International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

A Novel Approach For Removal of Mixed Noise Using Genetic Algorithm

Malvika[1], Harsharndeep Singh[2]

[1]Department of Computer Science & Engineering, BFCET, Bathinda, India

[2]Department of Information Technology, BFCET, Bathinda, India

Abstract: ***Median filters are favored for removing impulse noise due to their straight forwardness and less computational many-sided quality. In this paper, a new hybrid technique to removing Gaussian, Salt and pepper noise is proposed for colored images. Broad reenactments have been completed on an arrangement of standard low scale pictures and the best in class median filter variations are looked at as far as the outstanding picture quality appraisal measurements in particular mean square errors. Proposed system is evaluated on various parameters like MSE and PSNR. Performance of the proposed system is also compared with the performance of the existing systems and it is evaluated that the proposed system generates improved results than that of existing systems on various images collected from various standard datasets.***

Keywords: Image denoising; impulse noise; impulse detector; spatial domain techniques; median filter

1. Introduction

A Image is characterized as the two dimensional capacity, f (x,y), x and y are spatial directions and the abundance off f(x,y) at any pair of the directions is known as the power or dark level of a picture by then. At the point when the x, y and the power estimations of f(x,y) are limited and discrete amounts and the picture is known as an advanced picture. Advanced picture is comprises of a limited number of components, each of that have the specific area and worth. These components are alluded to as picture components, picture components and pixels. Subsequently computerized picture preparing alludes to the handling of advanced pictures by method for advanced PC.

The range of picture examination likewise called picture comprehension is in the middle of picture preparing and PC vision. There are no obvious limits in the continuum from picture handling toward one side to PC vision at the other. Be that as it may, a valuable worldview is to consider three sorts of electronic procedures in this continuum: low, mid, and abnormal state forms. Low-level procedures include primitive operations, for example, picture pre-handling to lessen clamor, contrast improvement, and picture honing. A low-level procedure is described by the way that both its sources of info and yields regularly are pictures. Mid-level procedures on pictures include assignments, for example, division (apportioning a picture into areas or items), portrayal of those articles to lessen them to a structure reasonable for PC handling, and arrangement (acknowledgment) of individual items. A mid-level procedure is described by the way that its sources of info for the most part are pictures, yet its yields are qualities separated from those pictures e.g., edges, forms, and the personality of individual articles. At last, abnormal state preparing includes understanding a troupe of perceived items, as in picture examination, and, at the most distant end of the continuum, playing out the psychological capacities ordinarily connected with human vision. Key strides in computerized picture handling are picture securing, picture improvement, picture rebuilding, shading picture preparing, pressure, picture division and acknowledgment. Among them picture division has turned out to be exceptionally important. An significance of division is, division is the principal stage in any endeavor to investigate or decipher a picture naturally. Division gives crosses over any barrier between low-level picture preparing and abnormal state picture handling.

The point of computerized picture handling is to enhance the potential data for human translation and preparing of picture information for capacity, transmission, and representation for self-sufficient machine discernment. The nature of picture debases because of defilement of different sorts of noise. Added substance white Gaussian noise, Rayleigh clamor, Impulse clamor and so on degenerate a picture amid the procedures of procurement, transmission and gathering and capacity and recovery. For an important and helpful handling, for example, picture division and article acknowledgment, and to have great visual showcase in applications like TV, photograph telephone, and so forth., the obtained picture signal must be without clamor and made deblurred. Picture deblurring and picture denoising are the two sub-regions of picture rebuilding. In the present exploration work, endeavors are made to propose proficient channels that smother the clamor and protect the edges and fine points of interest of a picture quite far in extensive variety of noise thickness.

2. Noise in Digital Images

The essential wellsprings of noise in computerized pictures emerge amid picture obtaining and/or transmission. The execution of picture sensors is influenced by an assortment of elements, for example, natural conditions amid picture acquisitions, and nature of detecting components themselves. Pictures are adulterated amid transmission chiefly because of electromagnetic impedance in a channel utilized for transmission. For instance, a picture transmitted utilizing a remote system may be ruined in light of helping or other climatic unsettling influences. Noise that may degenerate a picture sign is the spot Noise (SN). In some

biomedical applications like ultrasonic imaging and a couple building applications like union gap radar (SAR) imaging, such a Noise is experienced. The SN is a sign ward noise, i.e., if the picture pixel greatness is high, then the Noise is likewise high. The Noise is multiplicative on the grounds that at first a transmitting framework transmits a sign to the article and the reflected sign is recorded. At the point when the sign is transmitted, the sign may get defiled with added substance noise in the channel. Because of shifting reflectance of the surface of the article, the reflected sign size changes. So additionally the Noise changes since the noise is likewise reflected by the surface of the item. Noise greatness is, in this manner, higher when the sign size is higher. Along these lines, the dot noise is multiplicative in nature. There are diverse sorts of noises which degenerate a picture. The noise like Gaussian Noise, Rayleigh Noise, Gamma Noise, Speckle Noise and Impulse Noise are very regular.

3. Literature Survey

(Yang and Lee, 2015) proposed a powerful denoising calculation for Poisson-Gaussian noise is proposed utilizing the form let change, shrouded Markov models and Noise estimation in the change area. Creator supplements the calculation by cycle turning and Wiener separating for further enhancements. The HMM calculation receives an autonomous blend model to coordinate the non-Gaussian nature of the form let coefficients and embraces shrouded Markov models to portray the key conditions between the shape let coefficients. Moreover, this technique gauges ideal HMM parameters utilizing the EM calculation. The Poisson Gaussian noise change in form let area is acquired by sifting the Noise fluctuation of every pixel with the square of the shape let channel coefficients. Utilizing the evaluated HMM parameters of the sign and Noise fluctuations, the sign ward noise is diminished through Bayesian estimation.

(Marukatat, 2015) proposes a nearby force dissemination evening out (LIDE) technique for picture improvement. LIDE applies the possibility of histogram evening out to parametric model keeping in mind the end goal to improve a picture utilizing nearby data. Beyond any doubt neighborhood improvement strategies may not be reasonable for all cases. Notwithstanding, we trust that if nearby upgrade is required, the proposed strategy speaks to a decent and fascinating contrasting option to AHE. At last, both AHE and LIDE can deal with the adjustment in lighting condition to some degree. In reality, data contained in excessively dim or too splendid is as are not adequate for accurately upgrading these areas. Noise enhancement can be effectively seen on these areas. Shine protection requirement could be utilized to cover such relic. Be that as it may, a superior approach to handle this case would be to wire data from pictures acquired under various exposures. We trust that the neighborhood blend model utilized as a part of LIDE may give an intriguing technique to fusioning multi-presentation pictures.

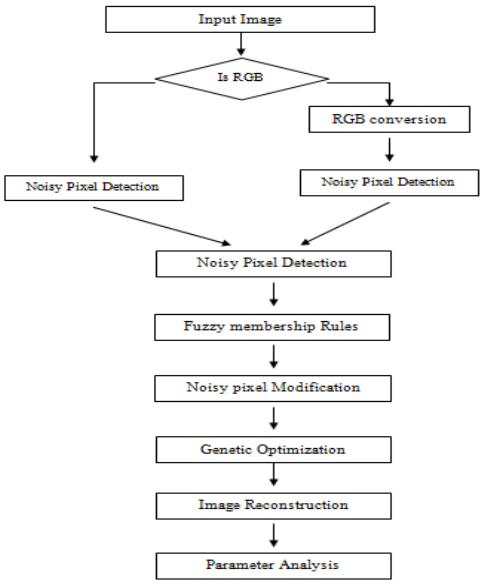
(Nasser Eslahi 2015) The inspiration of this paper is to present a novel structure for the reclamation of pictures adulterated by blended Gaussian-drive noise. To this point, initial, a versatile curve let thresholding rule is proposed which tries to adaptively expel the irritations showed up amid denoising process. At that point, another factual regularization term, called joint versatile measurable earlier (JASP), is set up which authorizes both the nearby and nonlocal factual textures, at the same time, in a brought together way. Moreover, a novel procedure for blended Gaussian in addition to drive Noise expulsion utilizing JASP as a part of a variety plan is produced we allude to it as De-JASP. To productively comprehend the above variety plot, an effective exchanging minimization calculation is created taking into account split Bregman iterative structure. Broad trial comes about show the adequacy of the proposed strategy contrasting and the present best in class strategies in blended Gaussian-motivation noise evacuation.

Wei Fan et al [2015] "Middle Filtered Image Quality Enhancement and Anti-Forensics by means of Variational Deconvolution" Median sifting makes the most of its prominence as a broadly received imagedenoising and smoothing instrument. It is additionally utilized by hostile to measurable scientists as a part of masking hints of other picture preparing operations, e.g., picture resampling and JPEG pressure. This paper proposes an image variational deconvolution structure for both quality improvement and against legal sciences of middle separated (MF) pictures. The proposed streamlining based system comprises of a convolution term, a loyalty term as for the MF picture, and an earlier term. The main term is for the estimate of the middle separating process, utilizing a convolution part. Our strategy can serve as a MF picture quality improvement procedure, whose viability is accepted by investigations led on MF pictures which have been already "salt& pepper" noised. Moreover, the attainability of hiding picture resampling follows and JPEG blocking antiquities is shown by tests, utilizing the proposed middle separating hostile to measurable strategy.

(Khan, U. Khan, Kong, and Kittaneh, 2016) proposed a standard methodology is to utilize dispersion for picture smoothing. In this paper, the entropy-change for an anisotropic dissemination of a unique mark picture is examined. a special pinnacle is found, connected with obscuring of the predominant structure. This gives territory on capable halting guideline for the anisotropic dispersion prepare, whose objective is to smooth the picture without aggravating the auxiliary data. The numerical results approved the presence of the limit between under-smooth and over-smooth locales of anisotropic dispersion.

4. Proposed Methodology

In the proposed work noise removal has been done by using detection of noisy pixels available in the image. Noise image has been created using mixed noise model. These two types of noises have been added to image to convert image into noisy image so that data can be used for filtration process. In the process of noise removal various steps must be carried out that has been explained below.



A. Load Input Image

Input image has been loaded to the system using image reader. Image has been stored in 2-D color image matrix. A represents image that has been input to the system using reader function. The image is decomposed into three different colors. This decomposition of the image has been done for conversion of the image into three different colors.

B. RGB Conversion

Input image has been combination of three true colors that are red, green and blue colors. On the basis of these colors image has been combined to obtain a color image of different pixel intensity. These colors have been divided into different regions for description red, green and blue colors.

R=A (:, :, 1)

After the extraction of three colors the conversion has been done that converts RGB images to grayscale by eliminating the hue and saturation information while retaining the luminance.

C. YCBR Conversion

YCBCR model has been used for color image to divide Image into different regions on the basis of different model specifications. This model divide image into intensity levels and luminance and chrominance levels.

D. Image Noise Addition

After selection of input image noise has been added to the image for conversion of image into noisy image. In the proposed model mixed noise has been added to the image. On the basis of mixed noise Gaussian and salt & pepper noise has been added to the image.

Salt and Pepper Noise

Salt-and-pepper noise adds certain amount of the pixels in the image is either black or white. Salt-and-pepper noise can, e.g., be used to model defects in the CCD or in the transmission of the image. Given the probability that a pixel is corrupted, we can introduce salt-and-pepper noise in an image by setting a fraction of r/2 randomly selected pixels to black, and another fraction of r/2 randomly selected pixels to white.

Gaussian Noise

Principal sources of Gaussian noise in digital images arise during acquisition e.g. sensor noise caused by poor illumination and/or high temperature, and/or transmission e.g. electronic circuit noise. In digital image processing Gaussian noise can be reduced using a spatial filter, though when smoothing an image, an undesirable outcome may result in the blurring of fine-scaled image edges and details because they also correspond to blocked high frequencies.

Mixed Noise

In the proposed work mixed noise has been used for noise addition process. In the proposed work salt and pepper noise and Gaussian noise has been added to the system. Both type of noise has been added to the system using different variance factors. Variance factor decided percentage of pixels that must be modified of the image.

In the proposed work noisy pixel detection has been done using maximum and minimum based threshold value. In the proposed work 3 * 3 window has been moved over the image. Image pixels value has been computed using different values of row and Coolum of the window size. Image pixels has been denoted by x_ij and i and j are the values depends upon image size that is r*c. 1<i>r and 1<j>c are the values for I and j.

W_ij={x_(i-1j-1,)…….,x ij,…….x_(i+1j+1)}

W represents window size that has been moved over the image for noisy pixel detection. T1 and T2 are threshold values that have been implemented over the image for detection of noisy pixel. On the basis of detection of noisy pixel image pixel weightage has been defined for noise cancelation. These weightage parameters are known as fuzzy membership parameters for image noise cancelation.

Y (i-f,j-f) = sum(sum(F.*x))/sum(sum(F));

This function has been used for construction of noise pixel cancelation. Where F denotes fuzzy membership weightage value and x denotes pixel values of the noisy image.

After cancelation of the noise genetic operator has been implemented on the image so that noise cancelation can be optimized. Genetic algorithm use different selection, crossover and mutation operators for noise cancelation optimization process.

E. Genetic Algorithm

Genetic algorithm is a nature inspired approach for noise removal in the image processing. This approach uses various operators for noise cancelation. In this process search space has been used for selection of the initial population. Once these functions are defined GA proceeds to initialize a population of solution randomly, then it is improved by repeated application of GA operators like selection, crossover and mutation

F. Search Space

The space for all possible feasible solutions is called search space. Each solution can be marked by its value of the fitness of the problem. Looking for the solution means looking for either maximum or minimum in search spaces. The search space can be known by the time of solving a

problem and we generate other points as the process of finding the solution continues

G. Selection

After search space initialization various chromosomes have been selected from the search space. Chromosome fitness has been evaluated using fitness evaluation function. This function selected randomly best fit chromosomes from search space.

H. Crossover And Mutation

New solution candidates are created by swapping two arbitrarily chosen sub trees from two parent's trees. This corresponds to exchanging quadrants of the same size but from potentially different image. Thus crossover acts on sub trees at the same level, possibly creating homogeneous branches. The Maximal tree depth, of course, is limited by the image, size. A mutation operator has been introduced which arbitrarily changes the tree leaf values, and finally, a local optimization operator was added which tunes, by Direct Binary Search, a given number of best candidates after each iteration. After implementation genetic operator optimized regions of the image has been reconstructed to form new enhanced noise free image.

5. Results and Discussion

In the proposed work whole image pixels have been used for detection of noisy pixels available in the image. In the proposed work noise pixel detection has been done using low threshold parameters. On the basis of these threshold value noisy pixels has been detected in the image. After removal of noisy pixels available in the image using fuzzy weightage factor. Weightage factor has been used for modification of noisy pixels available in the image and pixel has been modified using different neighbor pixel value information. After this process genetic algorithm has been implemented for noise cancelation optimization. Genetic algorithm uses various parameters for initialization of genetic approach.

Table 4.1: PSNR value of image filtered at different noise percentage

Salt & pepper Noise %	Gaussian Noise %	PSNR in dB (Fuzzy based)	PSNR in dB (Purposed)
5	5	26.79	31.83
7	5	26.63	31.65
9	5	26.54	31.56
11	5	25.65	30.82
13	5	26.45	31.45
15	5	26.68	31.67
17	5	26.47	31.51
19	5	27.71	32.55
21	5	25.46	30.62
23	5	27.78	32.58

This table represents value of peak signal to noise ratio of the image at different percentage of noise levels. Noise percentage in the image has been changed and peak signal to noise ratio at different percentage levels has been measured.

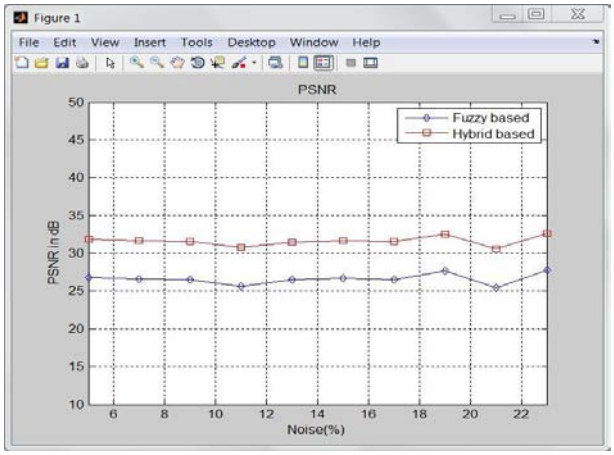


Figure 4.1: PSNR graph for proposed and fuzzy based filter

This figure represents graph between PSNR values of filter image using proposed and fuzzy membership rules based filter. On the basis of these graphs one can conclude that proposed approach provide high PSNR as compare to fuzzy based filter.

Table 4.2: MSE value of image filtered at different noise percentage

Salt & pepper Noise %	Gaussian Noise %	MSE (Fuzzy based)	MSE (Purposed)
5	5	11.70	10.62
7	5	11.87	10.85
9	5	12.00	10.98
11	5	13.31	12.04
13	5	12.48	11.38
15	5	11.81	10.82
17	5	12.09	11.04
19	5	10.53	9.72
21	5	13.63	12.37
23	5	10.45	9.68

This table represents value of mean square error of the image at different percentage of noise levels. Noise percentage in the image has been changed mean square error at different percentage levels has been measured.

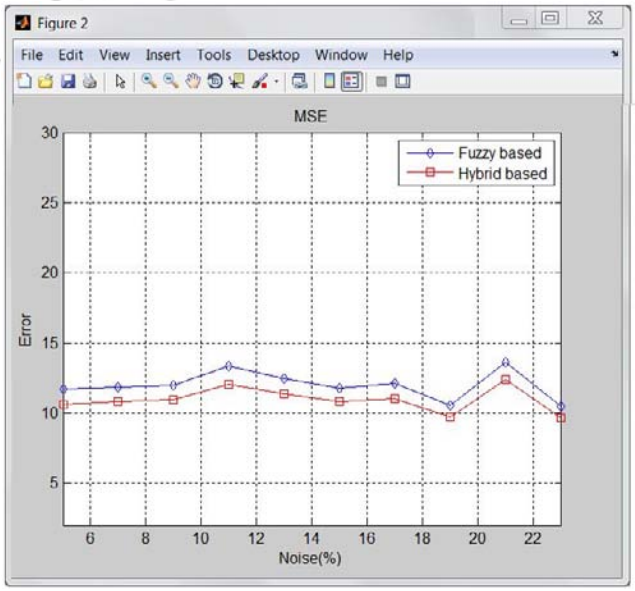


Figure 4.2: MSE graph for proposed and fuzzy based filter

This figure represents graph between PSNR values of filter image using proposed and fuzzy membership rules based filter. On the basis of these graphs one can conclude that proposed approach provides high PSNR as compare to fuzzy based filtered.

6. Conclusion and Future Scope

Image processing is the process for execution of different operations on the images for execution of different filters. In the process of image enhancement noise removal is first step for image enhancement. Various types of noises are available in the image due to light, atmospheric absorption. Gaussian, impulse and passion noises are available in the images that must be removed for image enhancement.

In the proposed work mixed noise detection and removal process has been done using hybrid fuzzy and genetic algorithm based approach has been used for noise removal in the image. Fuzzy based filter has been used for detection of noisy pixels available in the image. Noisy pixels have been detected using threshold value in the 3*3 window. This window use neighbor pixel information for noise detection in the image. After detection of noisy pixels available in the image noise removal has been done using fuzzy based weightage parameters. That has been measured for removal of noisy pixel available in the image using pixel modification approach. After pixels have been modified genetic operators have been implemented on the image so that selection, crossover and mutation process can evaluate new pixel values for image data. Genetic approach computes best fitness pixel values and replaces these values with old pixel values. Image component have been reconstructed for new image formation.

After reconstruction of image different parameters have been analyzed for performance evaluation of proposed system. These parameters are PSNR and MSE. On the basis of these parameters filtering approach performance has been measures. Highest the PSNR and minimum MSE represents that proposed approach provides much better results than previous used approaches.

References

[1] I. Irum, M. Sharif, M. Raza, and S. Mohsin, “A Nonlinear Hybrid Filter for Salt & Pepper Noise Removal from Color Images,” J. Appl. Res. Technocoloredl., vol. 13, no. 1, pp. 79–85, 2015.
[2] J. M and N. K. Narayanan, “An Efficient Mixed Noise Removal Technique from Gray Scale Images using Noisy Pixel Modification Technique,” in IEEE ICCSP, 2015, pp. 336–339.
[3] M. Afifi and K. F. Hussain, “MPB: A modified Poisson blending technique,” Springer Comput. Vis. Media, vol. 1, no. 4, pp. 331–341, 2015.
[4] V. Murugan and T. Avudaiappan, “A Comparative Analysis of Impulse Noise Removal Techniques on Gray Scale Images,” Int. J. Signal Process. Image Process. Pattern Recognit., vol. 7, no. 5, pp. 239–248, 2014.
[5] K. Malik and B. Smolka, “Improved Bilateral Filtering Scheme For Noise Removal In Color Images,” in Polish-Japanese Institute of Information Technology Bilateral Filter, 2014, pp. 2–8.
[6] B. C. Patel and G. R. Sinha, “Gray level clustering and contrast enhancement (GLC–CE) of mammographic breast cancer images,” Springer CSI Trans. ICT, vol. 2, no. 4, pp. 279–286, 2015.
[7] B. M. Jabarullah, S. Saxena, and C. N. K. Babu, “Survey on Noise Removal in Digital Images,” IOSR J. Comput. Eng., vol. 6, no. 4, pp. 45–51, 2012.
[8] S. Ansari and K. Mangla, “Eliminating Noise from Mixed Noisy Image by using Modified Bilateral Filter,” IJARCET, vol. 4, no. 5, pp. 2327–2332, 2015.
[9] S. Yang and B.-U. Lee, “Poisson Gaussian Noise Reduction Using the Hidden Markov Model in Contourlet Domain for Fluorescence Microscopy Images,” Springer PLoS ONE, vol. 10, no. 9, p. e0136964, 2015.
[10] R. Soman and J. Thomas, “A Novel Approach for Mixed Noise Removal using ‘ ROR ’ Statistics Combined WITH ACWMF and DPVM,” Int. J. Comput. Appl., vol. 86, no. 17, pp. 11–17, 2014.
[11] H. Gómez-moreno, P. Gil-jiménez, S. Lafuente-arroyo, R. López-sastre, and S. Maldonado-bascón, “A ‘“ Salt and Pepper ”’ Noise Reduction Scheme for Digital Images Based on Support Vector Machines Classification and Regression,” Hindawi Sci. World J., vol. 2014, no. 5, 2014.
[12] V. Crnojević and N. Petrović, “Impulse Noise Filtering Using Robust Pixel-Wise S-Estimate of Variance,” EURASIP J. Adv. Signal Process., vol. 2010, no. 1, p. 830702, 2010.
[13] M. J. Tanakian, M. Rezaei, and F. Mohanna, “Digital video stabilizer by adaptive fuzzy filtering,” EURASIP J. Image Video Process., vol. 2012, no. 1, p. 21, 2012.
[14] S. Marukatat, “Image enhancement using local intensity distribution equalization,” EURASIP J. Image Video Process., vol. 2015, no. 1, p. 31, 2015.
[15] T. M. Khan, M. A. U. Khan, Y. Kong, and O. Kittaneh, “Stopping criterion for linear anisotropic image diffusion: a fingerprint image enhancement case,” EURASIP J. Image Video Process., vol. 2016, no. 1, p. 6, 2016.
[16] Zhu Lin “A nonlocal means based adaptive denoising framework for mixed image noise removal” IEEE International Conference on Image Processing, pp. 454 – 458, 2013.
[17] Jielin Jiang “Mixed Noise Removal by Weighted Encoding With Sparse Nonlocal Regularization” IEEE International Conference on Image Processing,pp. 2651 – 2662, Volume:23, Issue: 6,2014.
[18] PeixianZhuang “Robust mixed noise removal with non-parametric Bayesian sparse outlier model” IEEE International Conference on Multimedia Signal Processing,pp. 1 – 5,2014.
[19] Jayasree M. “An efficient mixed noise removal technique from gray scale images using noisy pixel modification technique” IEEE International Conference on Communications and Signal Processing,pp. 0336 – 0339,2013.
[20] DjordjeBaljozovic “Mixed noise removal filter for multi-channel images based on half space deepest location” IEEE International Conference on IET Image Processing,pp-310 – 323,2013.

[21] Jian Zhang "Exploiting Image Local and Nonlocal Consistency for Mixed Gaussian-Impulse Noise Removal" IEEE International Conference on Multimedia and Expo,pp. 592 – 597, 2012
[22] Nasser Eslahi "Mixed Gaussian-impulse noise removal from highly corrupted images via adaptive local and nonlocal statistical priors" IEEE International Conference on Machine Vision and Image Processing,pp. 70 – 75, 2015M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.