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Analysis of Image Quality Enhancement by dissimilarity reconditioning under haze Conditions for Driving Reinforcement

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ABSTRACT

Image is the most regular and suitable means of assigning or transmitting information. Under haze weather conditions, the images captured have degraded contrast. Several natural phenomena like haze, haze, mist, rain, etc. decrease the superiority of the pictures and become less visibility. These factors make the present image processing techniques error and sensitive susceptible. In this paper, we suggest an efficient learning based picture enhancement that eliminate or nullify the haze that exists in the captured images. Here the haze is eliminated by using the image enhancement algorithm where the intensity of the haze is calculated in regarding with the atmospheric veil. By applying contrast restoration technique in either horizontally separated rows or vertically separated columns the haze is eliminated from the image. We can use median filters in order to remove the haze that exists. This approach is very much useful in the case of providing driving assistance as the haze weather conditions make the control and operation of a motor vehicle a bit complex and dangerous.

Key Words: Haze, Weather Conditions, picture Analysis, picture Processing, picture Enhancement

1. INTRODUCTION

All phenomenon's that are not artificial like, haze, mist, rain, etc. has the property to reduce the quality of the picture by degrading the difference and diminish the visibility. Under this weather criterion, the visibility space is falling off since the consumption and scatter of light by the atmospheric particles. The images of the outdoor scenarios, captured under haze conditions, are drastically degraded. These weather phenomena are critical and very dangerous under driving situations, since the drivers tend to misjudge the visibility remoteness although roaming under haze weather circumstances.

Haze has the negative effects on the value of the picture like defeat of difference and the change in the usual insignia of the captured picture. Haze is one of the majority hazardous climate conditions for driving since the visibility detachment decrease due to the presence of haze. Another effect called atmosphere light or full of atmosphere veil exists in this case [1]. This is due to the spreading outcome of light that causes additional weightlessness in the image parts. These impediments have to be overcome in order to provide a quality image. In order to overcome these effects and provide a quality image, we try to identify the incidence of the haze and eliminate its effect by performing the contrast restoration process and thus improving the quality of the unique haze picture.

Several general researches have been accepted out by various scientists with different techniques in the field of haze identification and visibility computation in haze weather conditions [1]. Here in our paper, we develop a difference reinstatement move towards with the help of Koschmieder's rule and we also plan to propose numerical form for estimating the full of atmosphere veil or air-light in the original haze images. This technique can be used in broad collection of applications and can also be practical for actual occasion applications.

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2. DIFFERENCE REINSTATEMENT

Difference usually refers to the dissimilarity in luminance or the gray level values in an icon and it is a significant quality of a figure. Contrast can be defined as the ratio of the maximum strength to the minimum strength over a figure.

Image restoration is the process of modifying a pragmatic figure in order to compensate for the defect in the imaging system that produced the experiential image [2].

In this paper, we perform contrast restoration process where the degraded contrast of the image due to the presence of haze is modified and restored for providing a better quality image which is a haze-free image.

3. KOSCHMIEDER'S LAW

Koschmieder calculated the luminance reduction through the ambience and designed a association among the attenuation of the luminance item C at a distance d and the luminance C_0. This equation can be expressed as,

$$C = C_0.e^{-kd} + C_\infty.\left(1 - e^{-kd}\right) \tag{1}$$

Where $k = \frac{2\pi}{\lambda}$

With the help of the Koschmieder's mathematical expressions, the power apparent in the figure can be obtained as,

$$I = f\left(S\right) + f\left(B\right) = \mathrm{Re}^{-kd} + B_\infty\left(1 - \mathrm{e}^{-kd}\right) \tag{2}$$

Here,

$P \rightarrow$ Image-pixel intensity

$B \rightarrow$ Brighteness-sky in haze conditions

4. IMAGE DEVELOPMENT ALGORITHM METHOD

4.1. Algorithm Overview

In order to compute the depth of the haze in the image we introduce a factor called atmospheric veil or air-light notion (L). It can be represented as,

$$L = B_\infty\left(1 - e^{-kd}\right) \tag{3}$$

This veil denotes the added haze in the image. Here in arrange to compute the unique haze free image we need to approximation the atmospheric veil and then it has to be used in computation.

From the atmospheric veil equation the input image representation can be given by,

$$I = P\left(1 - \frac{L}{B_\infty}\right) + L \tag{4}$$

Now the original haze gratis demonstration of the input image can be given as,

$$P = \frac{I - L}{1 - \frac{L}{B_\infty}} \tag{5}$$

Thus with the help of this equations the haze gratis illustration of the unique input picture can be obtained.

4.2. Atmospheric Veil Estimation

The enhancement method proposed here can be applied for equally ancient range and color pictures. For computing the atmospheric veil for colored images, we use a contribution image *X* with the gray level values that consists least of each color channel (*R*, *G*, *B*). Thus this provides the veil that has to be subtracted from every color channel.

$$X = \begin{cases} \text{Minimum of } (R, G, B) \text{ for color Pictures} \\ \text{I; for monochrome Pictures} \end{cases}$$

Inferring the atmospheric veil it is essential to examine the properties of the veil that are,

For inferring the atmospheric veil it is essential to examine the properties of the veil that are, The veil (*L*) must be greater than or equal to zero and it must be lesser than *X* .$0 \le L \le X$, the veil (*L*) must be a smooth function in many cases. Here the veil must be smaller than the dissimilarity among the common and the standard deviation of the input image *X*.

$$L \le \text{common}(X) - sd(X) \tag{6}$$

In general, the local average filters are used. As it does not provide security the edges of the image we go for median filters. These filters not only preserve edges but also remove the noise from the original input picture. Thus the center filters with the changeable (*n*) can be applied on the input picture

$$X\,N = \text{Median}_n(X) \tag{7}$$

With all these constraint, we also consider that only fraction *p* will be used to compute the veil in every pixel and is also used to control the restoration process strength. From this for determining the veil in the atmosphere, the equation obtained as,

$$L = \max\left(\min\left(p\,|\,N - std\,|,\ X\right),\ 0\right) \tag{8}$$

Once the atmospheric veil is determined we can apply the determined value to the entire pixels for the original haze free representation of the input picture.

5. EXSISTING SYSTEM

Until now the existing system uses the above mentioned equations for determining the haze free original image. And it applies the contrast restoration technique for the whole image i.e. the restoration process is carried out globally on an image. Since it is applied globally the restoration process of the images are not very effective. One more factor is that the existing system applies the concept only for the still image by adding synthetic haze in the captured image.

6. PROPOSED SYSTEM

In our paper, we propose and develop a new mathematical equation for computing the original haze free images. In arrange to calculate the unique haze gratis images; the newly designed equation can be represented as,

$$P = \frac{I - L}{1 - \frac{L}{B_\infty}}$$

In the already existing technique, the original haze free image representation equation the probability function is used where the denominator represents $1-\frac{L}{B_\infty}$. Here the value will be lesser than one always. Whereas in the newly developed approach, the denominator is the difference with the original intensity value, this provides a clear representation of the original haze free image.

As mentioned prior, the already existing system applied this contrast restoration concept only to the still images with the synthetically added haze. In our approach, we apply this technique for the real time images that are actually captured under haze conditions. It can also be applied for continuously moving images that are subjected to haze presence in it.

The global processing of the images shows low quality and hence in our approach we process the images by segmenting it into either rows or columns and applying the restoration technique to the locally segmented rows and columns. Thus the local processing if the images either in the horizontal direction or in the vertical direction are carried out.

7. BLOCK DIAGRAM AND DESCRIPTION

Initially the input images are obtained from the input devices that are camera and then acquisition is carried out on the obtained images. In the image acquisition process the analog images are obtained by scanning the sensor output. Usually the sensor devices are CCD camera etc. Here the acquired images are made to process for manipulation or improvement and then it is separated based on the RGB color palettes. Then histogram processing techniques are made where density, mean and standard deviation of the haze images are detected. And with these processes a database comparison is made with the acquired image and the histogram processed image.

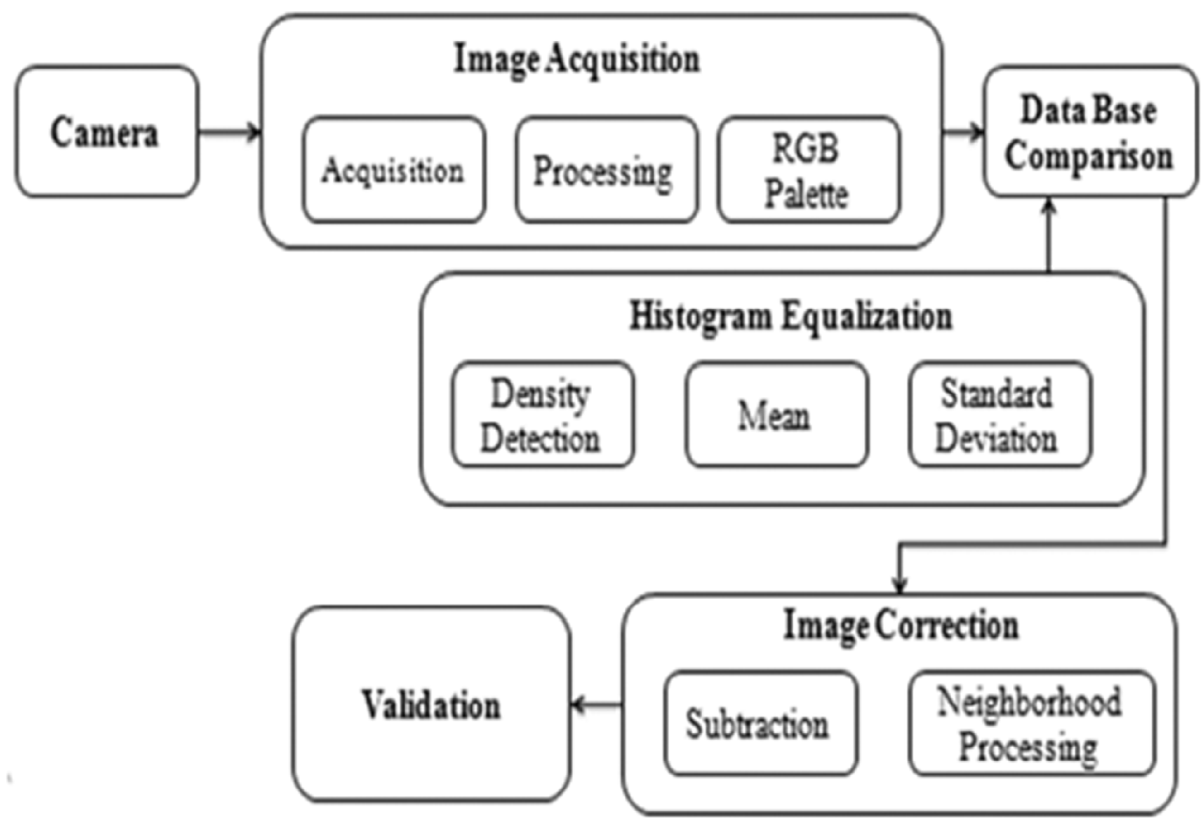

Figure 1: Block Diagram

Then the image correction step is carried out in order to avoid any incorrectiveness in the image and here subtraction and neighborhood processing techniques are carried out. In the subtraction process the objects are subtracted from the original image background where the haze density is more and in the neighborhood processing, the edges of the pixels are made to preserve. Finally the validated output image which is the original input image without any haze is obtained.

8. EXPERIMENTAL RESULTS

The experimental analyses are made with different techniques and equation and the various combinations outputs are studied. These simulation results are illustrated and represented as follows. Thus with the result analysis the appropriate output image without fog is obtained. This system can be implemented by supporting the LabVIEW software in the arduino systems and it is provided with the input devices like cameras and it can be supported with the vehicles. Thus the circuit monitors the traffic. If it detects any problems it immediately activate the alarm circuit and thus it provides assistance to the drivers under foggy weather conditions.

The image processing algorithm is taken in arrange to achieve the elimination of fog in the unique input picture. These algorithms are applied in the acquired images and are then processed for getting the fog-free images. Here the image processing algorithm is applied in the LabVIEW software tool. And then the output of the system is verified. It can be represented in the HMI (Human Machine Interface) system.

This HMI is derived in the front panel of the LabVIEW software. Here are some of the images that are taken from both the database as well as some of them from the real time images are processed by applying

Figure 2: Outputs of the Conventional Image processing Algorithm

the mentioned techniques and the simulation results are studied. By performing the LabVIEW program for conventional image processing algorithm the output can be obtained as shown below

8.1. Simulation of Row Separation Module

Here in the first process, the horizontal separation i.e. row separation module block is framed and the analysis is carried out. The output for this module can be obtained as follows and are verified with the existing equation.

In the row separation module, the captured input image is separated horizontally and processed. After processing of the image, the processed result is applied for the entire image module. By performing this analysis, we can get a cleared output image that reduces the fog from the original input image. And thus the output can be obtained in the row separation module.

8.2. Simulation of Column Separation Module

Here in this process, the vertical separation i.e. column separation module block is framed and the analysis is carried out. The output for this module can be obtained as follows and are verified with the existing equation.

In the column separation module, the captured input image is separated vertically and processed. After processing of the image, the processed result is applied for the entire image module. By performing this analysis, we can get a cleared output image that reduces the fog from the original input image. On comparing both processed standards, from the output analyses we get that the vertically processed images show more clarity than the horizontally processed images. This is because of the fact that the fog density is equal in the vertical distribution and it varies in the horizontal distribution. Thus the vertical separation process eliminates the fog more effectively compared to the horizontal separation processing.

8.3. LABVIEW OUTPUT FOR MODIFIED IMAGE PROCESSING ALGORITHM

The original equation is modified as listed above in order to obtain a clear fog-free output image. The output by performing this process can be listed as follows

By performing this analysis the fog elimination can be made more efficiently since it deals with the whole original image compared to the existing system in which the elimination technology uses a probability technique. Hence the modified equation is used for the elimination process which provides an efficient output which is a fog-free original image.

8.4. Output for the VI Program for Modified Image Processing Algorithm with Median Filter

The output for the modified image processing algorithm by using the median filter can be obtained as given below.

Figure 3: Output of the Row Separation Module

Figure 4: Output of the Column Separation Module

Figure 5: Output for the modified Image Processing Algorithm

Figure 6: Output for the modified Image Processing Algorithm by using the Median Filter

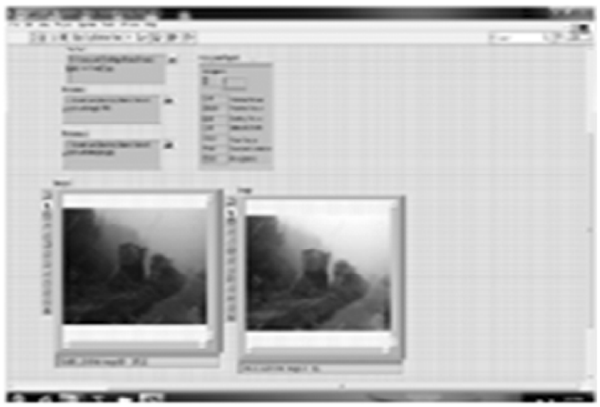

Figure 7: Output image of free-from haze

By using the median filter, the output images that are free from the fog can be obtained. This provides a complete output image without the fog that exists in the original image. Thereby the accidents that occur in the accident prone zones can be avoided. Thus by using the median filter, the fog can be eliminated from the original input images that are captured under the foggy weather conditions. For computing the atmospheric veil by using the median filter with modified equation gives the output image that are free-from haze can be obtained as shown below.

9. CONCLUSION

The above analyses make very clear concept that the locally processed images show a good quality compared to the globally processed technique. Also the vertically separated and processed image provides a clear vision compared to the horizontal one. Due to the fact that the fog density is equal in the vertical distribution and it varies in the horizontal distribution. Thus the picture development a process base on the Koschmieder's rule is applied and the atmospheric veil is computed. With the known atmospheric veil the fog free original input images are obtained. By applying this concept in real time applications like traffic surveillance under foggy conditions the performance can be improved well. This process can also be applied in image to remove the miasma, object finding and identification, etc. With this technique the accidents can be much reduced in the accident prone zones due to foggy weather conditions.

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