# Pre-Denoising, Deblurring and Ringing Artifacts Removal of Natural, Text and Grayscale Images

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**Abstract –** *we introducing simple yet effective method for image denoising, deblurring removal of ringing artifacts. The three processes mentioned above is done in the order they mentioned. The denoising removes the salt and pepper noise, while deblurring removes the blur. After the deblurring the ringing artifacts are removed. Denoising is done by the method of total variation minimization. There is no need of any edge selection methods for the deblurring. Deblurring done here is a prior based one. The intensity and gradient prior with regularization makes the deblurring clear and perfect. Artifact removal makes the image clearer*

***Key Words***: image denoising, deblurring, ringing artifacts, salt and pepper noise, edge selection methods, intensity and gradient prior

## 1. INTRODUCTION

The images captured right away from the sources are not usually ready for further use. The raw image is needed the processing before the use. Some Image will be too much affected by the noise. The astronomical images usually affected by the salt and pepper noises. The grains we usually see in the television is due to the presence of salt and pepper noise in the frames captured. Presence of this kind of noise ruins the quality of the images and make it less clear. This kind of noises best removed by the total variation minimization. In which the total variation of image details are minimised as much as possible. It removes the unwanted details and preserve the original details. The blurring is another important problem that we can identify in the images. The camera or object motion r defocus causes the deblurring. This also effects the quality of the images. Deblurring is done with intensity and gradient prior with $L_0$ regularization. Ringing artifacts are the ghost like structures present in the image. This makes the image to look like double or triple layered. The Laplacian transforms are used to remove the ringing artifacts. The important of the work is coming in the field of physics and astronomy. The system works with at most accuracy and speed

## 2. IMAGE DENOISING

Image noise is any degradation in the image caused by any kind of external interference or other kind of disturbances. Salt and pepper noise, periodic noise, Gaussian noise, Speckle noise etc. are the usual noise encountered in the images. The salt and pepper noise is the most common noise that we can see often. There are several methods to remove the salt and pepper noise. The best and adaptable method is selected here for the removal of the noise. This is done by analyzing four denoising methods and their algorithms, advantages and dis advantages. The method here chosen for denoising is total variation minimization. The other methods and their dis advantages are tabulated below.

**Table -1:** Methods for Denoising

| Denoising methods | | |
|---|---|---|
| Method f denoising | Advantages | Disadvantages |
| Gaussian Filtering | Optimal for flat part of images | Edges and text are blurred |
| Anisotropic Filtering | Straight parts of images are restored | Flat regions are degraded |
| Neighboring Filtering | Non-local algorithm | No robust |
| Total variation minimization | Straight edges are maintained | Textures can be over smoothed |

The total variation minimization can be used for the process of denoising because the disadvantages that we analyzed here is actually an advantage for deblurring. Smoothing of textures is a boon because the deblurring become easy in this case.

The denoising problem was effectively solved by the Stanley .H. Chan's [2] Lagrangian method of video restoration. The paper solves the Total Variation $L_1$ (TV/LI) problem by introducing the intermediate variables. The TV/LI problem is further subdivided in to F- sub problem, U-sub problem- r-sub problem according to the regularization variable. Stanley's paper deals with the video information. The singe frame algorithm was formulated instead of triple frame. The system well works with the actual TV/LI probem with singe frame.

## 3. IMAGE DEBLURRING

Image deblurring is the process that removes the distortion from any blurry images. It uses the knowledge of how optical system blurs the single point of noise. Simply the deblurring removes the blurring artifacts from the images. Causes of blurring are defocus aberration and motion blur. Defocus aberration occurs because of the imperfection of focusing of the optical system. Motion blur occur because of the apparent motion of the object or camera. The blur is typically modelled as the convolution of PSF (Point Spread Function) And a sharp input image. Output of this function is the deblurred image. In the case of deblurring we only have the deblurred image we have to estimate the actual image. Thus here we deal with the inverse problem. We have to estimate the corresponding PSF for estimating the actual image.

A blurred image y can be formulated as the result of a convolution process with a spatially invariant kernel. Or point spread function,

$$y = x*k + e \qquad (1)$$

Where x and e denote the latent image and noise; k is a blur kernel; and∗is the convolution operator. Given a blurred image y, we estimate the latent image x and blur kernel k with a regularized formulation based on the proposed prior P(x),

$$\min_{x,k} ||x*k-y||_2^2 + \gamma||k||_2^2 + \lambda P(x) \qquad (2)$$

Where the first term is concerned with image data, and the remaining two terms are constraints for the blur kernel and the latent image, with respective weights, γ as well as λ.

Algorithm for deblurring the text images and finding the latent images was done by the steps formulated in the Jinshan Pan's paper for regularized deblurring [1]. The prir based deblurring focusin on the intensity and gradient prior

The algorithm used for the purpose of deblurring is iterative. The blur kernel is estimated first and then the process of deblurring is done. Blur kernel is estimated and the latent image is formed then the process of convolution is dne Algoritm for deblurring is given below

**Deblurring algorithm:**

1. Input the blurred image
2. Initialize the PSF
3. Perform the deconvolution with input image and PSF
4. Find the latent image
5. Estimate PSF of the latent image
6. Again deconvolution with the input image with new PSF
7. Repeat till the threshold to get the final deblurred image

## 4. RINGING ARTIFACTS REMOVAL

The final process done here is the ringing artifact removal. The process removes the ghost like appearance found in the edges of the image. The algorithm used for the removal of ringing artifact is given below.

**Ringing artifact removing algorithm:**

1. Apply Laplacian priors to the estimated kernels
2. Calculate the results using the minimization problem
3. Perform the ringing suppression by the bilateral filtering
4. Subtract the filtered image from the lateral image

## 5. RESULTS

The results obtained from the MATLAB code corresponding to the above algorithms are shown below

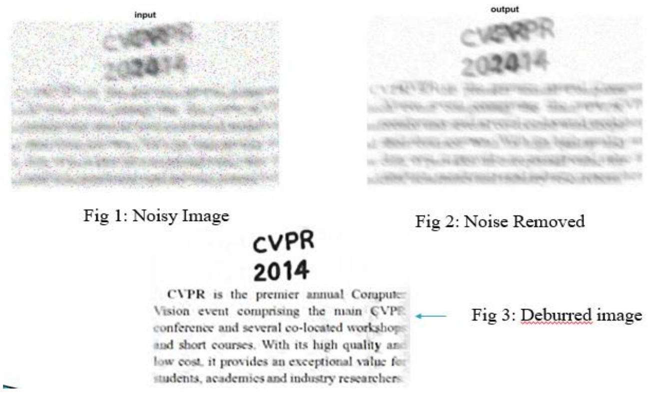


Fig-1: Obtained result image set (screenshot)


Fig-2: Obtained result image set 2(screenshot)

## 3. CONCLUSION

The burred noisy artifact affected images was clearly denoised, deblurred and artifacts removed by executing the above set of algorithms. The speed for deblurring was found high in black and white images than the colour image. Lots of future works can be added to the proposed work such as image object detection. Experimental results show that proposed algorithms does not need any edge selection methods or image pre-processing. The proposed algorithm can also be extend to deblur the natural images with low illumination.

## REFERENCES

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## BIOGRAPHY

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