

# A Review on Efficient Method of Single Image Dehazing Centered on Multi-Scale Fusion

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**Abstract:** *The visibility of the outdoor images is degraded on account of bad atmosphere conditions. That is principally because of the environment particles such as haze and fog that spread and absorb the light. Haze is an atmospheric singularity that significantly degrades the visibility of outdoor scenes. This paper presents a new single image strategy for the improvement of the visibility of degraded images that are changed. Image fusion is an activity which combines the data from two or more resource images from the same landscape to create one solitary image including more exact information of the scene than the resource images. To preserve the regions with good visibility, their important features get filtered by computing three measures (weight maps): luminance, chromaticity, and saliency. The derived images are weighted by specific weight map followed by Laplacian and Gaussian pyramid representations to reduce artifacts occurred due to weight maps. Subsequently the resulting picture is going to be improved from your past and more obvious. Several studies and research has been completed in the disciplines such as Computer Vision, Parallel and distributed processing, Automatic object detection, Image processing, Robotics and Remote sensing. This paper show effectiveness and the power of a fusion-based strategy of dehazing centered on single degraded image. The method performs a per-pixel manipulation, which is straightforward to implement and then apply the directed filter to improve the image quality. Our effective method demonstrates to yield comparative and even better results than the more complex state-of-the-art techniques but has the advantage to be appropriate for real-time applications.*

**Keywords:** Outdoor scenes, Single image, Fusion, Dehazing, Multi-Scale fusion, per-pixel, weight maps.

## 1. Introduction

Image processing techniques enrich the quality of an image from the degraded image. Image Fusion is a method of improving the quality of image from given input images. The fusion-based strategy derives from two original hazy image inputs through the use of a white balance and a contrast enhancing procedure. Subsequently the resulting image is going to be improved from your past and more obvious. Many development and research is being done in the field areas such as Computer Vision, Automatic object detection, Image processing, parallel and distributed processing, Robotics and remote sensing. This paper reports a comprehensive research performed over some image fusion calculations regarding their execution. The paper illustrates effectiveness and the power of a fusion-based way of dehazing centered on a single degraded image that is changed. The strategy works in a per-pixel manner, which can be straightforward to execute. The dissertation eventually concludes with the evaluation produced about the image fusion calculations that are different, determining the Pyramid Fusion algorithm.

Many authors have presented different methods for efficient single image dehazing with goal of improved performance. However each of these existing methods is having their limitations.

First, many existing methods use the concept of patches based computation where it is assumed that, in every patch, there is a constant airlight. Generally, the assumptions made by patch-based techniques do not hold. That's why additional

post processing steps are required further.

Secondly, existing methods use the concept of estimating the depth map which ultimately increases the complexity of dehazing techniques. Due to these limitations most of existing techniques are slower in performance which is not useful techniques under real time environment. Recently one more method based on fusion is presented to overcome above problems successfully; however there are still further needs to investigate this method under different performance parameters and performance conditions.

Image Fusion is a mechanism that enhances the quality of information from some images. By the procedure for Image Fusion the great info from all the images that were specified merged together to create a resulting image whose quality is superior to any of the input images. That is accomplished by using a series of operators on the pictures that will make the good information in each of the image notable. The resulting image is created by combining the magnified information into a single image from the derived input images. Image Fusion has applications in huge array of locations. It's useful for therapy and medical diagnostics.

## 2. Literature Survey

Improving and enhancing image is a fundamental task in several vision and image-processing applications. Repairing blurred images need some specific strategies; so many important methods that were significant have emerged to resolve this difficulty.

Codruta Ormiana Ancuti and Cosmin Ancuti [1] proposed a strategy for single image dehazing by multi-scale fusion. They approach a system that is a fusion-based that derives from two original hazy image inputs by applying white-balance along with a contrast enhancing procedure. To combine efficiently the information of the produced inputs to maintain the areas with great visibility, their significant characteristics are filtered by them by computing three measures (weight maps): luminance, chromaticity, and saliency.

Dr. H.B. Kekre et al. [2] offered an evaluation on image fusion methods and performance analysis parameters. Basically image fusion means to incorporate information that is accompanying from different resources into one image that is fresh. The thought is to reduce redundancy and uncertainty in the output while optimizing useful information specific to a task or an application. Dr. H.B. Kekre et al covered the basic principles of image fusion. Different pixel level algorithms for image fusion and means of assessing and valuing the functionality of these fusion algorithms progress to the precedence and proposed sequence using an edge detection algorithm in inclusion. Two primary demands should meet in fusion algorithm. They primarily should determine the most significant attributes in the input images and move them to the fused image without reduction of details. Secondly, any artifacts or inconsistencies should not be brought in by the fusion technique which may divert the person observer or subsequent processing phases. This paper proposed that the fusion process includes three fundamental phases. Those are: Image Acquisition, Image Registration and Image Fusion. Ahead of the image fusion algorithm is applied to the resource images, image registration can be used to ensure the communication between the pixels involved in the input image. Finally, the image fusion procedure can be used to join the important information in the set of source images, into an image that is solitary.

M.A. Mohamed and B.M. El-Den [3] proposed execution of image Fusion methods by using FPGA. They combine the data from 2 or even more resource images from an identical scene to create a solitary (single) image. In addition results are assessed by computation of Root Mean Square Error RMSE, Entropy; Mean Square Error MSE, Signal to Noise Ratio SNR and Peak Signal to Noise Ratio PSNR measures for fused images and a comparison is accomplished between these methods. Subsequently we selected the greatest ways to apply them by FPGA.

R. Fattal et al. [4] suggested a system on single image dehazing; he explained the way of calculating the optical Transmission in blurred scenes when only one input image is provided. According to this estimate, the dispersed light is removed to increase image visibility and regain an image that is free of haze. In this method a refined image formulation model is formulated that is responsible for transmission function as well as surface shading. This enables us to solve ambiguities in the information by searching for the solution in which the resulting transmission and shading functions are statically uncorrelated.

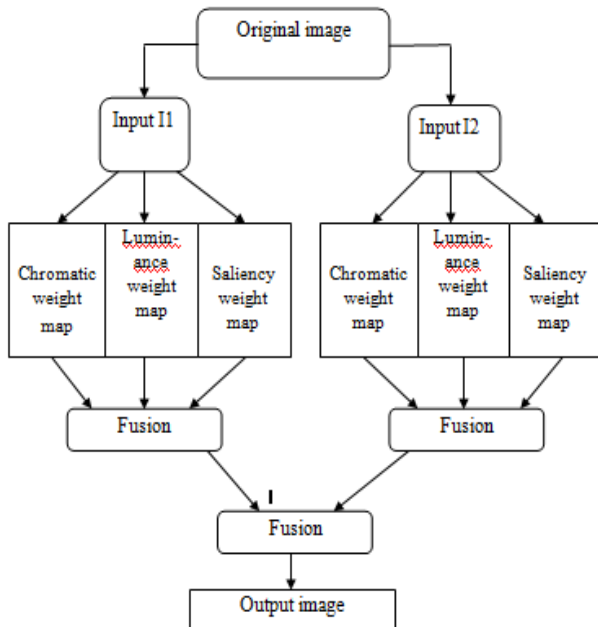
Robby T. Tan et al. [5] suggested visibility in poor weather by single image dehazing. Haze and fog, can dramatically weaken a scene's visibility. In computer vision, the absorption and scattering procedures are usually modeled by a linear combination of the direct attenuation as well as the atmospheric air light. According to this design strategies are suggested, and a lot of these need multiple-input images of a scene, which have possibly different atmospheric conditions or distinct degrees of polarization. This requirement is the primary disadvantage of these approaches, because in several scenarios it is not easy to be carried through. To work out the situation, we expose an automatic system that simply takes single input image. This approach relies on two fundamental findings: first, images with enhanced visibility have more contrast in comparison to images suffering from poor climate; second, atmosphere-light. The variance of it largely depends upon the space of things to the audience, seems to be easy. Depending on both of these findings, a cost function is created in the framework of Markov random fields which may be economically enhanced by different methods, such as belief propagation or graph-cuts. The system doesn't need the image's geometric information, and is appropriate for both grey and color images.

K. He., J. Sun et al. [6] suggested a method using dark channel prior for single image haze removal. The dark channel prior is a type of statistics of the haze-free outdoor images. It's established on a key observation that most of the areas in haze-free images include some pixels that have hardly high intensities in at least one color channel. Using this prior with the haze imaging model can immediately estimated by the thickness of the haze and regain a high quality haze-free image. This proposed prior is demonstrated by obtained outcomes on various outdoor haze images. Also, a high quality depth map may also be acquired as a by-product of haze removal. Dehazing is highly desired in computer vision applications and consumer/computational photography. First, eliminating haze may substantially raise the visibility of the scene and the color shift caused by the airlight gets corrected. Generally, the image which is haze-free is more pleasing visually. Second many computer vision algorithms, from low level image-analysis to high level object recognition assumed that input image (after Radiometric calibration) is the scene radiance. The performance of vision algorithms (e.g., feature detection, photometric investigation, filtering) may necessarily suffers from low contrast, biased image radiance. Lastly dehazing of an image can be advantageous to many vision algorithms, advance image editing and can produce depth information.

### 3. Basic System Architecture

The key theory behind the fusion based technique is that two input images get derived from the original input with the goal of regaining the visibility for every single area of the image in at least one of these derived images. Furthermore, the fusion enhancement technique approximations for every single pixel the desired perceptual established qualities (called weight maps) that command the share of every input to the final outcome. So that the output image can be obtained that satisfy the visibility assumptions (great

presence for every single area in one or more of the inputs) needed for the fusion process. The optical model get examine for this type of degradation. There are two issues that are important, the primary one is the color cast which is released as a result of the airlight influence. The secondary is having less visibility into remote areas because of attenuation and scattering occurrences. The initial derived input signal guarantees an all-natural interpretation of the output, by reducing chromatic casts which can be due to the airlight color, while the contrast improvement measure gives a better global visibility, but mostly in the areas that are misty (i.e. hazy). Fig 1. Shows Outline of the algorithm for fusion based strategy.



**Figure 1:** Outline of the algorithm

However, by using both of these procedures, the produced inputs chosen separately nevertheless have problems with poor visibility. Accordingly, to combine efficiently the information of the produced inputs, their significant characteristics get filtered (in a per-pixel trend), by calculating a few measures (weight maps). Thus, in the fusion framework proposed by Codruta Orniana Ancuti and Cosmin Ancuti, the produced input signals are weighted by three normalized weight maps (luminance, chromatic and saliency) that aim to maintain the areas with great visibility. Eventually, to decrease artifacts released by the weight maps, this fusion based strategy is designed in a multi-scale manner, utilizing a Laplacian pyramid representation of the inputs along with Gaussian pyramid representations of normalized weights. This approach has a few advantages over previous single image dehazing methods. First this strategy works in effective per-pixel calculations, distinct from nearly all the prior approaches [6]-[8] that process patches. A suitable per-pixel strategy minimizes the number of artifacts, because systems that are patch based involve some limits because of the assumption of constant airlight in every area (patch). Generally, the assumptions created by patch-based methods tend not to maintain, and therefore added post-processing measures are needed.

Second, because this method doesn't calculate the depth (transmission) map, the intricacy of this strategy is leaner than all the previous methods. Ultimately, this method works faster which causes it to be appropriate for real time uses. Also compared using the current successful execution of Tarel and Hautiere [8] this method has the capacity to restore a blurred image in much less time, while revealing more visually possible outcomes when it comes to colors as well as details. The approach was examined extensively for a big group of distinct hazy images. Outcomes on various images that are blurred show the effectiveness of this fusion-based approach. The primary conclusion is that this strategy is not as susceptible to artifacts, giving very similar results using the physically-based methods including the means of Fattal [4], He et al. [6], Nishino et al. [21] and Kopf et al. [12]. We consider that this can be a vital advantage of this method.

#### 4. Conclusion

In this way we surveyed various strategies for dehazing the foggy and hazy images. This paper contains an abstract view of various techniques proposed in recent past year for single image dehazing. The investigation demonstrated that better outcomes will be created by the fusion based image dehazing for just about any additional techniques. Our contribution towards this work will surely be helpful for further processing in image dehazing. Through this survey we additionally examined different type of prior/regularization techniques and corresponding optimization approaches for multi-scale fusion and enhancement of haze image's quality.

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