HYBRIDIZATION OF OPTIMIZED FILTRATION GF-GBCOA METHOD FOR IMAGE DEFOGGING

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Abstract: Over the last few decades, image defogging is addressed because of the extreme changes in the features of various environments. Various factors make the image-defogging process such as uneven airlift, contrast, and darkness in hazy pictures. Different estimation and learning-based methods are used to defog the pictures to overcome the issues of the halo artifacts. However, the proposed method reserved suitable boundary and illumination to retain the actual color of the picture. In addition, Image defogging plays an essential role in different computer visualization applications like as object detection, surveillance scheme, and authentication scheme. Analyze the various paper in the image defogging system found a major issues such as (i) Noisy or foggy images, (ii) Low level contrast and (iii) high accident rate. The research system is based on the development of digital image processing methods using digital road scenes, building etc. of different image filtration phases of the images. The defogging procedure is mainly consists of different key-points such as; (i) Gray Scale Conversion (ii) Color Model (iii) White Balance and (iv) Image contrast. Firstly, the uploaded images, converts into the grayscale image and, reduce the dimensionality of the image. Color Model describing the way colors signified as tuples of numbers, normally as three and four color component images. White Balance is a procedure of eliminating un-realistic colorcasts. It is adjusting colors so that the image looks more real and natural. Image contrast is represented in display and an image. It is the basic difference between min and max pixel intensity of an image. Applying the DCP approach, it is used to estimate atmospheric light for the main purpose of image defogging. This research work is developing a dark channel prior (DCP) based image defogging approach with enhanced transmission-map to escape blocking objects. After this, an approach has implemented a Guided filtration and Hybrid approach (GBCOA) method to improve the quality of an image, optimize the degrade quality image and improved the high average gradient factor. Hybrid approach has taken a final decision. The developed system accurately and efficiently determines the fog free image. Result analysis that the transmission map, atmospheric color and average gradient parameter for optimizing the defogging image. The image quality, color mapping, calculated from desktop application was compared with the existing method readings; the running time second was less than 0.46 seconds.

Keywords: *Image Defogging, Hazy images, Guided Filter, GBCOA (Guided filtration and Hybrid approach), DCP(dark channel prior).*

I. INTRODUCTION

Generally, the quality of the pictures is degraded in different atmospheric situations like as fog and haze because of the effect the particles on weather [1]. The particles in the light cause the attenuation of the scattered light from the scene. The brighter atmosphere brightness combined with the light acquired by the digital camera and, alters the contrast and color of the picture [2]. The given figure 1demonstrate the comparison among the haze free and haze picture. The reflected light on (a) decreased the picture contrast due to haze that results in a cloudy appearance of the picture as compared to (b) picture. Hence, it is essential for the computerized visualization to enhance the visualized influenced by the picture and its features.

(a) (b)
Fig 1. (a) Defog Image (b) Image Fog Free [2]

Normally, the picture de-hazing method is called as haze elimination and defogging is decreasing the interference because of the haze. Image dehazing eliminates the undesired visualized effects and it is measured as the picture enhancement method. Moreover, it is different from the tradition noise elimination and contrast improvement, when the degradation to picture pixels induced by the availability of the haze dependent on the distance among data object and acquisition sensors and density of fog. The influence of fog on picture pixels also overwhelms the dynamic assortment of the colors. The establishment of the image defogging techniques has been valuable to the real life applications comprising video assisted transference, outside video surveillance, remote sensing and drive assists services.

Defogging techniques are used in the variety of the applications and it is not dependent and non-dependent of the fog. It is essential of the image acquired in available situation that may be controlled by defogging method. The main approach is a fog detection method that considered the unnoticeable region in the image as foggy area. The other is classification procedure [3,4].Some of the challenges of image defogging are described as:

- Computerized vision scheme requires automated approach.
- Haze removal complex methods.
- The different image scenes are diverse atmospheric situations.
- Ambiguity among picture color and depth of defogging.
- Homogeneous atmosphere during image defogging [5].

Some of the applications of the image defogging are described as [6];

- Object Detection And Tracking
- Video Surveillance.
- Identify Target
- Recognition of the Traffic Signals.
- Remote Sensing
- Driver Assisted Schemes.
- Video Assist Transportation.

Guided Filter is the new edge reservation and smoothen filtering presentation. Hence, when the actual picture is complicated and noisy, the improved picture worked as noise enhancement. The outcome is localized linear conversion of the guided picture. The guided filter achieves the smooth restraint on the illumination element. The output of the last defogged picture reserves the noise of the actual picture and improves the expected error of the illumination element. The guided filter measured the smoothening restraints of the illumination element and the replicated combined picture [7].

The proposed method is based on the combination of two methods such as Genetic and Bee colony. These are optimization methods to improve the image quality with fitness values. Both descriptions are explained as below:

A. Genetic Algorithm

The main approach of the genetic algorithm (GE) is the decreasing of the normal selection and persistence of the fittest value.

In the genetic algorithm, the output value is demonstrated as the chromosomes[8] that are computed for the fitness value and which are ranked from the best to the worst value that is dependent on the fit value. The procedure for the creation of the novel output in GA is simulating the standard selection of the active creatures. This procedure is proficient by recurring services of the three genetic operators that are;

- Selection
- Crossover, and
- Mutation.

The suitable chromosomes selected to grow into parents to create the new offspring or chromosomes [9]. The chromosomes are the fittest, which are selected with the maximum possibility comparable to chromosome with the minor fitness. The selected possibilities are mainly described using the related ranks of the fitness values. The cross over operator is combined to the chromosomes of the parents of the parent offspring's are selected to generate the new chromosome.

B. Bee Colony Optimization Method

Bee algorithm is utilized for searching the best probable outputs for the optimization issue. This algorithm used artificial bee that imitates foraging behavior of the bees. Every candidate output worked as the food-source (flower)[10], population (colony) of n.m agent as bees that is utilised as search and output area. The fitness is computed at every interval. This algorithm is two stages; initialization process and main finding circle.

Every search cycle comprises five processes:

- Recruitment
- Local-search
- Lessening the neighbourhood
- Leaving the site, and
- Global finding.

Bee Colony optimization is called as bottom up model with diverse types of the species. It is based on the swarm intelligence model. The bees worked as the social insects that is mainly combined and arranged in the family groups. BCO [11] is a Meta heuristic approach that used to swarm behavior of the bee interrelates locally along with other surroundings that simulate the foraging behavior of honey bee and linked global exploring finding [12]. BCO hunts synchronously the promised areas of the output area and samples for desirable areas. This algorithm used the bottom up model and swarm intelligence of honeybees.

The article sections are organized as: Sect 2 represent the survey of the different methods used in image defogging. Sect 3 discussed the existing challenges and research gaps. Sect 4 described the research methodology of the proposed work and sect 5 discussed the conclusion and future scope of the research work.

II. PRIOR WORK

The main goal of the research is to present the investigator with the detailed analysis of the novel research. It inspired the subjects by identifying the data and helping the investigators to define specific investigation. In the below section, the various papers have been surveyed with methods, used techniques, parameters and advantages and

issues. **Zhang, W et al., 2019 [13]** proposed research on the foggy atmosphere, a single picture defogging technique depends on the multiple scale retina along with the color restoring of the multiple channel convolution. The complete defogging procedure comprises four keys: approximation of the illumination elements, guided filter process, rebuilding of the fog free pictures and white balanced process. Initially, the multiple scale Gaussian size was engaged for the extraction of the features to expect the illumination element. Then, the MSRCR technique was applied to improve the globalized contrast, complete data and color renovation of the picture. In addition, the smoothing restraints of the illumination element and replicated element was measured mutually utilising guided filter (GF) two times, and improved picture fulfils the smoothing restraint and noise in improved picture was decreased. After that, the improved picture by MSRCR and the picture proceeded by other guided filter were fused through linear mass to rebuild the last fog-free picture. In the final procedure, the removal of the effect on the color of the de-fogged picture, the last de-fogged picture was considered through white balanced approach. Simulation outcome demonstrated that the planned technique performed better as compared to previous models. **Choi, K. Y et al., 2017 [14]** implemented a fog recognition approach for considering the de-fogging technique in the availability of the fog. In this research, they defined the features for the detection in the absence of the trained procedure for pictures through a monocular digital camera in road atmosphere and process detection approach depends on the features. Moreover, the planned technique aligns the fog elimination power in accordance to fog level and technique to accurate the reduced illumination rate because of the fog removal. Normally, the fog picture comprises the light gray color because of the scattered rays. Hence, the foggy related to minimum saturation (S) and high value (v) in the HS colored domain. In addition, the fog was identified by computing the proportion rate (S) and (V) and compared the proportionality with the already defined threshold. Experimental outcome showed that the planned fog recognition technique to enhance the quality of picture. The achieved detection was acquired up to 97.5%. **Anwar, M. I et al., 2017 [15]** developed an efficient approach for the unique picture fog elimination that was desirable of handling the pictures of gray (G) and color (C) channels. The planned model includes Dark channel prior monitored by weighted least squares and high dynamic range depends on the fog elimination model. The observation was applied for the assessment of the defogged picture acquired from the planned model and compared to the diverse fog elimination to enhance the performance. The major uses of the planned approach were able to reserve the deep data in the maintenance of the color excellence. The proposed approach used HDR transformation of the picture previously reserving the information through WLS filter and represented the output picture. Various types of the scene below fog situation were tested, and rates of gamma related factor along with co-efficient were selected for more effective planned model. Moreover, the color quality for the RGB picture and picture conversion modules produced the desirable outcomes. **Liu, W. et al., 2019 [16]** presented a new method for fog extraction scheme dependent on the current enhancements in advanced general network. They had built up a start to finish learning framework that utilizes unpaired fog and fog-free preparing pictures, ill-disposed discriminators and cycle consistency misfortunes to consequently develop a defogging framework. Like Cycle GAN, the framework has to change ways, which maps foggy pictures to a fog-free picture area and different map's fog-free pictures to a fog picture domain. In the mist to fog-free change way, foggy pictures were mapped to an initial fog-free area. Additionally, in the fog-free to fog change way, fog-free pictures were changed to a haze picture space first and the outcomes were then passed onto a subsequent change system to the haze picture area. In building the fog-free to haze area change, they expressly insert the surrounding degradation model (1) in the learning procedure. Besides, a sky earlier was acquainted with decrease ancient rarities. They present exploratory outcomes on manufactured foggy and common foggy picture data sets to show the viability of the new defogging system. **Patel, A. et al., 2017 [17]** presented a demonstration of the different picture and video defogging techniques and the detailed study of the picture restoration and improvement methods. Generally, the single picture de-fogging methods were essential between the investigators. Hence, the video de-fogging methods had influenced the viewpoint of the investigators in current study. In the proposed research, they constructed the picture and moving object-defogging methods. **Wang, S et al., 2018 [18]** studied on new regular technique of the image, de-fogging dependent on the hardy region conversion. The planned model utilized the numerical approach for the dissemination of using the converted pseudo code differential operator that acquires more standard featured and defined the image defogging. The compelling examination, calculation was liked. Broad quantitative and subjective assessments had been exhibited that algorithm improved successfully the defogging of genuine and reproduced images. When compared to the past defogging methods, the fundamental commitment of this research contains the accompanying viewpoints: (i) According to an absence of edge data in the foggy picture, proposed calculation can give a lot of edges and surfaces through demonstrating pseudo differential bit on the tough space to acquire copious priori imperatives. (ii) By exploiting portrayal of comparability between Solid space H and Lévesque space L, They made H spaces connecting with the Strong Littlewoods maximal manager to depict the supreme of H space just as to explain good guess of the misfortune work which brought about by the past calculation. The system can re-establish a foggy picture, which showed more outwardly conceivable outcomes. An exploratory outcomes exhibit that compound regularization strategy was not just ready to limit the clamour and obscuring impact, yet in addition ready to uncover

significant picture highlights, for example, edges and surfaces. **Hu, H. M. et al., 2019 [19]** developed an illumination decay dependent defogging technique to enhance the fog pictures in visualized maritime surveillance. The single image defogging technique for visualized maritime surveillance was provided. Initially, a thorough dissipating model was proposed to figure a fogy- picture in the shine formed ecological enlightenment. At that point, a light decay approach was proposed to dispense with the shine impact on the airlift brilliance and recuperate a haze (fog) layer, in which objects at the boundless separation have uniform luminance. Furthermore, a communication - map estimation depends on the non-nearby lines were used to oblige the transmission map into a sensitivity range for the info haze picture. Finally, the proposed light remuneration approach empowers the defogging picture to protect the common enlightenment data of the information picture. Likewise, a haze picture dataset was set up for visual oceanic (maritime) observation. The simulation results dependent on the built up database show that the proposed technique can beat the cutting edge strategies as far as both the abstract and target assessment criteria. Besides, the proposed strategy can viably expel fog and manage foggy pictures.

III. EXISTING PROBLEMS AND CHALLENGES

The images captured using the camera in poor weather conditions such as fog or haze is degraded in terms of low contrast and faded colors. The solution to this problem is to develop an algorithm for removing fog from these images. The existing methods focus on the overall contrast enhancement of images and even removal of the fog without quality contrast enhancement. The MSR [20] technique is linear weigh fusion of the multiple SSR along the diverse scale that may improve the color picture and there exists the issue of the color degradation. MSRCR considered the color recovery factor depends on MSR that may improve the picture with improved color assurance, but color of the picture get diverge from the actual color and complete picture change in to white color. MSR technique is used to eliminate the fog in dense situations for numerous data objects. Hence, the defogged picture is fog free image where MSR improved with the related contrast and not the scene. It operates the retina to acquire the illumination element and it used the gamma improvement to stable the picture brightness. Hence, the attenuation illumination was not measured for picture after defogging displayed in local distortion and blurred data.

The available and upcoming techniques of deep learning methods (Gene-Bee-Colony) can assist the medical practitioners in deciding whether an evident anomaly in a Roadside Image, Sea Images and Cloudy Images is a defog or not. This work addresses the problem of single image defogging based on multi-channel CNN method and tries to find a novel yet efficient solution for it. There are some existing approaches that were proposed for image quality and enhancement of roadside image defogging but these approaches are not fully accurate. Table I gives the information about the previous work issues.

Table I: RESEARCH GAPS

Author Names	Research Gaps
Weidong Zhang Lili Dong [13]	Image Degradation in foggy weather
Yong Xu, Jie Wen[21]	Less visible situations like as fog atmosphere, it is not easy to search the runway and hazard from visualized network of the flight.
Zahid Tufail [22]	It compute the surrounding light up to 1.55 bright pixel of dark channel and planned an interactive technique to prevent maximum color saturation issue.
Liu, W. et al [23]	Outdoor environments can be affected by poor weather conditions such as fog, dust, and atmospheric scattering of other particles

IV. PROPOSED METHODOLOGY

This proposed work is to enhanced single image defog images. In this research work, firstly RGB component will be used to enhance a defogging image and transmission or DCP is dependent on the dark pixels with minimum intensity in color channel. Multiple scale Gaussian kernels engaged for extracting the specific features to guess illumination element. Then, MSRCR technique applied to improve the globalized color, complete data and color restoration of picture. On other hand, smooth restraints of both illumination element and reflected element are measured collectively using guided filter ,thus improved picture fulfills the smooth effect and noise in improved picture get decreased. Then, the improved picture by MSRCR and picture get processed by other guided filter are fused by linear weigh to rebuild final fog free picture. At the end Hybrid (GBCOA) optimization is used to enhance image.

The main features of this proposed work:

1. To improve the quality of picture by developing filtering methods.
2. With multi-scale Gaussian kernels are employed to extract precise features to estimate the illumination component..
3. To enhance the global contrast (colour), feature data, and colour restoration of the picture.
4. To propose a new hybrid (G-BCOA) optimization algorithm of the optimization process.
5. To compare and analyze the proposed system with existing methods.

The detailed methodology of the work is as given in figure 2. This proposed work is divided into the following steps:

1. **Initialization:** To collect the dataset in the sea, oceans, roadside scenes, buildings and forest images from the online site repository. Upload the dataset images for the image acquisition. Uploaded images are in color or 3D images and convert the uploaded color image into grayscale image. The LAB color region method is third axis color scheme with size L demonstration for weightlessness and A and B for color size. The operation with LAB color space model includes all the colors in the area. It is extract means of representing color is equipment independently.

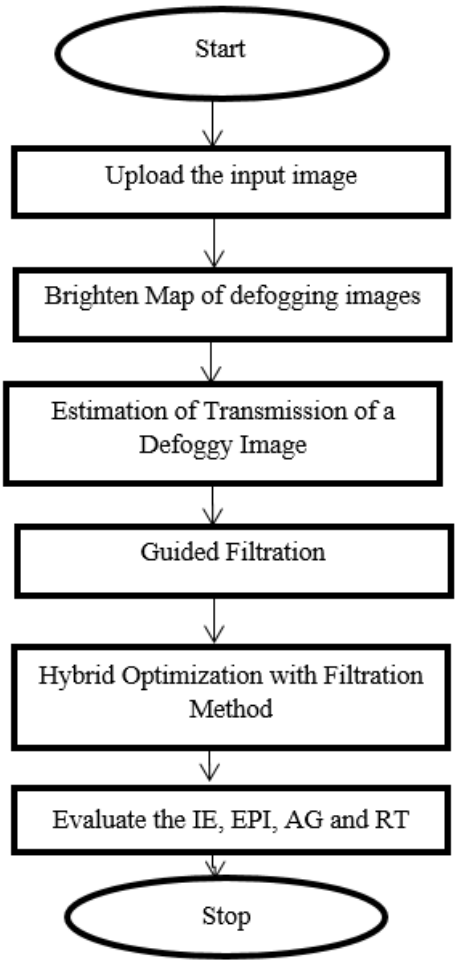


Fig 2. Proposed Flow Work

2. Histogram based White Balancing and Contrast Enhancement:

Generally, an image enhancement plays an essential role in the digital image processing services and the most popular approach is the white balance. The key model in histogram is dependent on the white balance include color constancy and related development factors. Generally, the color reliability in conventional approach focused on the lean network where white balance focused on low-level model. Moreover, a white-balance image enhancement process is linear model that provides a good quality image but failed to provide actual component as output picture. The difference between the contrast enhancement and, white balance displays with linear conversions. In addition, the contrast and brightness are two factors for realistic visual two-dimensional signal to human visual network as picture.

3. DCP and Guided Filtration in Foggy Images: RGB element differentiated in three colors as red, green, and blue picture. Gaussian-based dark channel is planned in actual picture for identifying the RGB color element in every pixel of the actual picture. Conventionally, atmospheric light measured as the bright pixel in the input picture, estimating that there is absence of saturated pixel. Moreover, the estimation is invalid in realistic situations. Accordance to the proposed approach, the distinctive light can accurately achieved by selecting the portion of brightness pixel in dark channel of normalized input. In single image model, the distinctive light is expected from major haze pixels. Guide filtering is neighborhood procedure such as other filter operations taking statistical area in related spatial neighbor with guided picture after computing the value of output pixel. If the guidance is similar as filtered picture, the infrastructure is similar with boundary in actual picture in guided picture. In case the guided picture is dissimilar, infrastructure in guided picture must influence the filtered picture, focusing designs on actual picture. It is known as structure conversion.

4. Hybridization Filtration Optimization Method:

This proposed approach is used to remove the distortion in the GF picture. It is used to optimized the image with the help of the filtration process and fitness function. This approach has improved the image quality, and Average gradient. The proposed system calculates the performance metrics such as AG, EPI, RT, MSE, and IE compared with the existing methods.

IV. RESULT AND DISCUSSIONS

In this section includes the complete survey of the dataset that includes the number of images working to calculate the system method for improving the performance of the visible and contrast restoration model. In addition, the mathematical concept for the used metrics is also explained.

A. Data set Description

- **Data Set 1: RIDA and FRIDA2**

RIDA and FRIDA2 are the data set of numerous pictures that are working to compute the systematic model to improve the performance of the visibility and contrast restoration (CR) models. RIDA contains the ninety (90) synthetic pictures of eighteen (18) urban road scenes. The viewpoint is nearest to the single driver of the vehicle. For every image without the fog is connected to 4 foggy pictures and a depth map (DM). Various types of the fog are additional to every four connected pictures: consistent fog, mixed fog, clouds and cloudy heterogeneous fog. The scenes are used for testing the visible and contrast restoration methods intensively and selectively shape of fog

models. The parameters of the digital camera are described. The picture dataset FRIDA or FRIDA2 downloaded as a specific archive file and it is used for the investigation purpose.

- **Dataset 2: I-HAZE**

Image defogging has become essential calculation image subject in current years. However, because of the loss of the ground truth pictures, the defogging methods are neither directed nor selective. An I-HAZE is introduced to remove the issue, and novel dataset contains 35 picture pairs of foggy and related fog free indoor pictures. However, the current defogging dataset is diverse where foggy pictures have created using actual fog generated at specific fog machine. To simplify the color calibration and enhance the evaluation of the defogging methods, every scene contains Macbeth Color supervisor. In addition, through the pictures captured in regulating the environment, both the fog free and foggy pictures are captured below similar illumination situations. It demonstrates an essential use of the I-HAZE database that permits the selective compared to current picture defogging methods using conventional picture quality metrics like as PSNR and SSIM.

(a) Foggy Images

(b) Ground Truth Images

Fig 3. De-foggy Image Dataset[24]

B. Mathematical Performance

The mathematical expressions are defined in below:

- ***Average Gradient***

It is the measurement of the gradient magnitude of the picture and it takes the variation of every adjacent pixel into an account. Average Gradient is adjusted by:

Average Gradient = $\frac{1}{(H-1)(w-1)}\sum_Y \sum_Z \frac{G(Y,Z)}{\sqrt{2}}$ …….. (i)

In equation (i), H and W is the dimension of the picture and G is the gradient vector of the picture.

- ***Data Entropy***

The data entropy is called as the Shannon entropy. It is given as;

S = - $\sum_j P_j \log P_j$ ……(ii)

It includes the computing of the entropy where, it is taken by possible distribution. It includes the P x log p for the probable outcomes as the distributed data.

- ***Edge Preservation Index***

It is the ability of the deepness of the edge of the picture; it demonstrated the capability of improved picture to manage the vertical or vertical boundaries of the actual picture. However, the maximum rate of EPI is suitable for edge preservation quality. It is given as;

EPI = $\frac{\sum_{j=1}^{n}(F_1 - F_2)Filter}{\sum_{j=1}^{n}(F_1 - F_2)actual}$ ……. (iii)

In equation (iii), the amount of the pixel in the picture where F1 and F2 is given by the grayscale rate of left and right to adjacent values.

- ***Running Time***

It is the amount of time, which produced the real time running data. In addition, the difference of the construction time and end time and, it is given by;

Running Time= Construction time – End Time …….. (iv)

- ***Mean Square Error Rate (MSE)***

It is the measurement of the quality of the estimation data It is essentially the non-negative data and value of nearest to zero value.

MSE =$\frac{1}{n}\sum_{k=1}^{n}(y_j - y_j')^2$ ……. (v)

In equation (v), MSE is the mean value of the $\frac{1}{n}\sum_{k=1}^{n}1$ Square of the errors.

C. Result Analysis

In this section, described about the proposed result screenshots, performance metrics, Comparison graphs and tables.

Fig 4. Uploaded input Image and Resized Image

The above fig 4 shows, Initialization process to upload the input image, resize image and applying brightness mapping and, developed the DCP method using transmission and estimation in the foggy image. Proposed the guide filter in the color space, image, extract the pixels, and improve the image quality.

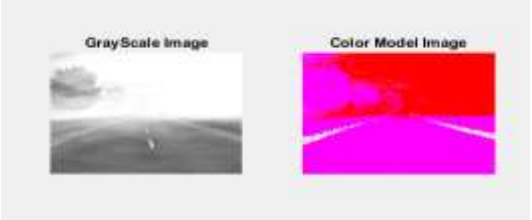
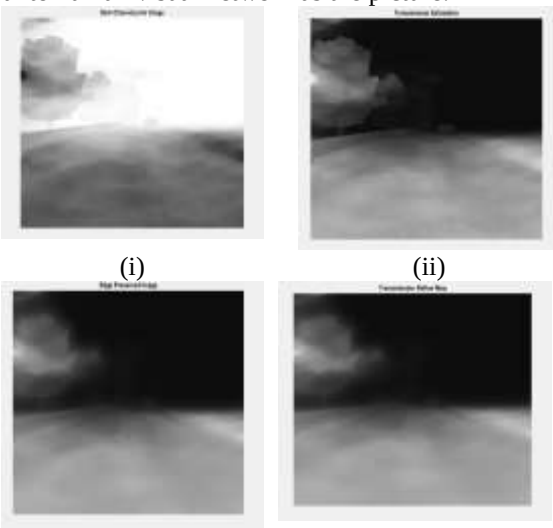


Fig 5. Grayscale and Color Model Conversion

Fig 5 defined to convert the color image to a grayscale image. This conversion process is used to reduce the dimensionality of the image and find the noisy data in the converted image. After that, we applied the LAB color space is an operational with LAB color space model includes all the colors in the area. It is extracting mean of representing color in equipment independently.

Fig 6. White Balance and Enhance Contrast Image

Above fig 6 shows the white balance, image and the enhancement contrast image. The linear model leads better quality picture but failed to receive component as output picture. The linear conversion is the key approach in white balance procedure. In latest model, the variance among the contrast enhancement and white balance are display dependent on the linear conversion. Contrast and brightness are two main approaches for real visual two-dimensional signal to human visual network as the picture.



(i) (ii)

(iii) (iv)

Fig 7 (i) Dark Channel Prior Image (ii) Transmission Estimated Image (iii) Edge Preservation Image, and (iv) Transmission Refine Map

Figure 7(i), (ii), (iii), and (iv) show the DCP (Dark Channel Prior) method are different inputs. The Gaussian based dark channel presented in required actual picture for identification of the RGB color element actual picture. The Gaussian based dark channel planned in actual picture for identification of the RGB color component in every pixel of the actual picture. Conventionally, the distinctive light measured as a bright pixel in input picture, estimating the unavailability of saturated pixels. Hence, the estimation is invalid in real applications. In accordance to DCP model, the surrounding light may accurately achieve the detail assortment of the brightest pixel in the normalized dark channel.

Fig 8. Guided Filter Image

Fig 8 shows the filtered image and developed the GF to refine the transmission such that the completion time complexity of the defogging method gets O(n). It is the kind of the edge preservation smoothening operator and filters the input picture with the guidance of another picture.

Fig 9. Hybrid Filtered Image

Fig 9 shows the final filtration image using hybrid optimization method. The proposed model may efficiently eliminate the fog from different kind of the fog pictures and acquire complete data of defogged pictures. In addition, the suitable results are acquired for building images.

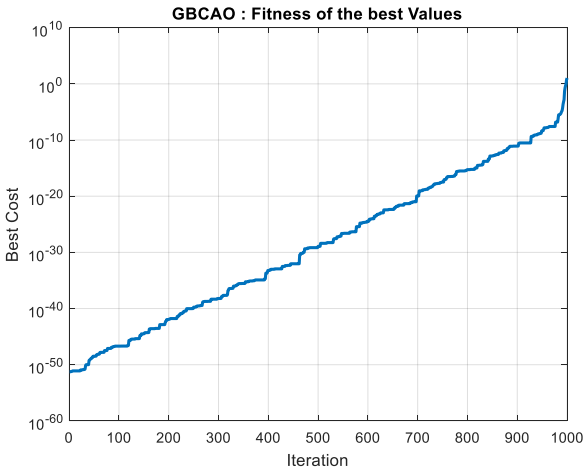


Fig 10. . Hybrid Optimization Best Function

Fig 10 shows the hybrid optimization method best function of the hybrid image. Fitness value is the specific selective function that is used to sum up unique figure of merit and design output is achieved for required result. Fitness value is used in hybrid approach for guiding the simulation towards optimum design outputs.

Table II shows the evaluation of the proposed system performance metrics shown in different number of images.

Table II. PERFORMANCE PARAMETERS

Images	AG	IE	EPI	RT	MSE
	102 %	2.0%	1.9%	1.3%	1.2%
	106 %	2.2 %	1.98 %	1.4%	1.23 %
	108 %	2.23%	2.30 %	1.66 seconds	1.50 %
	109 %	2.20%	2.11 %	1.54 seconds	1.45 %
	106 %	2.120 %	2.01 %	1.44 seconds	1.35 %
	107 %	2.020 %	2.00 %	1.21 seconds	1.11 %
	102 %	1.820 %	1.90 %	1.25 seconds	1.15 %

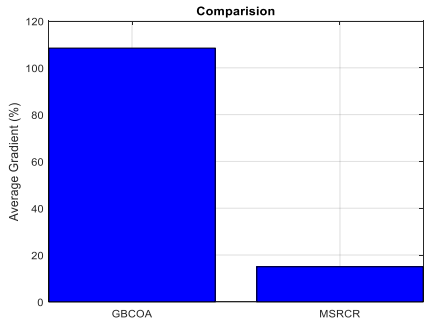


Fig 11. Comparison – Average Gradient

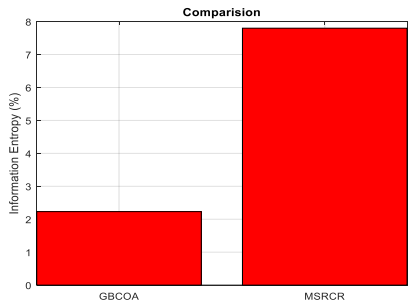


Fig 12. Comparison – Information Entropy

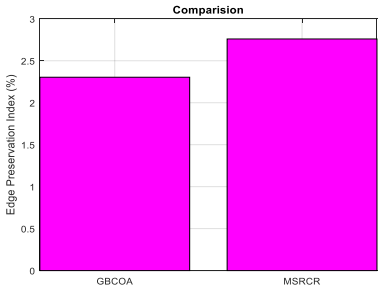


Fig 13. Comparison – Edge Preservation Index

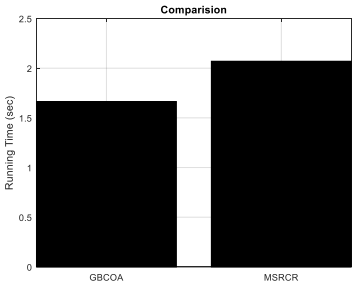


Fig 14. Comparison – Running Time

Fig 11 up to 14 shows the comparison between proposed system and existing methods using different parameters such as (i) Average Gradient (AG) (ii) Information Entropy (IE) (iii) Edge Preservation Index(EPI) (iv) Running Time(RT) and (v) MSE. The proposed performance parameters have enhanced the existing metrics.

TABLE III. PROPOSED PARAMETERS VALUES

Parameters	Values
Average Gradient	108.4 %
Information Entropy	2.23%
Edge Preservation Index	2.30%
Running Time	1.66 seconds
MSE	1.50 %

Table IV. EXISTING PARAMETERS

Parameters	Values
Average Gradient	14.9%
Information Entropy	2.76%
Edge Preservation Index	7.8 %
Running Time	2.07 seconds

Table III shows the proposed system AG value is 108 per cent, IE value 2.2, EPI value is 2.3, RT value is 1.6 seconds and MSE value 1.5. Table IV shows the existing system performance value is AG value 14.9, EPI value 2.76, IE value is 7.8 and Running Time value is 2.07 Seconds.

V. CONCLUSION AND FUTURE SCOPE

In proposed work, developed a digital image defogging method in the digital road scene, construct the buildings, and to identify various image filtration stages of pictures. The defogging process mainly contains various key factors like as grayscale conversion, color model, white balance, and image contrast. Initially, the uploaded pictures

are converted into the grayscale picture and decrease the dimension of the picture. Then, the color model explains the method colors identified as the tuples of the numbers, normally three or four color element pictures. White balance is the process of removing the non-realistic colorcasts. It is the method to adjust the colors so that the picture seems more natural and authentic. Image contrast is the demonstration in displaying an image that shows the main differentiation among the minimum and maximum pixel intensity of the picture. DCP method is applied for estimating the distinctive light for the main reason of image defogging. The proposed work is implementing a dark channel prior based image defogging with an improved broadcast mapping to break out jamming objects. After that, an image quality is improved using guided filtration and hybrid method (GBCOA) and also, degraded image quality is optimized. In addition, a hybrid model developed inaccurate way to identify the fog free picture. Experimental analysis has been done to determine the transmission map, atmospheric color, and average gradient metrics for optimization of the defogging picture. Along with that, the image quality, color mapping computed from desktop application is compared to existing method where the reading, running time second was minimum than 0.46 second. Graphical User Interface is considered using Graphical User Interface Design Environment layout editor or script. The interface gives tools for designing UI of the proposed software system. The proposed system accuracy and efficiency of the results also depend upon the quality of defogged image processed. The Image quality has enhanced by using best data sets with high resolution images.

In the future scope, some algorithms based on gradient can be implemented where the heterogeneous network is taken into deliberation and scattering coefficient can be estimated to recover the superiority of the picture. The further method can efficiently verify the target from the scene far-away from the point of view; it can find the precise position of the image object, improve the boundary, recover the picture information, and lastly get the suitable defogging consequence.

VI. REFERENCES

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