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A Hybrid Technique for Remove Fog from Image using Edges and Color Enhancement Method, Adjustable Empirical Function with Wiener Filter

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Abstract

At present, greatest outdoor video-surveillance, optical remote sensing systems and driver-assistance have been designed to work under decent visibility weather conditions. Less visibility often happens weather of hazy or foggy conditions and can strongly influence accuracy or even general functionality of such vision systems. Fog reduces the visibility of a scene and thus the performance of numerous algorithms of computer vision which use feature knowledge. Fog formation is the function of the depth. Estimation of depth knowledge is under constraint problem if single image is presented. Hence, fog removal need assumptions or prior information. In this paper, present a novel algorithm for fog or haze removal purpose with combination of edge enhancement method, color enhancement method, adjustable empirical function and also Wiener filter for efficient outcomes.

Keywords—*fog removal; Wiener filter; edges and color enhancement; Gaussian, etc*

1. Introduction

The outdoor scene images are degraded through various reasons, but reasons of one source are condition's of bad weather presence [1]. Haze, smoke and Fog are a road accidents reason. Fog is a ice crystals or water droplet collection draped in the air at or near the surface of earth. The outdoor surveillance systems effect is limited through fog. Under foggy weather conditions, the color and image contrast, are drastically degraded. This degradation level improved with the distance from the camera to the object. Fog decreases the contrast image level that affects the visual image quality. In the visual quality, visibility and computer vision, image level field is affected through airlight and attenuation phenomena. Light beam coming from a scene point, gets attenuated scattering through atmospheric particles. This phenomenon is termed as attenuation, which decreases contrast in the scene. And from the source Light coming is scattered towards camera and also adds whiteness in the scene. This phenomenon is termed as airlight. Fog result can be mathematically realized as an exponential function of distance from camera scene. Hence the fog removal need the depth map estimation. In order to find depth knowledge for systems applying single images as input, need prior assumptions to approximation the depth map. Therefore, numerous approaches have been suggested which utilize various images. Recently, numerous single image fog elimination algorithms have been proposed with applying a stronger prior or assumption.

For enhancing the image visibility level and reducing noise and fog numerous image enhancement approaches are used. After enhancement again restored the improve image with restoration approaches. For enhancing the visibility level 4 main steps are used. The first step is a foggy image acquisition procedure. Second is the estimation procedure. The

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third is an enhancement procedure (increase noise level, reduce fogging or visibility level). The last step is restoration procedure (restore enhanced image).

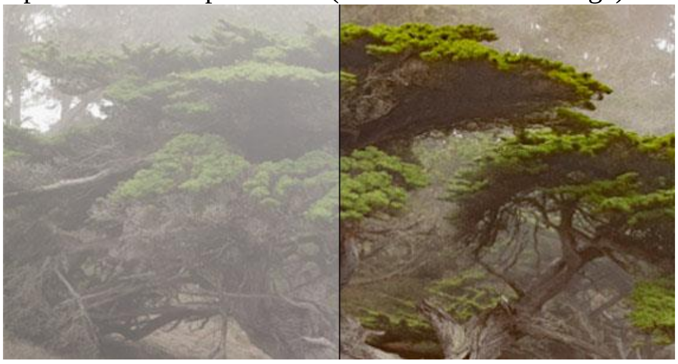

Figure 1. Original Image and Fog Removal Image

Fog in the cloud form is called as stratus cloud. Fog is prominent from mist only by its density. Fog decreases visibility to less than 1km whereas mist decreases visibility to no less then lkm.

Table 1. Visibility and Weather Condition of Fog, Mist, Haze[2]

	VISIBILITY	WEATHER CONDITION
FOG	Visibility less than 1km	Cloudy
MIST	Visibility between 1& 2 km	Moist
HAZE	Visibility between 2 & 5 km	Noise

2. Image Restoration

Image restoration is the task of taking a noisy and blurred image and estimating image restored. Degradation may come in numerous forms, for example noise, motion blur, and camera misfocus. Image restoration approaches the goal of reversing the degradation undergone through an image to recover the true image. Images may corrupt through degradation, for example linear frequency distortion, noise and blocking artifacts. The degradation process is assumed to be linear and shift invariant.

The degradation contains of two different distinct processes:-

a) Deterministic blur: - The blur may be occurs because of various reasons for example motion, defocusing of camera and atmospheric turbulence.

Gaussian blur: - A Gaussian blur (also called Gaussian smoothing) is the image blurring outcome through a Gaussian function. It is an extensively used result in the graphics software, classically to decrease image reduce and noise detail. The visual effect of this blurring method is a smooth blur resembling that of observing the image of a translucent screen, distinctly various from the bokeh effect produced through focus out lens or the object shadow under usual illumination. Gaussian smoothing is also used as a preprocessing stage in the algorithms of computer vision in order to improve image presentation and scale space implementation.

$$G(x) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Where *x* is the distance from an origin in the horizontal axis, *y* is the distance from the origin in the vertical axis, and σ is the S.D of the Gaussian distribution.

Out of focus blur: - This blurring is produced by a defocused optical system. It distributes a single point uniformly over a disk surrounding the point. The aesthetic blur quality produced in the out-of-focus image parts produced through a lens. Bokeh has been described as "the way lens renders out-of-focus light points". Differences in the aperture shape and lens aberrations cause few lens designs to image blur in a way that is eye pleasing, while others different create blurring that is distracting or unpleasant-"bad" and "good" bokeh, respectively. Bokeh happens to scene parts that lie outside the field depth. Photographers occasionally deliberately use a shallow focus method to produce images with prominent out-of-focus regions.

Bokeh is often greatest visible around less background highlights, for example light sources and specular reflections, which is why it is often associated with many different areas. However, bokeh is not limited to the highlights; blur happens in the each out-of-focus image regions.

The psf of out-of-focus blur is given by

$$h(x,y) = c\begin{cases} 1, \sqrt{(x-c_x)^2 + \left(y-c_y\right)^2} \le r \\ 0, \qquad\qquad otherwise \end{cases}$$

Where r is the radius and (c_x, c_y) is the center of the out-of-focus point spread function. The scaling factor c has to be chosen such that $\iint h(x,y)\,dx\,dy = 1$.

Motion blur: - Motion blur is due to relative motion between the recording device and the scene. When an object or the camera is moved during light exposure, a motion – blurred image is produced. The motion blur can be in the form of a translation, a sudden change of scale, or some combination of these. When scene to be translated relative recorded to the camera at a constant velocity $v_{relative}$ under an angle of ϕ radians with the horizontal axis at the time of exposure interval$\left[0, t_{exposure}\right]$, the distortion is one-dimensional.

Defining the length of motion by

$$L = v_{realtive} \times t_{exposure}$$

The point spread function is given by

$$h(x,y,L,\emptyset) = c\begin{cases} \frac{1}{L}, if\sqrt{x^2+y^2} \le \frac{L}{2}\ and\ \frac{x}{y} = -tan\emptyset \\ 0, \qquad\qquad otherwise \end{cases}$$

The discrete version of the above equation is not easily captured in a closed from expression in general. For a special case, when ϕ = 0, an appropriate approximation is given by

$$h(n_1, n_{2,}L) = \begin{cases} \frac{1}{L} & if\ n_1 = 0, |n_2| \leq \left|\frac{L-1}{2}\right| \\ \frac{1}{2L}\left\{(L-1) - 2\left|\frac{L-1}{2}\right|\right\} & if\ n_1 = 0, n_2 = \left|\frac{L-1}{2}\right| \\ 0 & otherwise \end{cases}$$

Atmospheric turbulence: - Atmospheric turbulence is a severe limitation in remote sensing. Although the blur introduced with atmospheric turbulence depends on a variety of factors like temperature, exposure time, for long-time exposures, the point spread function can be described reasonably well by a Gaussian function

$$h(x, y, \sigma_G) = C\ exp\left(\frac{x^2 + y^2}{2\sigma^2{}_G}\right)$$

Here, σ_G determines the blur spread amount, and the constant C is to be chosen so that the above equation is satisfied.

Atmospheric turbulence is, small-scale, uneven motions of air categorized through winds that differ in direction or speed. Turbulence is significant because it churns and mixes the environment and causes vapor of water, smoke, and various substances, as well as energy, to become distributed both horizontally and vertically.

Atmospheric turbulence near surface of Earth's differs from that at advanced levels. At low levels (within a few hundred surface meters), turbulence has a marked daily variation under partly sunny skies and cloudy, reaching a maximum about midday. This happens because, when heats of solar radiation the exterior, the air above it becomes warmer and extra buoyant, and cooler, denser air to displace it. The resulting air vertical movement, together with disturbances of the flow around surface obstacles, creates low-level winds highly irregular. At night surface cools quickly, chilling the near ground air; when that air becomes chiller than air above it, an inversion of stable temperature is generated, and wind gustiness and speed both lessening sharply. When the sky is overcast, temperatures of low-level air vary less between night and day, and also turbulence remains closely constant.

At altitudes of numerous thousand meters or more, surface topography frictional effects of the wind are significantly reduced, and small-scale turbulence characteristic of the absent lower atmosphere. Although upper-level winds are commonly relatively proper, they frequently become turbulent sufficient to affect aviation.

Figure 2(a). Foggy Blurred Image
Figure 2(b). Image is Blurred Due to Temperature

b) Random noise: - The noise may create in the image-formation procedure, transmission procedure or a combination of them. Image restoration is an area that deals with improving the image appearance. However, unlike improvement, which is subjective, restoration of the image is objective, in the sense that restoration methods tend to be based on probabilistic or mathematical image degradation models. Enhancement, on the other different hand, is based on the people subjective preferences regarding what constitutes a "good" improvement outcome. The process by which the original image is blurred is usually very complex and often unknown. To simply the calculations, the degradation is often modeled as a linear function which is often referred as the point spread function.

3. Deblurring Technique

A. Lucy- Richardson Algorithm Technique:

The Richardson–Lucy algorithm, also known as Richardson–Lucy deconvolution, is an iterative pocess for improving a hidden image that has been the blurred through a known PSF.[5] It has been present empirically that if this iteration converges, it converges to the maximum likelihood solution for uj.

B. Neural Network Approach:

NN is multiprocessor computer system form, with simple processing elements, an interconnection high degree, adaptive interaction between elements, When an element of the NN fails, it can continue without any issue through their parallel nature [6]. ANN makes available a robust tool for approaching an object function provide I/O set and for reconstruction function from a class an image. An algorithm for example Back propagation and Perceptron utilize gradient- decent methods to tune the network parameters to best-fit a training I/O set examples. Here we are applying Back propagation neural network method for image restoration. This method is capable of learning complex nonlinear functions are expected to create an enhanced structure particularly in high frequency regions of the image. We used a two-layer Back propagation network with completely connectivity.

C. Blind Deconvolution Technique:

There are basically two types of deconvolution methods. They are projection based blind deconvolution and maximum likelihood restoration. In the first approach it simultaneously restores the true image and point spread function. This begins by creating initial estimates of the PSF and true image. The technique is cylindrical in nature. Firstly, we will discover the PSF estimate and it is followed through image estimate. This cyclic process is repeated until a predefined convergence criterion is met. The merit of this technique is that it appears robust to inaccuracies of support size and also this approach is insensitive to noise. The problem here is that it is not unique and this technique can have errors associated with local minima. [7]

In the other method the maximum likelihood estimate of parameters for example covariance matrices and PSF. As the PSF estimate is not unique other assumptions, for example size, symmetry *etc*. PSF can be taken into account. The basic advantage is that it has got less computational complexity and also helps to find blur, noise and true image power spectra. The drawback with this approach is the algorithm being converging to local minima of the cost function estimated. [4]

D. Deblurring With Blurred/Noisy Image Pairs:

In this method image is deblurred with noisy image help. As a first level, both images blurred and noisy image are used to find an accurate blur kernel. It is often most challenging to get blur kernel from one image.

Following that a residual deconvolution is complete and this will reduce artifacts that appear as spurious signals which are common in image deconvolution. As the third and final step the remaining artifacts which are present in the non-sharp images are suppressed through the gain controlled deconvolution procedure. The main advantage of this approach is that it takes both the noise and blurred image and as an outcome produces high quality reconstructed image. With these two different images an iterative has been formulated which will estimate a good initial kernel and decrease artifacts. There is no special hardware is required. There are also disadvantages with this approach like there is a spatial point spread function that is invariant. [8]

E. Deblurring With Motion Density Function:

In this method image deblurring is done with the motion density function help. A unified model of camera shake blur and a framework has been used to improve the camera latent and motion image from a single blurred image. The motion of the camera is represented as an MDF which records the time spent fraction in all discretized all possible camera poses space portion. Spatially varying blur kernels are derived directly from the MDF. One limitation of this method is that it depends on imperfect spatially invariant deblurring estimates for initialization. [3]

F. Deblurring With Handling Outliers:

In this method various types of outliers such as pixels saturation and non-Gaussian noise is analysed and then a deconvolution method has been proposed which contains an explicit component for outlier modelling. Image pixels are classified into two main categories: Inlier pixels and Outlier pixels. After that an Expectation-Maximization method is employed to iteratively refine the outlier classification and the latent image. [9]

G. Deblurring by ADSD-AR:

In this approach ASDS (Adaptive Sparse Domain Selection) scheme is introduced, which learns a sequence of the compact sub-dictionaries and assigns adaptively all local patch a sub-dictionary as sparse domain. With ASDS, a weighted *l1*-norm sparse representation model will be proposed for IR tasks. Further two different adaptive regularization terms have been introduced into the sparse representation framework. First, the AR models set are learned from the image patches dataset. The best fitted models of AR to a provide patch are adaptively certain to regularize the image local structures. Another, the image nonlocal self-similarity is introduced as a various regularization term. [10]

4. Literature Survey

Wei-Jheng Wang (2013) *et. al.,* present that The outdoor image's visibility captured in weather of inclement will become degraded because of the haze, fog, mist presence and so on. Unfortunate visibility caused through atmosphere phenomenon in the turn bases failure in the applications of computer vision, for example outdoor object recognition, obstacle detection, video surveillance, and intelligent transportation systems. In order to explain this issue, visibility restoration methods have been developed and perform a significant role in numerous applications of computer vision. However, full haze elimination from an image with difficult construction is challenging for visibility restoration approaches to achieve. This paper proposes a new visibility restoration technique which dark channel prior and the median filter operation combination utilize in order to achieve efficient haze elimination in a single image with a complex structure. The experimental outcomes demonstrate that proposed method gives superior haze elimination in comparison to the earlier state-of-the-art technique through visual evaluation of various scenes [11].

Shilong Liu (2015) *et. al.,* present that captured digital images under poor atmospheres are weakly degraded in their capacities to the take adequate information quantity to the viewer or computer-based procedures. One of the general causes affecting the outdoor images quality can be traced to that coming from atmospric condensations for example haze or fog. Algorithms of image processing, hence, had been developed to address de-hazing issue in order to recover scene data. Dark channel prior method, in specific, had initiated a big various research activities because of its satisfactory possibilities and performance for further applications and improvements. In this paper, a review of dark channel prior methods based is presented. The restoration principle through a ray transmission model applied in image de-hazing is examined together with a models classification generally employed. The problems encountered in the de-hazing algorithm implementation are addressed and discussed. A most dangerous issues future and summary trends discussion are also included in this review [12].

Artur Loza (2013) *et. al.*, present that This paper defines a novel fast technique for foggy image restoration derived from the prior methodology of dark channel. Based on the formation of the physical foggy image model, the restoration algorithm parameters are estimated from the single color image saturation channel without scene prior knowledge. The proposed method performance is evaluated on a real-world images set and compared with various state-of-art fog elimination and contrast enhancement methods. It is present that the novel technique outperforms other tested methods in execution speed and perceptual restored images quality terms [13].

Dubok Park (2012) *et. al.*, present that Images captured under the conditions of foggy, often contain poor contrast and color. This is primarily because of air-light degrades quality of image exponentially with the depth of fog between the camera and the camera. In this paper, images of fog-degraded restore through first estimating depth applying the physical model characterizing RGB channels in a single monocular image. The effects of fog are then eliminated through subtracting estimated irradiance, which is empirically related to scene depth knowledge obtained, from the complete irradiance received through the sensor. Effective color restoration and images contrast taken under conditions of foggy are demonstrated. In the experiments, validate the efficiency of this technique via representative performance measurements [14].

M. Ramesh Kanthan (2014) *et. al.*, present that proposed new algorithm helps to resolve the degraded illumination problem and the foggy weather range assessment. For example, contrast restoration approaches, the proposed algorithm increases the interest present object accuracy in the foggy image applying Convergence Index Filters. The current approaches work based on the statistical measures and it may not for images work where scene objects are inherently similar to atmospheric light. In suggested algorithm gradient energy magnitude along with directional knowledge is used as an extra parameter to discover the objects embedded in foggy image. Few of the convergence index filters are ARF, CF, SBF, IR. The image gradient can be a significant information source for texture discrimination. The COIN filter property works with vector information and does not depend on contrast data. When this property is applied in the elimination of fog, estimates the proposed algorithm the transmission map to maximize the output image contrast [15].

Hongyu Zhao (2015) *et. al.*, present that Atmospheric conditions induced through suspended particles, for example, haze and fog, severely alter scene appearance. In this paper, propose a new defogging technique based on local extrema, aiming at enhancing the image visibility under hazy and foggy weather condition. The proposed technique utilizes an atmospheric scattering model to fog elimination realize. It applies the local extrema technique to figure out three pyramid levels to estimate atmospheric veil, and manipulates the tone and details contrast at various scales by multi-scale tone manipulation algorithm. The outcomes of the comparison experiments with classical approaches demonstrate that the proposed method can achieve extra accurate restoration for the details and color, resulting in a higher improvement in image visibility [16].

Shih-Chia Huang (2014) *et. al.*, present that visibility of outdoor image's captured in extreme weather is often degraded because of the sandstorms, haze, fog presence and so on. Poor visibility caused with the help of atmospheric phenomena in turn causes failure in the applications of computer vision, for example outdoor object recognition systems, obstacle detection systems, video surveillance systems, and intelligent transportation systems. In order to solve this issue, visibility restoration methods have been developed and perform a significant role in numerous applications of computer vision that operates in numerous weather conditions. However, eliminating the fog from a single image with a color distortion and complex structure is a challenging task for visibility restoration methods. This paper proposes a new visibility restoration technique that uses a combination of three basic modules: a depth estimation module, a visibility restoration module, and a color analysis module. The proposed depth estimation module takes median filter method benefit and adopts the adaptive gamma correction method. Through doing so, halo effects can be avoided in images with complex structures and efficient transmission map estimation can be attained. The proposed color analysis module is based on the gray world analyzes and assumes the color characteristics of the hazy image input. Subsequently, the visibility restoration module utilize adjusted transmission map and color-correlated knowledge to repair the color distortion in varied scenes captured at the time of inclement weather conditions. The experimental outcomes demonstrate that proposed technique provides superior haze elimination in comparison to the earlier state-of-the-art technique by qualitative and quantitative evaluations of various scenes captured at the time of numerous weather conditions. [17]

Rita Spinneker (2014) *et. al.,* present that in growing various cars, the driver is supported through ADAS. In specific camera based ADAS are a basic component for further enhancements in driving safety and comfort. While imaging sensors are acting well under good weather conditions, their effective suffers under adverse environmental influences for example heavy rain, snow or fog. To handle such optical threats and to estimate data cameras feature in order to warn the assistance system of possible critical working conditions, a self-diagnosis mechanism is of great significance for reliable operation of an optical ADAS.

In this paper an approach of camera based fog detection as part of a self-diagnosis mechanism for ADAS based on the blurring effect of fog is presented. The encouraging results of experiments have shown that the presented approach of analyzing the power spectrum slope (PSS) of a small image block in close proximity to the vanishing point enables a fast discrimination of street scenes with and without fog [18].

S. OudayaCoumall, *et. al.,* [19] in says there are many situations wherein only partial information about the reference may be provided for image quality assessment. Under such circumstances, their work proposes a restoration before an image is being analyzed using quality metrics. Restoration of the image before quality assessment is made using two types of filtering techniques. Image quality assessment undergoes various stages of down sampling an image and frequency grouping of DFT coefficients. On grouping of DFT co-efficient, combined score of phase and magnitude is obtained represented by Qc' Investigation of Qc values indicate that images corrupted with higher variance ie. (>0.8) can be restored b means of improved median filter and images corrupted through lower variances can be restored by the adaptive median filter.

SinaFirouzi *et. al.,* [20] in their paper, have introduced a novel algorithm to modify the phase correlation method for motion estimation in blurred images/frames. Unlike common motion estimation techniques such as block matching and regular phase correlation, the method is designed to estimate the motion in transitions from non-blurred to blurred frames and vice versa, and also in frames with different blurring values. They have compared our method against the bur-invariant motion estimation method which uses a 2*n* power of phase in the spectrum domain and they have shown that our method obtains lower errors in motion estimation. They have also shown the strong resilience of this method against noise.

Justin Varghese1 *et. al.,* [21] proposed AFSWA filter is designed for the restoration of digital images that are corrupted with salt and pepper impulse noise. The initial part of the impulse detection scheme used min/max check for differentiating non-impulsive pixels from that of impulsive pixels. The detected impulsive pixels are once again refined by checking their edge nature by determining weighted directional distances. The fuzziness in the amount of impulse corruption and similarity among uncorrupted pixels is utilised by, respectively, using the traditional SMALL and modified Gaussian functions for better impulse detection, signal restoration and details-preservation. The experimental analysis favored the proposed filter at all impulse noise ratios in terms of subjective and objective metrics.

Zayed M. Ramadan [22] in this paper, a novel method for detection of impulsive noise and suppression in images has been described and analyzed. Two impulsive noise models applied on several images of different characteristics, and a wide range of noise densities were considered in this paper. Equal and unequal amounts of pepper and salt densities are both considered and examined in this paper. Small sizes of square filtering windows used in the proposed method decrease the blurring problem while preserving image details. Extensive simulation results indicate the superior performance of the proposed technique over various present state-of-the-art approaches in terms of image restoration quality and preservation of image fine details and sharp edges.

Sheelu Mishra (2014) *et. al.,* presents that Image Enhancement and Image restoration method which will be used for image restoring from an image of fog degraded. Image Restoration is an area that deals with enhancing the image appearance. Restoration methods tend to be based on image degradation probabilistic or mathematical models. And enhancement of image is an area which deals with enhancing the image quality measure. To enhancing quality of image, image enhancement can selectively restrain and enhance few data about images. It is a technique image noise decreases, remove artifacts, and maintain details. Its purpose is to increase various analyses of image features, display and diagnosis. The general objective of this paper is to propose an integrated method which will integrate the nonlinear enhancement method with the gamma correction and dynamic restoration method. [23]

Shalini Gupta (2014) *et. al.,* focused in specific on the distances of estimating visibility and detecting daytime fog problem; thanks to these efforts, an original technique has been developed, patented and tested. The technique enables computing the meteorological visibility distance, a measured defined through CIE as distance beyond which a black object of an appropriate dimension is perceived with a less than 5% contrast. The proposed solution is an original one, featuring the utilizing a single camera and necessitating benefit the occurrence of just the road and sky in the scene. As opposed to various approaches that need the explicit road extraction, this technique offers less constraints through virtue of being applicable with no extra than the homogeneous surface extraction containing a portion of the sky and road within the image. [24]

Shriya Sharma (2015) *et. al.,* present algorithm of fog elimination is to airlight map estimate for the provide image and then achieve the required operations on the image in order to overcome the fog in the image and improve image quality. The dark channel prior technique of fog elimination is additional appropriate and time-saving in real-time systems. In this paper, an efficient technique for fog removal of foggy images based on the dark channel prior and GA combination is presented. It is found that the proposed method is additional appropriate for obtaining higher image quality than the most of the present method. [25]

Rajbeer Kaur (2014) *et. al.,* present that In the calculating parameter the efficient light intensity also provide the scattering estimates of the atmospheric light, combined Laplace of the air-light is and minimum values provide us the basic light map spread which is further used in the intensity restoration. The visibility is extremely dependent on the color saturation values and not over saturated, which accounts for image quality development. Results on numerous images demonstrate the power of the proposed algorithm. [26]

Tarun **A** (2014) *et. al.*, present that novel fog removal method IDCP which will integrate CLAHE and dark channel prior and adaptive gamma correction to eliminate the fog from digital images. Fog in image decreases the digital image's visibility. Poor visibility not only degrades the perceptual image quality but it also affects algorithms of the computer vision performance for example object detection, tracking, segmentation and surveillance. Numerous factors for example fog, mist and haze caused through the water droplets present in the air at the time of bad weather leads to poor visibility. [27]

Table 2: Comparative parameters [28]
Comparison between Existing systems [29]

Algorithms	Type of blurr	Rating	PSNR
Wiener filter	Gaussian	*	17.06
Neural Network	Gaussian, Out-offocus	****	31.10
Iterative RichardsonLucy Algorithm	Gaussian	**	19.65
Laplacian	Gaussian	***	31.02

*= Worst Result **=Good ***=Better ****=Best

Table 3. Comparison between Existing Systems [29]
Proposed Methodology

Algorithm	Description	Disadvantage
Markov Random Field	Incorporates the prior that neighboring pixels should have similar transmission values	Tends to produce over enhancement images in practice.
Bilateral Filter	A Bilateral Filter is a filter based on Gaussian blur but preserves edges.	Defogging result is not so good when there are discontinuities in the depth of scene. The haze among gaps cannot be removed.
Median	It is a simple	Thin lines on a

Filter	filter that uses the median to obtain its result	plain background will not be preserved.
Polarization Based Method	Polarization based methods eliminate the haze effect using two or more images taken with various degrees of polarization.	Requires multiple images. So, the requirement met with real-time applications of images. Eg. changing scenes, or image taken from a static old database
Depth estimation method	Depth at various locations in an image is estimated then fog is removed from the image	The algorithm is complex and the processing speed is slow. Edges are not preserved.

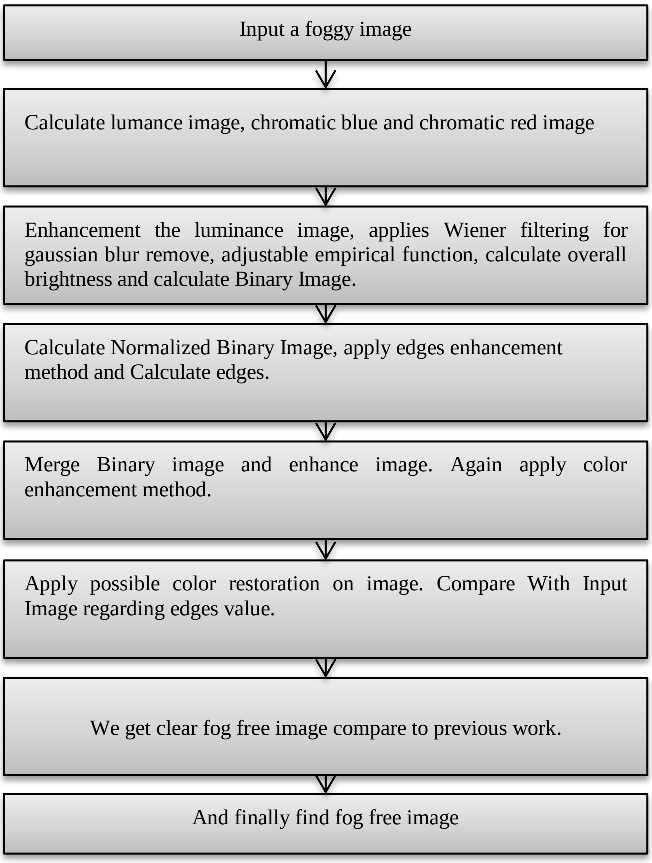

Figure 3. Proposed Methodology for Fog Removes

5. Conclusion

Outdoor scenes images captured in not good weather suffer from bad contrast. Under conditions of bad weather, the light reaching a camera is severely scattered through the atmosphere. So the image is getting highly degraded due to additive light. Additive light is from from scattering of light by fog particles. Additive light is generated through mixing the visible light that is emitted from different light source. This additive light is called air light. Air light is not uniformly distributed in the image. Bad weather reduces atmospheric visibility. Poor visibility degrades perceptual quality of image and algorithms of computer vision, performance for example navigation, tracking, and also surveillance. Actual weather condition is valued information to invoke corresponding approaches. Based on the analysis of atmospheric scattering models and statistics of vrious outdoor images, for foggy images, we discover that the value highest and lowest in color channels tends to be the atmospheric light value. In this paper, present a novel algorithm for fog or haze removal purpose with combination of edge enhancement method, color enhancement method, adjustable, Wiener filter and also estimates the haze-factor from single image through using an adjustable empirical function without manual input constraint for efficient outcomes.

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