcomings of the traditional methods are summed up. At the same time, the solutions are finally mentioned, which is very logical and clear.

Response 7: To obtain a comprehensive evaluation of the proposed GIC method, two candidate dehazing methods namely B3 and B4 have been selected to compare with the GIC method. More details can be found in the modified Table 1.

Point 8: Chapter 3 introduces the concepts and principles of the shading partition enhancement global illumination compensation factor and evaluation indexes of image dehazing, but there is a lack of practical application methods and methods. If the methods to realize these two innovative parts in software resources can be added, it will be more convincing.

Response 8:

Algorithm 1 The shading partition enhancement mechanism	
1、Read image img	
2、Get the maximum and minimum values within an $n \times n$ area of the image. $[I_{\max}, I_{\min}] = \max_\min(img_L)$ 3、Enhance the center pixel with surrounding pixels. $Lw/Lb = \mathrm{Img_sharp}(I_{\max}/I_{\min})$	From Equation (6)
4、Get the range of bright and dark regions from the input image. $k_1 = \max(img_L) - mean(img_L)$ $k_2 = \min(img_L) - mean(img_L)$ 5、Get enhanced bright and dark area information.	From Equation (7)(8)

$bright = \frac{k_1(Lw - mean(Lw))}{\max(Lw - mean(Lw))}$ $dark = \min\left(\frac{-k_2 Lb}{\max(Lb)}\right) - \frac{-k_2 Lb}{\max(Lb)}$	
6、Image fusion $output = \begin{cases} bright + mean(img_L), bright \geqslant 0 \\ dark + mean(img_L), bright < 0 \end{cases}$	From Equation (9)

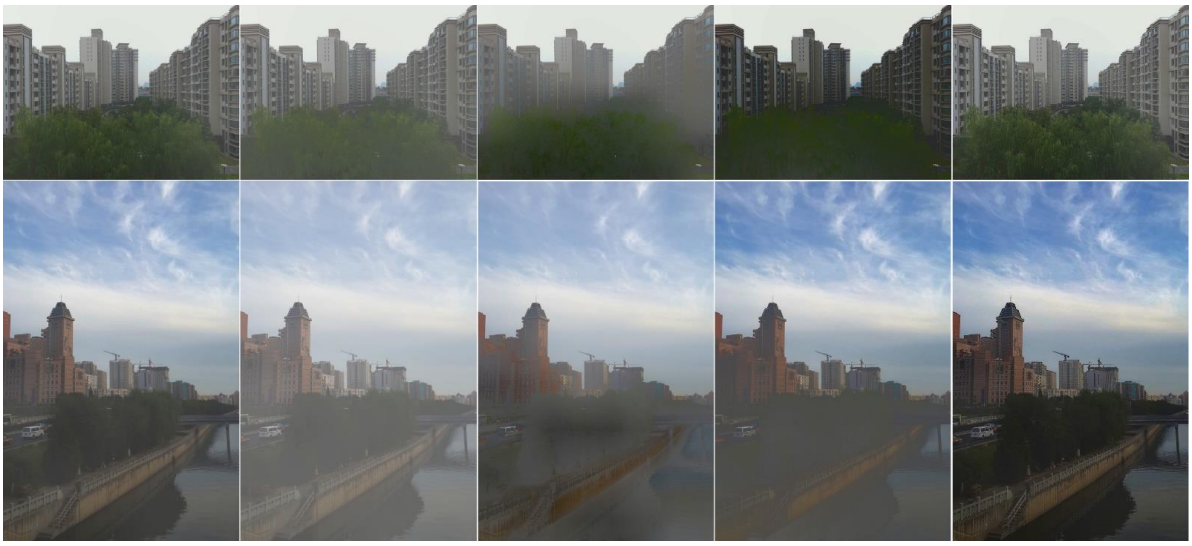
The **function *max_min()*** is employed to compute the maximum and minimum pixel values in the × range. The **function *Img_sharp()*** represents the result of the multiplication of the surrounding pixels with the center pixel value. **Functions of** max() and min() are used to get the maximum and minimum values of a matrix. The mean() is used to get the mean of the matrix.

Algorithm 2 Global Illumination Compensation Factor	
1、The DCP calculation is performed on the enhanced image. $I^*_{DCP} = \min_{y \in \Omega(x)} \left(\min_c I^{*^c} \right)$	From Lines 253
2、Calculates the average value of pixels in a small range. $w(x) = \underset{y \in \Omega(x)}{mean} I^*_{DCP}$	

Point 9: In the experiment, the images processed by the shadow segmentation mechanism and the images processed by B1 and B2 methods are compared and analyzed, and evaluated with the indicators mentioned in Chapter 3. Please note whether B1 and B2 methods are the latest processing methods?

Response 9: In Page 9, Lines 302-308.

The purpose of this part of the experiment is to highlight that the shading partition enhancement mechanism is more suitable for image dehazing than other image enhancements. Therefore, the GIC method is compared with the methods without image enhancement, histogram equalization, CLAHE, and Retinex. Four candidate dehazing methods **namely B1, B2, B3 and B4 have been selected to compare with the proposed GIC method** in Section 4.1. The following are qualitative and quantitative comparisons, which demonstrate the feasibility and **effectiveness** of the shading partition enhancement mechanism **in the GIC method.**



(a) (b) (c) (d) (e)

Figure 1. Comparison of outdoor image dehazing for the five methods. (a)B1 method processing results, (b) B2 method processing results, (c) B3 method processing results, (d) B4 method processing results, (e) GIC method processing results.

Original Table 1. Comparison of indexes of the three methods.

Methods	PSNR		SSIM		SSEQ		NIQE	
	AVG	SD	AVG	SD	AVG	SD	AVG	SD
B1	18.67	3.61	0.88	0.05	18.20	6.36	**2.61**	0.60
B2	18.48	3.25	0.79	0.09	18.01	6.30	3.39	0.81
GIC	**22.07**	**3.02**	**0.90**	**0.05**	**15.49**	**5.60**	2.76	**0.59**

New Table 1. Comparison of indexes of the five methods.

Methods	PSNR		SSIM		SSEQ		NIQE	
	AVG	SD	AVG	SD	AVG	SD	AVG	SD
B1	18.67	3.61	0.88	0.05	18.20	6.36	**2.61**	0.60
B2	18.48	3.25	0.79	0.09	18.01	6.30	3.39	0.81
B3	19.54	2.39	0.71	0.09	16.25	5.87	4.14	0.81
B4	13.75	4.10	0.51	0.24	24.65	15.10	4.09	1.72
GIC	**22.07**	**3.02**	**0.90**	**0.05**	**15.49**	**5.60**	2.76	**0.59**

Method B1 does not perform image enhancement, method B2 uses histogram equalization processing, method B3 denotes Contrast Limited Adaptive Histogram Equalization (CLAHE) processing, and method B4 adapts Retinex processing. Except for the different image enhancement methods, the other processes of these methods are the same as the GIC algorithm.

From both qualitative and quantitative perspectives, the shading partition enhancement mechanism has better dehazing effect and stability than other image enhancement methods, proving the effectiveness of this mechanism in image dehazing.

Point 10: It should mention the scope for further research as well as the implications/application of the study.

Response 10: This GIC method is proposed to deal with out-door images, especially those with blue sky or other consistent background. It can remove the fog effectively, thus improving the quality of

images. In this case, downstream tasks including object detection and image classification can be accomplished with improved accuracy.

Point 11: I recommend including the limitations regarding the consideration of damage indicated in this review in the limitations assessment. This part of the document can be improved and completed with more rigour.

Response 11:

About the limitation assessment, we carefully compare established image dehazing and try to find potential improvement based on dehazing mechanism. In Paragraph 4 of Abstract, the description has been modified as follows:

Page 2, Line 65

Among the above methods, although the fusion-based method guarantees the gradient information of multi-scale input, its image restoration strength is insufficient to some degree. The deep learning based dehazing methods usually need considerable well-labeled samples, indicating high cost in data collection and curation. Based on the atmospheric scattering model, we analyze the shortcomings of the DCP method and the fog imaging principle. It is hypothesized that the brightness and color of a pixel of the input image will be affected by the surrounding pixels in a limited range. In order to eliminate negative interference from the neighborhood of pixel, this paper proposes the GIC algorithm to compute real prior information.