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DEGRADED IMAGE ENHANCEMENT FOR REMOTE SURVEILLANCE SYSTEM

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Abstract: An atmospheric conditions like fog as well as haze considerably degrades outdoor image visibility. Sometimes for security person, it's become very difficult to monitor or identify a target object in low visibility. Therefore in such a challenging environment its become a need to have reliable remote monitoring and surveillance. The proposed strategy based on fusion principle significantly removes the haze from single hazy input image. In this, by processing original hazy image two images are derived to retain the contrast and color features in the output dehaze image. To preserve the region with good visibility, important features are extracted by computing three weight maps. The derived inputs simply blended with weight maps in fusion method to yields image which further divided into blocks to enhance the contrast of each block which finally gives the dehaze version of the original image. This dehaze image will securely transfer to the remote location. Thus this system produces dehaze image with secure transmission

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INTRODUCTION

Remote Surveillance is the process of keeping the close looks on the suspicious activities of the object or target people for the purpose of investigation or protecting them. This can include observation from a distance by means of electronic equipment such as CCTV cameras and UAV. But many times due to bad weather conditions such as Haze or Fog captured image has bad contrast issue. Due to the low visible images motive of surveillance cannot fulfill. Hence, there is a need of enhancement techniques that significantly improves the visibility of degraded images. Captured aerial images are processed to dehaze. To transfer such a dehaze image securely to remote location image encryption algorithm is required.

Image Enhancement is nothing but the processing an image in a way that the output image is easily readable as well as understandable by the people. Due to insufficient light or unfavorable environment condition or some other causes many time captured images has bad contrast issues. It is necessary to improve contrast of the image for better performances in all image and video applications.

The image enhancement methods can broadly be divided in to the following two categories. First is spatial domain method which directly deals with the image pixels and pixel values are manipulated to achieve desired enhancement. Second is frequency domain method in which image is first transferred in to frequency domain by Fourier Transform and then all the enhancement operations are performed in the frequency domain and then the Inverse Fourier transform is performed to get the resultant image.

Single image dehazing technique that is able to accurately dehaze images using only one original degraded image. Fusion process is most suitable alternative to restore the hazy images. Image Fusion is a process of combining the relevant information from a set of images into a single image, where the resultant fused image will be more informative and complete than any of the input images [1].

Good quality digital image is the basic need for various applications of present digital world like remote sensing, face recognition, object tracking, vehicle detection, surveillance, satellite imaging and various security purposes

Image encryption is an intelligent hiding of information. The main idea in the image encryption is to transmit the image securely over the network so that no unauthorized user can able to decrypt the image. The image has properties like correlation, redundancy and capacity which play an important role from aspect of encryption technique usefulness [16].

The remainder of this report is organized as follows. Section II presents Literature survey. Section III briefly addresses the issues in current systems and how it can be overcome. Section IV reports methodology in which image dehazing method is proposed as well as encryption process is given, and Finally, Section V concludes the topic.

LITERATURE SURVEY

Literature involves techniques for providing image security through block permutation, pixel permutation and use of chaos function along with their merits and demerits.

Multi-Image Dehazing Based On Different Weather Condition

S. Narasimhan [2] and S. Nayar [3] uses multiple images taken from different weather condition. The basic method is to take the differences of two or more images of the similar scene. These multiple images have different properties of the contributing medium. This approach can significantly improve visibility, but its drawback is to wait until the properties of the medium change. So, this method is unable to deliver the results instantly.

Polarization Technique

T. Treibitz [4], Y. Y. Schechner [5], S. Shwartz [6] and Y. Averbuch [7] uses two or more images of the same scene taken with different polarization filters. The basic method is to take multiple images of the same scene with different degrees of polarization, which are acquired by rotating a polarizing filter attached to the camera. The shortcoming of this method is that it cannot be applied to dynamic scenes for which the changes are more rapid than the filter rotation and require special equipment like polarizer and not necessarily produce better result.

Depth Map based Method

S. Narasimhan and S. Nayar [8] uses depth information for haze removal. This method uses a single image and assumes that 3D geometrical model of the scene is provided This 3D model then aligns with hazy image and provides the scene depth. This method requires user interaction to align 3D model with the scene and it gives accurate results. Its shortcoming is that it is not automatic, it needs user interactions.

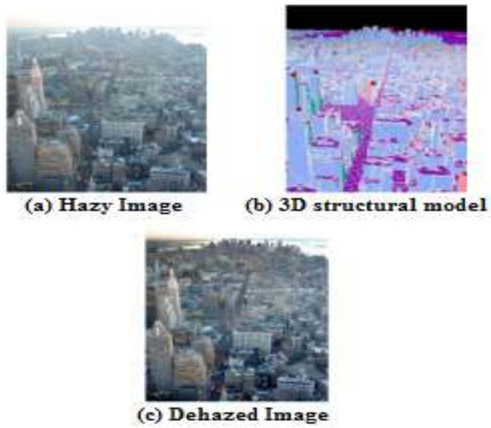


Figure 1. Depth Map Based Method [15]

Statistical Based Single Image Dehazing

X. Tang [12] and R. Fattal [10] perform statistical based single image dehazing. [10] decomposed the image into two components i.e. light which is reflected from surface (albedo) and shading, and then estimate the scene radiance based on independent component analysis (ICA) assuming that the shading and object depth are locally uncorrelated. The main drawback of this method is that it cannot handle heavy haze images.

Contrast Based Single Image Dehazing

R. T. Tan [11] and N. Hautiere [13] performs contrast based single image dehazing. [11] observes that a haze free image must have higher contrast compared with the input hazy image and removes the haze by maximizing the local contrast of the restored image. Tans method suffers from color fidelity.

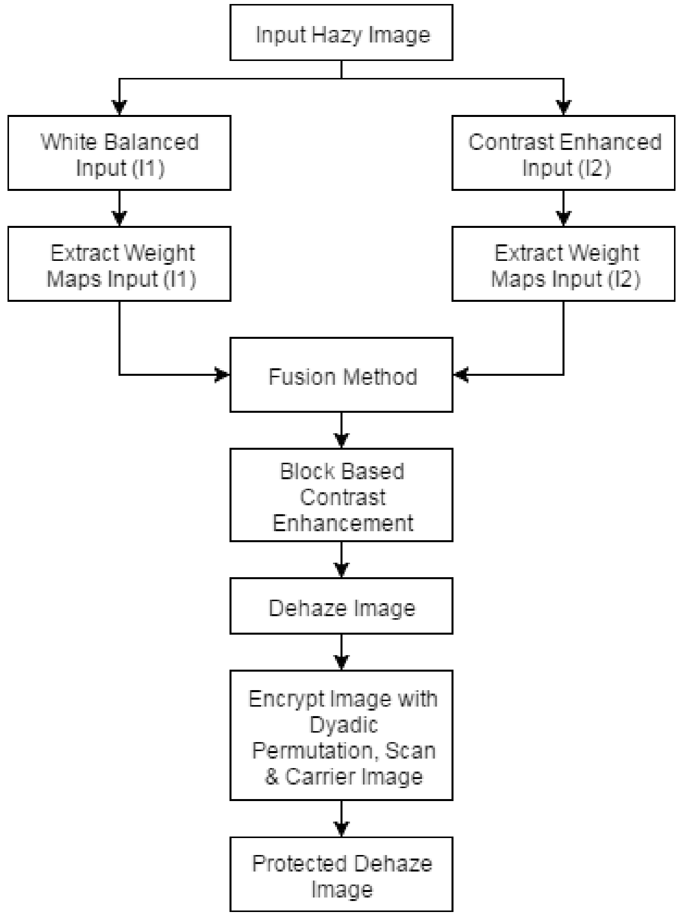
Figure 2. Contrast Based Single Image Dehazing [11]

PROBLEM STATEMENT

Weather conditions such as fog and haze affects the image quality in outdoor surveillance. Images that are taken in such atmosphere significantly degrade their visibility. To recover the image with good visibility using only one hazy image proposed fusion principle is used. In this, by performing contrast enhancement and color balancing process two derived images are extracted. First derived image captures the hazy free region and second derived image captures hazy regions with enhanced contrast. These derived images are used further to preserve the regions with good visibility. Each of the derived image is weighted by three feature maps i.e. luminance, chromatic and saliency maps. Then, all the derived inputs and weight maps are fused together by Fusion method which gives fusion output image which further divided into blocks to intensify the local contrast of each block to yield final dehaze image. This dehaze image is then transmitted to remote location using efficient encryption techniques.

METHODOLOGY

Proposed methodology as shown in figure 3 generates two images from the hazy image by the process of a color balance and contrast enhancement. To preserve the region with good visibility, extract their important feature by computing several weight maps like luminance, chromaticity and saliency from both of the derived images. These weight maps control the contribution of each input to the final obtained result. In Fusion strategy, combine derived input images with weight maps and resultant image is divided into blocks to enhance the contrast of each block which finally gives the dehaze image. In image encryption, dehaze image is divided into small chunks and apply dyadic permutation to each chunk then recompose the image. Scan image using zigzag scanning to provide necessary diffusion and generate intermediate encrypted image. Using linear congruential generator generate carrier image which is exclusive-OR with intermediate encrypted image to provide final encrypted image.



Block diagram of Proposed Methodology

Input Creation

Fusion based dehazing approach takes two inputs derived from original image. The first input I1(x) is obtained by color balance process on image. Color or Grey balancing process discard unwanted color casts which appears due to varying atmospheric color and focuses on natural appearance of the image. Only color balancing is not enough to retrieve the image with good visibility. It requires extracting additional components from the image such as contrast. The second input I2(x) is extracted to retrieve visibility information of the hazy areas within the image. This is obtained using following formula:

$I2(x) = (I(x) - I)$

The process of contrast management and color balancing gives the necessary visibility in hazy regions but at the cost of compromising loosing local features of the image. Therefore to gain the features with details along with good visibility in hazy region weight features are computed.

Weight Maps

The derived inputs are weighted by following weight features:.

Luminance Weight Map: This map (WnL) deals with visibility of individual pixel. It gives high weights to the bunch of pixels those having good visibility and small to the rest. Luminance weight is nothing but the deviation from input to luminance and RGB channel. To perform this weight map can lose the color information as well as global contrast. Therefore, to avail the global contrast and color details additional maps such as chromatic map and saliency map are computed respectively.

Chromatic Weight Map: This weight map (WnC) deals with saturation gain as it controls saturation gain in dehaze image. This map is nothing but the distance between the maximum saturation and its saturation value. This map gives high values to the most saturated pixels and small to rest. Human eyes are more sensitive to the images that has high level saturation therefore chromatic map is considered in image dehazing process.

Saliency weight map: The Saliency weight map (WnS) deals with the degree of visible region with respect to its neighborhood regions. Visual saliency is nothing but the perceptual quality that makes an pixel, person, or object stand out among its neighbors. In general, saliency also referred to as visual attention, seeks to estimate the contrast of the image region relative to their surroundings.

The resulted weight Wn is obtained by multiplying the processed weight map WnL, WnC, WnS.

$$Wn = WnL * WnC * WnS$$

Fusion Method

The fusion process is obtained by summing the inputs weighted by corresponding resulted weight map. Each pixel x of the output F is computed by summing the inputs In weighted by corresponding normalized weight maps Wn:

$$F(x) = \Sigma_n Wn(x) * In(x)$$

Where In symbolizes the input (n is the index of the inputs) that is weighted by the normalized weight maps Wn. Some artifacts are introduced at the time of deriving inputs and weight features. To prevent such degradation problem a classical multi-scale pyramidal strategy has been opted. In this Laplacian and Gaussian pyramids are used for derived input images and weight maps respectively. Laplacian operator used to decompose image into pyramids and Gaussian pyramid is computed for resultant weight maps. Consider Gaussian and Laplacian pyramids have the same number of levels. The fusion among the Laplacian inputs and Gaussian resulted weights is done at each level (default levels are 5) and result gives the single image.

Fl(x) = Σn Gpl[Wnx] * Lpl[Inx]

Id(x) = Σl Fl(x)

Where l represents the number of the pyramid levels (default value of the number of levels is l=5) and Lp is the Laplacian version of the input In while Gp represents the Gaussian version of the normalized weight map of the Wn. This step is performed on each pyramid level successively.

Block Based Contrast Enhancement

It is a technique that adjusts the image intensities in such a way that contrast of the each block is enhanced. Block based Contrast Enhancement takes dehaze image as input which is divided in to chunks or blocks for contrast enhancement. First, frequency for each grey level is counted and calculates cumulative distribution function for each block. Then, by applying following formula, contrast can be enhanced in each block.

$$C_e(v) = round\left(\frac{cdf(v) - cdf_{min}}{(M * N) - cdf_{min}} * (L-1)\right)$$

Block wise Contrast Enhancement enhance local contrast of each block which gives better result than that of applying the same formula on entire image.

Encrypted Dehaze Image

To securely transfer the dehaze image to the remote location following step makes it secure.

Step 1: Divide image into small blocks of size (M * N).

Step 2: Select values for i & j, where 0< i <M & 0< j <N

Step 3: Perform

ij XOR I(m,n)

Where $0 < m < M$ and $0 < n < N$

It will give dyadic permuted image.

Step 4: Read 2-D dyadic permuted image into 1-D array using Zigzag scan and then Raster scan 1-D array into 2-D image. The resultant image will be intermediate encrypted image.

Step 5: Initialize values of a, b, X0, m in following formula of linear congruential generator which gives pseudorandom number from X1, X2, .. , Xn.

Step 6: Initialize values of a, b, X0, m in following formula of linear congruential generator which gives pseudorandom number from X1, X2, .., Xn Perform

$X1+1 = (aXi + c) \mathrm{mod}\ m$

Where m is modulus $m > 0$

a is multiplier $0 < a < m$

c is increment $0 < c < m$ and

X0 is starting value $0 < X0 < m$

Step 7: Read the pseudorandom number in base 4 number system which gives numbers from S1, S2, .., Sn.

Step 8: Read 12 Sequence of pseudorandom number from S1 to S12 to generate 24-bit binary which will act as pixel intensity in carrier image.

Step 9: Repeat Step 8 until complete carrier image is generated.

Step 10: Perform X-OR operation on intermediate encrypted image with carrier image to get final encrypted image.

Decryption process requires initial values for linear congruential method so that carrier image can be generated. Encrypted image X-OR with generated carrier image to get intermediate encrypted image. This intermediate encrypted image is scan in zigzag and raster combination 4 times to get dyadic permuted image. Generate sub block image using same value of i, j. Perform ij XOR Id(m, n) on each block to generate Original Image.

Performance Parameter

Quality assessment approach consists in computing the ratio between the gradients of the image before and after restoration. In this measure three indicators, e, r and Σ are used.

e - represents edges newly detectable after restoration,

r - represents the mean ratio of the gradients at visible edges,

Σ - represents the percentage of pixels which become ultimately black or ultimately white after restoration.

CONCLUSION

Remote surveillance system suffers from low visibility due to haze and fog. The proposed method satisfies the need of a good visibility under bad weather conditions for remote surveillance. In proposed technique, Original hazy image is given to the single image contrast enhancement technique which produces two derived inputs and from those derived input weight maps are computed to have visibility in each region. Fusion principle combine derived input images and their weight maps together and further it intensify the local contrast of each region to give final dehaze image. This image is encrypted and transfer to remote desktop for surveillance. Thus, the system produces dehaze image with secure transmission.

REFERENCES

1. Anju Rani, Gagandeep Kaur,“Image Enhancement using Image Fusion Techniques”, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 9, 2014.
2. S. Narasimhan and S. Nayar, “Contrast restoration of weather degraded images”, IEEE Trans. Pattern Anal. Mach. Intell., vol. 25, no. 6, pp. 713724, Jun. 2003.
3. S. Narasimhan and S. Nayar, “Chromatic framework for vision in bad weather”, in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2000,
4. T. Treibitz and Y. Y. Schechner, “Polarization: Beneficial for visibility enhancement”, in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2009.
5. Y. Y. Schechner, S. Narasimhan, and S. Nayar, “Polarization-based vision through haze”, Appl. Opt., vol. 42, no. 3, pp. 511525, 2003.
6. S. Shwartz, E. Namer, and Y. Schechner, “Blind haze separation”, in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., 2006.

7. Schechner and Y. Averbuch, “Regularized image recovery in scattering media”, IEEE Trans. Pattern Anal. Mach. Intell., vol. 29, no. 9, pp. 16551660, Sep. 2007.

8. S. Narasimhan and S. Nayar, “Interactive de-wheathering of an image using physical models”, in Proc. IEEE Workshop Color Photometric Methods Comput. Vis., Oct. 2003.

9. J. Kopf, B. Neubert, B. Chen, M. Cohen, D. Cohen-Or, O. Deussen, M. Uyttendaele, and D. Lischinski, “Deep photo: Model-based photograph enhancement and viewing”, ACM Trans. Graph., vol. 27, no. 5, p. 116, 2008.

10. R. Fattal, “Single image dehazing”, ACM Trans. Graph., SIGGRAPH, vol. 27, no. 3, p. 72, 2008.

11. R. T. Tan, “Visibility in bad weather from a single image”, in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2008.

12. K. He, J. Sun, and X. Tang, “Single image haze removal using dark channel prior”, in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2009.

13. J.P. Tarel and N. Hautiere, “Fast visibility restoration from a single color or gray level image”, in Proc. IEEE Int. Conf. Comput. Vis.,Sep.Oct. 2009.

14. E. J. McCartney, “Optics of the Atmosphere: Scattering by Molecules and Particles”, New York, USA: Wiley, 1976.

15. Ruchika Sharma1, Dr. Vinay Chopra, “A Review on Different Image Dehazing Methods”, International Journal of Computer Engineering and Applications, Volume VI, Issue III, June 2014.

16. Reza Moradi Rad, Abdolrahman Attar, “A New Fast and Simple Image Encryption Algorithm Using Scan Patterns and XOR”, International Journal of Signal Processing, Image Processing and Pattern Recognition, Vol.6,No.5,2013.