

A Novel Method for the Contrast Enhancement of Fog Degraded Video Sequences utilizing Guided Filter

K.Vijay Krishna, T.V.S.Gowtham Prasad, T.Ravi Kumar Naidu

Abstract- Mist and cloudiness debase the nature of see and caught video by decreasing the differentiation and immersion. Therefore the deceivability of scene or question. The goal of the present work is to upgrade the deceivability, immersion differentiate and decrease the clamor in a foggy video. The strategy is proposed which utilize single edge for improving foggy recordings in multi level transmission outline. The strategy is quick and free from commotion or antiques that for the most part emerge in such upgrade strategies. An examination with existing strategies demonstrates that the proposed strategy execution better as far as both preparing time and quality. The proposed technique works continuously for VGA determination. The proposed work likewise displays a plan to expel mist rain and snow continuously. Finally different metrics are calculated for knowing the quality of a reconstructed video and are compared with the previous technique.

Keywords: Fog removal, Image enhancement, attenuation, FFT, Fog removal method, contrast enhancement.

1. INTRODUCTION:

Car collisions are normal in the midst of loathsome atmosphere. It is assessed that two million people fail miserably of car collisions over the world consistently. Poor detectable quality is the best explanation behind incidents. Bits of knowledge showed that in the region of 1999 and 2002, around 10% of setbacks in Spain occurred in the midst of appalling atmosphere. Estimations referred to by the US branch of transportation road atmosphere organization program express that in the midst of 11 years from 1995 to 2005, an ordinary of 17% of crash fatalities happened as a result of dreadful atmosphere conditions; this mean a typical of 7,400 people executed each year in USA alone [1]. As shown by NHTSA, in year 2008 alone, 3,280 deadly car crashes come to fruition by terrible atmosphere conditions in USA [2].

In horrendous atmosphere, driving a vehicle is more troublesome than normal atmosphere condition. The essential driver of road mishaps is driver's weakness to see every single visual data (i.e., road signs or development signs) they get while driving. Road signs or development signs are expected to help the driver to accomplish the

objective safely. Road sign affirmation (RSR) Framework continuously can be used as a piece of vision-based driver help structure (DAS) that helps the driver to investigate vehicle by giving road sign information. RSR can be embedded in unmanned vehicles as well. These systems must be effective to any modification in atmosphere conditions. Nonstop terrible atmosphere ejection estimation has a dedication in road sign affirmation (RSR) structure [3]. This power can be proficient by using an appalling atmosphere departure structure as a pre-taking care of unit. Outside vision systems are used for various purposes, for instance, perception, course, dissent distinguishing proof, after, and division [4,5]. These structures and counts require visual prompts and parts information. Poor detectable quality realized by the terrible atmosphere conditions degrades the execution of outside vision system. Terrible atmosphere conditions, for instance, fog, haze, and cloudiness made by the water dots present observable all around [6-9]. On account of the proximity of the water globules in condition, light is scattered in air before accomplishing the camera. Effect of cloudiness predominantly is brought on by two spreading wonder: debilitating and airlight [10-12]. Light

shaft starting from a scene show gets contracted due scattering by barometrical particles. This ponder is named as tightening that reduces separate in the scene. Light beginning from the source is scattered toward camera and prompts the move in shading. This wonder is named as air light.. So as to enhance deceivability in cloudy pictures, early scientists utilize the conventional strategies of picture preparing to expel the murkiness from a solitary video. Shih-Chia Huang et al in [1], displayed videos caught amid haze conditions regularly include undermined deceivability and undesirable shading cast property. In this strategy, deceivability reclamation approaches as a rule can't adequately reestablish pictures because of diminished assessment of mist profundity and the diligence of shading cast issues. The creator displayed a deceivability rebuilding approach utilizing Palladian-strategy to expel mist thickness estimation and shading cast issues. In this way, a superior picture with clear deceivability and bright picture can be produced.

Singsong Zhu et al in [2], proposed a novel and compelling single picture change calculation for mist video. The creator acquainted another calculation with refine the various types of an indistinct on the foggy video after apply dim channel earlier. The outcomes demonstrated that this strategy makes the dehazing result all the more near genuine scene.

2. FAST FOURIER TRANSFORM

Snappy Fourier Transform (FFT) is the snappier and capable procedure for Discrete Fourier Transform (DFT). Discrete Fourier Transform is the change which takes the discrete banner in time territory and changes that banner in its discrete repeat space depiction. This property of DFT means the centrality of DFT in the area of range examination. FFT being the quick and discrete nature similarity DFT is suitable for the banner's range examination in MATLAB dynamically. Discrete Fourier Transform empowers us to figure an estimation of the Fourier Transform on a discrete course of action of frequencies from a discrete game plan of time tests. A snappy Fourier change (FFT) computation figures the discrete Fourier change (DFT) of a gathering, or its retrogressive. Fourier examination changes over a

banner from its special region (consistently time or space) to a depiction in the repeat space and the a different way. A FFT rapidly procedures such changes by factorizing the DFT grid into a consequence of pitiful (generally zero) factors.[1] as needs be, it makes sense of how to reduce the multifaceted way of enrolling the DFT from,

$$F(x,y) = \sum_{m=0}^{M-1} \sum_{n=0}^{N-1} f(m,n)e^{-j2\pi(x\frac{m}{M}+y\frac{n}{N})}$$

which rises in case one basically applies the importance of DFT, to, where is the data assess. Fast Fourier changes are extensively used for a few applications in outlining, science, and number juggling. The fundamental considerations were progressed in 1965, however a couple of figuring's had been settled as perfect on time as 1805. In 1994, Gilbert Strang portrayed the FFT as "the most fundamental numerical count of our lifetime" and it was joined into Top 10 Algorithms of twentieth Century by the IEEE journal Computing in Science and Engineering. There are a wide grouping of FFT computations including a wide gathering of science, from clear complex-number math to gathering hypothesis also, number speculation; this article gives a game plan of the open procedures and some of their general properties, while the specific breaker are depicted right hand articles related underneath. The DFT is secured by going to pieces a procedure of qualities into parts of different frequencies. This operation is basic in many fields (see discrete Fourier change for properties and usages of the change) yet figuring it particularly from the definition is as regularly as conceivable too move to possibly be productive. A FFT is a way to deal with oversee coordinate figure an adjacent result more quickly: choosing the DFT of N centers in the unadulterated way, using the definition, takes $O(N^2)$ arithmetical operations, while a FFT can manage the same DFT in just $O(N \log N)$ operations. The refinement in speed can be colossal, especially for long informative annals where N may be in the thousands or millions. All around that truly matters, the estimation time can be diminished by two or three offers of size in such cases, and the change is general meandering from $N \log N$. This epic change made the figuring of the DFT sensible; FFTs are of heavenly criticalness to a wide gathering of uses, from bleeding edge hail prepare and unraveling for the most part

differential conditions to calculations for lively development of huge numbers. The best-known FFT calculations rely on upon the factorization of N, however there are FFTs with $O(N \log N)$ strangeness for all N, regardless of for prime N. Different FFT figuring's essentially rely on upon the way that is a N-th primitive base of solidarity, and along these lines can be related with undifferentiated from changes over any limited field, for example, number-theoretic changes. Since the inverse DFT is the same as the DFT, yet with the switch sign in the sort and a $1/N$ consider, any FFT estimation can without a ton of a develop be adjusted for it.

$$F(m,n) = \frac{1}{MN} \sum_{m=0}^{M-1} \sum_{n=0}^{N-1} f(x,y) e^{-j2\pi(x\frac{m}{M} + y\frac{n}{N})}$$

$$F(m,n) = \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} f(x,y) e^{-j2\pi x\frac{m}{M}} e^{-j2\pi y\frac{n}{N}}$$

3. METHODOLOGY

Input video:

In this work we initially expel dimness from picture, and after that enhance the nature of picture and reestablished the deceivability of unique picture and hence get a great cloudiness free picture utilizing Image preparing approach. The trial comes about exhibit that the proposed method delivers a palatable reestablished picture. By utilizing dimness evacuation calculations, we can improve the security and strength of the visual framework. The fog expulsion systems can be ordered into two classifications: video upgrade and picture rebuilding. Picture improvement does exclude the motivation behind why mist corrupts picture quality. This system improves the complexity of fog video however it prompts loss of data in picture. In this work, we present an enhanced single video de right of passage calculation, which is construct Dark divert earlier Estimation in light of chose district to evaluate the barometrical light, and get more precise outcome. Here, It portrays the arrangement of a fog video as takes after:

$$I(x) = j(x) t(x) + A(1-t(x))$$

Where I is the watched fog video, J is the scene brilliance, An is the worldwide climatic light, and t is the medium transmission. It depicts the bit of the light that is not scattered and achieves the camera. The objective of dimness evacuation is to recoup J, An, and t from I.

Pre-Processing:

In our plan, we initially transfer cloudy picture then goes towards the further preparing. As a pre-handling step is particularly advantageous considering that it is as of now important for assessing the environmental light and transmission delineate.

Dark Channel Prior Estimation:

We propose a Dark Channel Prior, for single video fog evacuation. Dull channel earlier strategy can create a characteristic fog free video. Be that as it may, in light of the fact that this approach depends on a factually free supposition in a neighborhood fix, it requires the autonomous segments shifting essentially. The dim channel earlier depends on the accompanying perception on dimness free outside pictures: in the vast majority of the non-sky patches, no less than one shading channel has low power at a few pixels. At the end of the day, the base force in such a fix ought to have a low esteem. Formally, for a video J, we characterize:

$$J^{dark}(x) = \min_{c \in \{r,g,b\}} (\min_{y \in \Omega(x)} (J^c(y)))$$

Where J' is a shading channel of J and Q(x) is a neighborhood fix focused at x. Our perception says that with the exception of the sky area, the power of Jdark is low and has a tendency to be zero, if J is a dimness free open air video. We call Jdark the dull channel of J, and we call the above measurable perception or information the dim channel earlier. The low forces oblivious channel are for the most part because of three variables: a) Shadows. e.g., the shadows of autos, the shadows of leaves, b) Colorful questions or surfaces. e.g., any protest (for instance, green grass/tree/plant, blue water surface; b); c) Dark questions or surfaces. e.g., dull tree trunk and stone.

Estimating the Atmospheric Light:

The air light was assessed from fog picture by utilizing dim channel earlier with a settled fix measure. This technique is productive in an assortment of video. In any case, in some exceptional pictures, for instance videos with numerous light sources, the estimation will be invalid. In the event that the min separating is finished with a too little window, then it might get light sources in the video, which can degenerate the estimation. The red pixels demonstrate the gathering of pixels the calculation finds the maximum R, G, and B values among to collect the environmental light gauge.

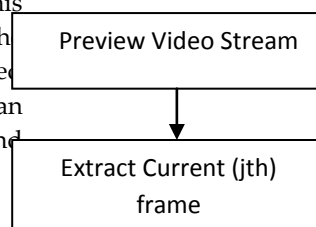
Remembering the true objective to overcome the artifacts[2][3] introduced by individual channel, another edge sparing execution known as Guided picture channel is suggested that will channel the yield dependent upon the information of the course picture. Guided video filtering is one of the spatial space change strategy in which the isolating yield is locally an immediate alter of the course video. Guided channel has incredible edge-defending smoothing properties and does not experience the underhanded effects of the slope inversion old rarities that are seen while utilizing square with channel. It can perform better at the pixels close to the edge when showed up diversely in connection to separate channel. The guided channel is moreover a more non specific thought past smoothing. By utilizing the heading video, it makes the disconnecting yield more formed and less smoothed than the information. It can exchange the structures of the bearing.

Picture to the separating yield, empowering new secluding applications, for example, dehazing and guided feathering. Likewise, guided channel gets the smart and non-figure attributes of straight time check and gives a flawless choice to ceaseless applications if there should arise an occurrence of HD sifting. From this time forward, it is thought to be one of the speediest edge guaranteeing channels. Guided channel in light of current circumstances has an $O(N)$ time (in the measure of pixels N) amend

estimation for both lessen scale and shading pictures, paying little identity to the bit measure and the degree of compel. $O(N)$ time addresses that the time multifaceted nature is independent of the window radius(r) and thus subjective piece sizes can be utilized as a bit of the applications. Here, the standard thought and conditions of a guided channel is watched out for. The key suspicion of the guided channel depicts a region organize display between the heading video I and the separated yield picture q , taking p as a data video.

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Guided filter:



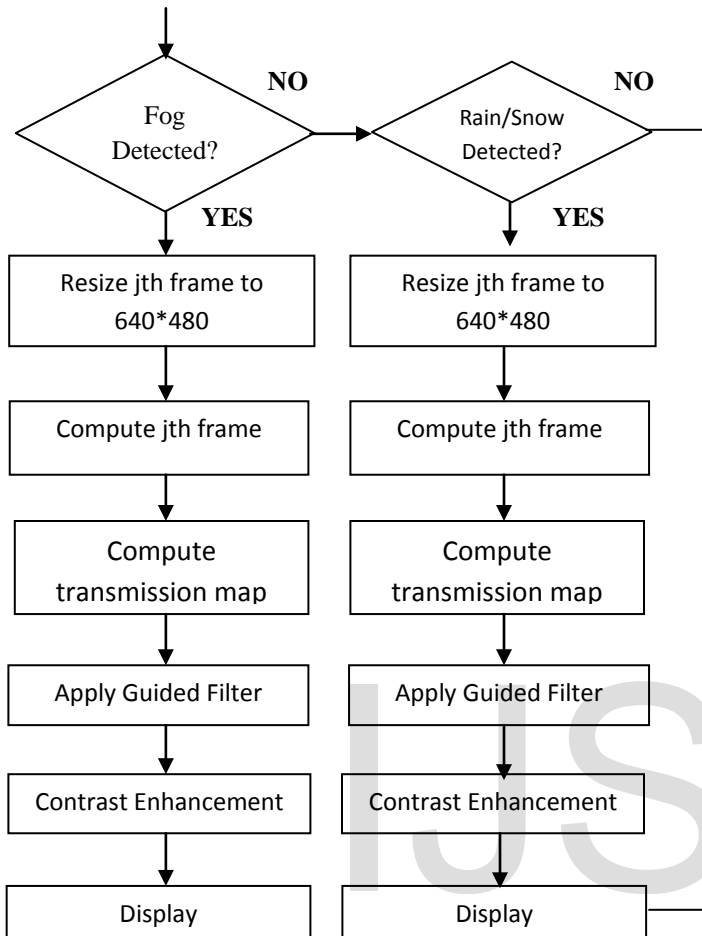


Fig 1: Proposed Method for Fog removal in video

RESULTS AND DISCUSSION:

In order to evaluate the performance of the proposed method, we implemented the proposed method and FFT by using MATLAB software. Five common used test videos were used in our simulation which is shown below.

PSNR		MSE		VQM	
Proposed Method	Existing Method	Proposed Method	Existing Method	Proposed Method	Existing Method
69.38	67.94	0.05	0.07	0.99	0.89
62.39	60.94	0.18	0.22	0.98	0.87
63.10	61.88	0.17	0.19	0.97	0.76
65.13	64.11	0.11	0.11	0.96	0.65
61.00	59.96	0.21	0.24	0.92	0.68

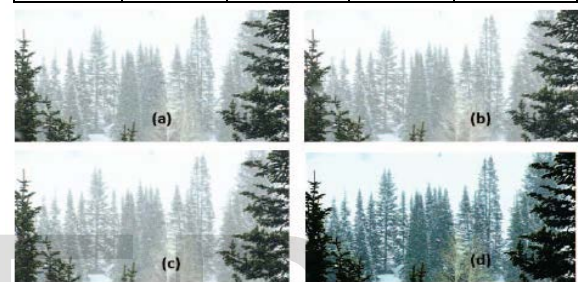


Figure 1: Snow removal from video (a), (b) & (c) input videos and (d) is output video

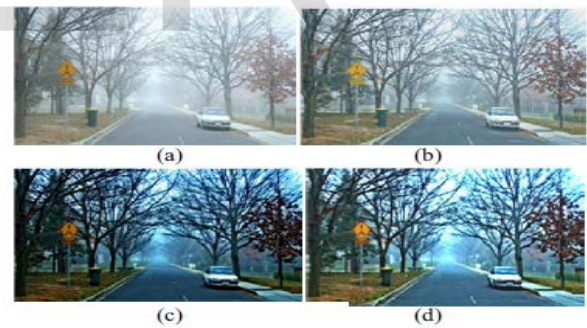


Figure 2: Fog removal from video (a), (b) & (c) input videos and (d) is output video



Figure 3: Fog removal from video (a), (b) & (c) input videos and (d) is output video

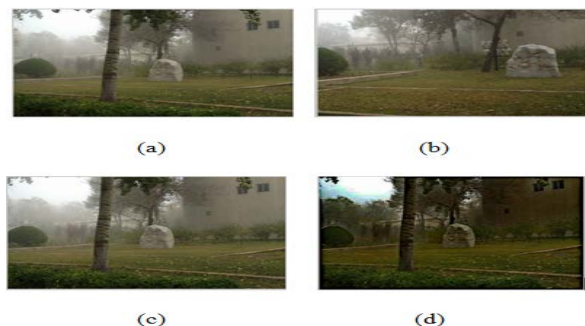


Figure 4: Fog removal from video (a), (b) & (c) input videos and (d) is output video

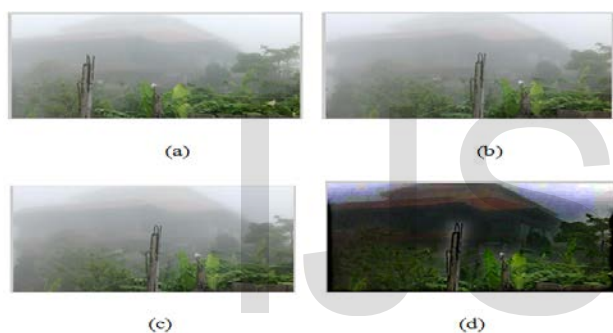


Figure 5: Fog removal from video (a), (b) & (c) input videos and (d) is output video

In this paper, we adopted peak-signal-to-noise-ratio (PSNR), MSE and VQM to measure the visual quality of a video. For the above five foggy videos the metrics are calculated and specified below.

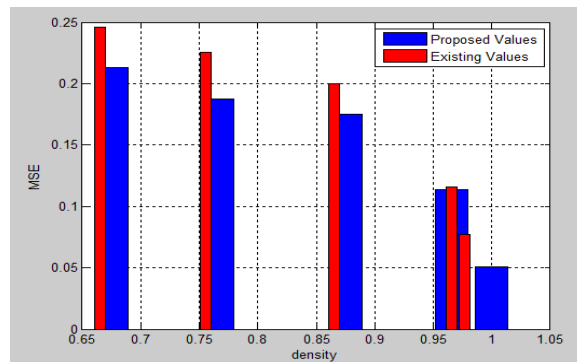


Figure 6: Bar Graph for Existing and proposed values of MSE and Density

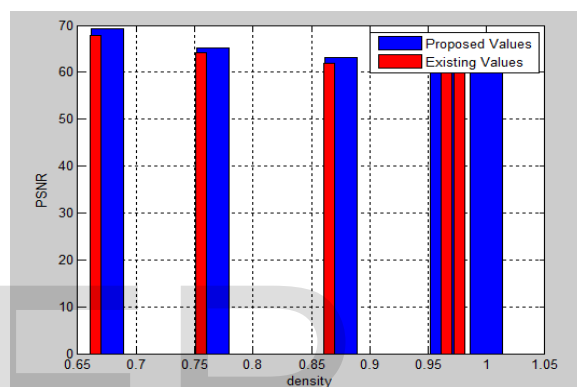


Figure 7: Bar Graph for Existing and proposed values of PSNR and Density

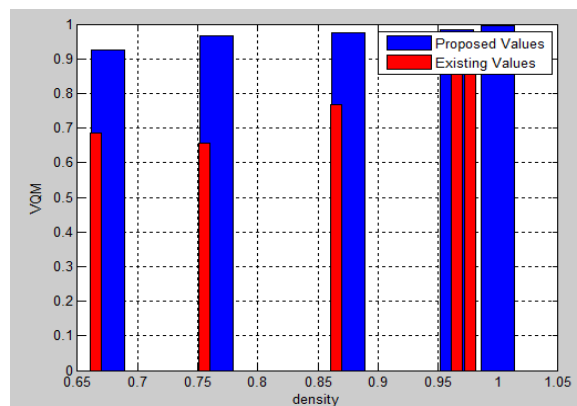


Figure 8: Bar Graph for Existing and proposed values of VQM and Density

Conclusion:

This paper presents a Guided filter method for effective suppression of halo effects in the unrefined transmission map. Through the use of the proposed Guided filter with dark channel prior, both excellent dehazing effect and high processing speed can be achieved as demonstrated by our experimental results. Additionally, annoying halo effects along depth edges have been significantly suppressed in restored images. The experimental results show that the dark channel prior combined with the proposed Guided filter exhibits superior haze removal effects and much faster refinement speed than can the modern filter.

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About Authors:



Mr. Vijay Krishna* received B.Tech degree in Electronics and Communication Engineering from RGM CET, Nandyal in the year 2015 and M.Tech in Communication Systems from Sri Vidyanikethan Engineering College, Tirupati in the year 2017.



Mr. T V S Gowtham Prasad** Assistant Professor (SL), Dept of ECE, Sree Vidyanikethan Engineering College, A. Rangampet, Tirupati received B.Tech in Electronics and Communication Engineering from SVEC, A. Rangampet, Tirupati and M.Tech received from S V University college of Engineering, Tirupati. Pursuing Ph.D from JNTU, Anantapur in the field of Image Processing as ECE faculty. Interesting Areas are Digital Signal Processing, Array Signal Processing, Image Processing, Video surveillance, Embedded Systems.



Mr. T .Ravi Kumar Naidu***Assistant Professor,
Dept of ECE, SreeVidyanikethan Engineering
College, A.Rangampet, Tirupati received B.Tech
in Electronics and Communication Engineering
from SVP CET, Puttur and M.Tech received from
HIET affiliated to JNTUH, Hyderabad.
Interesting Areas Digital Signal Processing,
Array Signal Processing, Image Processing,
Video Surveillance, Embedded
Systems, Digital Communications.

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