ISSN : 3107 - 4308

EMERGING TRENDS IN DIGITAL TRANSFORMATION

Published By :
D3 Publishers

VOLUME-1 ISSUE-1,
INAUGURAL EDITION

ETDT

ETDT

Emerging Trends in Digital Transformation

Volume-1, Issue-1, April 2025 ISSN: **3107-4308** *Paper ID:* ***ETDT-V1-I1-04***

ENHANCING DIGITAL IMAGES THROUGH CONTRAST ADJUSTMENT NOISE REDUCTION AND MOTION BLUR REMOVAL

[#1]Mr. Boorla Santhosh,
Research Scholar,
Department of ECE,
Shri JJT Universirty Rajasthan, India.
boorlasanthosh@gmail.com

[#2]Dr. Anupama Desh Pande,
Supervisor,
Department of ECE,
Shri JJT Universirty Rajasthan, India.
dranupamaece@jjtu.ac.in

ABSTRACT: Digital photography and intelligent transportation systems are only two of many applications that rely on image augmentation to improve visual quality. Improved visibility and brightness can be achieved through the use of contrast augmentation techniques such as adaptive histogram and histogram normalization. Filters such as median, Wiener, and MATLAB-based algorithms effectively remove unwanted distortions, making noise reduction an essential component. Resolving motion blur and improving picture sharpness are both possible with the same filtering methods. This research shows a GUI that combines all of these improvement features into one spot. With only one input picture, users may simply reduce noise, adjust contrast, and fix motion distortion. Through the integration of complex processing techniques, this study speeds picture improvement for numerous applications.

KEYWORDS:Linear Filter, Image enhancement, noise removal, Histogram equalization, Contrast enhancement, image processing.

1. INTRODUCTION

Computer image processing allows planetary scientists to improve pictures of Mars, Venus, and other heavenly bodies. Improving a photo's aesthetic appeal is a common goal of image editing. Improving the quality of an image in order to make its contents more noticeable is called image enhancement. Improving the image's quality is necessary to make it better than the original for its intended use.

Bringing up details that were hidden in low-contrast photographs is the main goal of image enhancement. It is possible to eliminate dithering, decrease picture noise, and improve sharpness. Many methodologies begin with contrast enhancement. These include, but are not limited to, those dealing with voice recognition, texture synthesis, computer graphics, intelligent transportation systems, digitization, military applications, medical applications, industrial applications, and multidimensional systems. In terms of seeing the world around us, sight is far and away the most potent of the five senses.

Smell, taste, and touch round up the five senses.

The visual pallium receives almost 99% of the brain's processing power. Because of this, changing the image is crucial. The mid-gray level becomes the brightest part of the image since AHE always adds artifacts and changes the contrast, regardless of the original image. This leads to the production of subpar processed photos with similar histograms. The presence of noise in the final image following image acquisition indicates that an error has occurred. Consequently, the provided image gives an inaccurate depiction of the relative brightness of each pixel.

The term "noise reduction" describes the process of cleaning up a signal or picture by

DOI : https://doi.org/10.5281/zenodo.16900459

eliminating unwanted noise. A thorough comprehension of the input signal is crucial, as the nature of the signal dictates the expected result; hence, there is conceptual overlap between noise reduction and signal processing.

The sensor takes a raw picture, which is then processed through a series of filters to improve it. We get the finished product as a result. Removing noise from digital color photos is the biggest challenge. Various methods exist, depending on the technology used to create the image, for adding noise to it. Each pixel in a photograph records the average amount of light that was gathered during the exposure time.

Edge sharpness is improved when the subject is motionless and fully focused during the exposure. When individual cells, or pixels, in a picture absorb light from different directions at the same time, the resulting image becomes blurry. Usually, the margins of images are not very clear. Photos with a lot of fog show a lot less detail. Finding and piecing together pieces of blurry photos can yield this data. To better grasp the concept, try out the motion blur photography practice.

The topic must be outside the depth of field of the lens for the image to appear sharp or in focus. Blurring occurs because light enters each pixel from all directions when the shutter is open. In most cases, motion blur occurs when the exposure period is greater than the speed of movement. Identifying motion in blurry photos is our primary objective. Blurs brought about by the camera's movement will also be investigated, in addition to blurs induced by the subject or background. That is to say, there ought to be multiple points of interest inside the scene. The end result will have better fluidity, less noise, and more contrast.

IMAGEENHANCEMENT

These two forms of picture enhancement are easily distinguishable from one another.

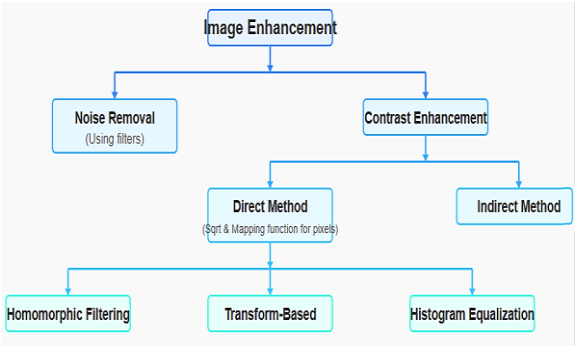


Fig1:Technique for managing one's reputation

Adjustments to blur, sharpness, brightness, and noise reduction can all enhance a picture. What defines "good" picture augmentation is currently unclear, and we lack a systematic framework to address this.

NoiseRemoval

It is a way to alter photos such that unwanted parts are no longer there. Applying this information to the photograph or image happens during its capture. A number of factors, including background noise, a faulty part, or an operator without enough training, might cause noise-capturing equipment to miss some sounds.

Contrastenhancement

Hue and brightness are required for contrast comprehension. Improving pictures so they can

DOI : https://doi.org/10.5281/zenodo.16900459

be used by automated image processing systems and made more human-readable is the main goal.

2. HISTOGRAMEQUALIZATION

The goal of this method is to change the look of a picture such that it serves a specific function. One method that works well to increase contrast is histogram equalization (HE). By considering the probability of each gray level occurring in the image, the HE mechanism converts the grayscale into a uniform histogram. In many cases, the HE method can make an image's dynamic range and random distribution more uniform. How strong the HE is depends on how dark the original image is. At lower contrast levels, sharpening takes place. Because of how easy it is to use, anybody can do it. It can be used for texturing, medical image processing, and voice r

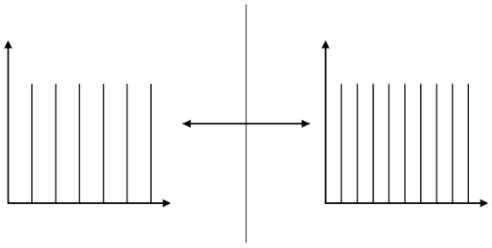


Fig2:Histograms that are analogous

Advantage:

Using an understandable invertible function improves this approach. If one knows how to normalize a histogram, they can get it back to the original.

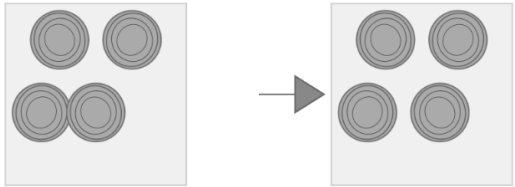
Disadvantage:

The method's oversimplified nature is its worst flaw. It will make the background noise louder while downplaying important details.

3. FILTERSROLEIN DENOISING

Filtering images eliminates the haze. A few instances of operational visual noise are as follows: This image shows the spectrum of ultrasound scans, from very bright to very dark.

The average, median, and mean filters are among the many available options. In order to detect compromised image pixels, the filter uses spatial processing methods. Through comparison with nearby pixels, it determines which pixels are most likely to be random noise. You can change the level of comparison and the neighborhood's dimensions. A pixel is considered impulse noise if it is not spatially aligned with its comparable neighbors, giving it a visually distinct appearance. To fix this, just swap out the problematic pixels for the median value of nearby pixels that are noise-free.



Noise image after applying our filter

Fig3:before and after the installation of a screen

DOI : https://doi.org/10.5281/zenodo.16900459

4. MOTIONBLURRING

As the subject or the camera moves during the exposure, the image's clarity decreases. Due to rapid movement, blurring can be caused by motion. But, in order to distinguish the blur in a motion-blurred picture, specific traits can be employed. This provides guidance on how to identify moving objects in a still picture. Since there is a direct correlation between motion and PSF values, PSF is the primary factor that determines motion blur. Linear, or space-invariant, motion blur is the most basic and studied type. The concepts of motion and motion blur are actually a little more nuanced than this oversimplified depiction suggests. Reconstructing blurry images is a major challenge, particularly when trying to identify and capture criminals. A snapshot taken after a bombing or hit-and-run might help identify a person or their license plate. A thorough understanding of the blurring function is required for accurate distortion image recovery. These mistakes can have been caused by camera movement during the production. The pixels are scattered throughout the motion's course during the duration of the camera's exposure. During the exposure period, the image is gradually developed, turning a single pixel from each area into multiple separate pixels. The term for these fuzzy pictures is "motion haze." The idea that mathematical models may be used to recreate images with blurred motion is a common misconception.

$$g=f*h+n, \quad (1)$$

A noise vector IZ, a linear shift-invariant point spread function (h), and the original, unaltered picture f are all used in this context. There are a number of ways to get f from g after the PSF is known. When pictures are blurred due to motion, the Point Spread Function (PSF) is typically uncertain in real-world circumstances. As a result, techniques for extracting PSFs from distorted images were developed, suggesting that restoration should be based on PSFs. In order to create a deblurring filter, this study uses an ADMM (alternating direction method of multipliers) algorithm that is subject to a total variation constraint.

5. RESULTS

In order to create the GUI, we used MATLAB. You can change the image's brightness and histogram. Adaptive histogram equalization, picture histograms, and histogram equalization are various picture processing approaches. Following this, you can apply the median filter, the Wiener filter, our custom motion blur filter, and our custom noise filter.

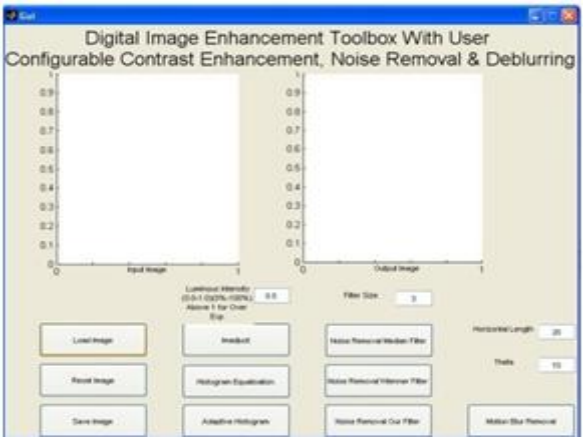


Fig4:MATLAB was used to create the user interface.

DOI : https://doi.org/10.5281/zenodo.16900459

Volume-1, Issue-1, April 2025 ISSN: **3107-4308** *Paper ID:* ***ETDT-V1-I1-04***

Fig5:Every new image must be better than the previous one.

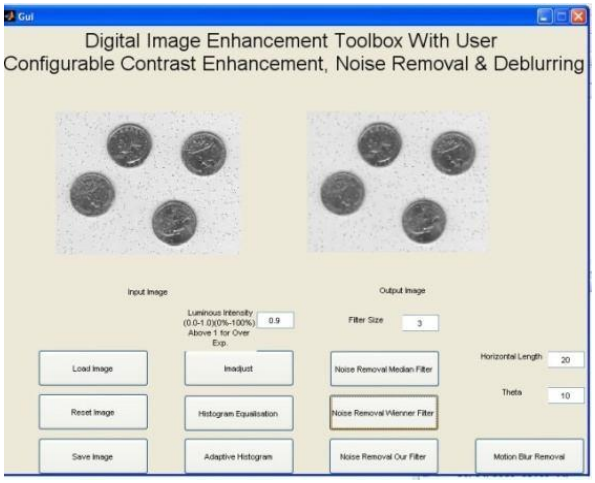


Fig6:A champion filter can be used to reduce noise.

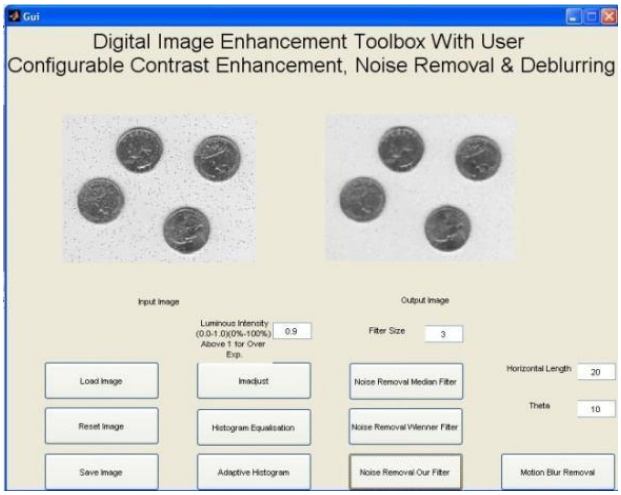


Fig7:The research led in the creation of an entirely new display.

DOI : https://doi.org/10.5281/zenodo.16900459

Fig8:Complete variation improved image clarity.

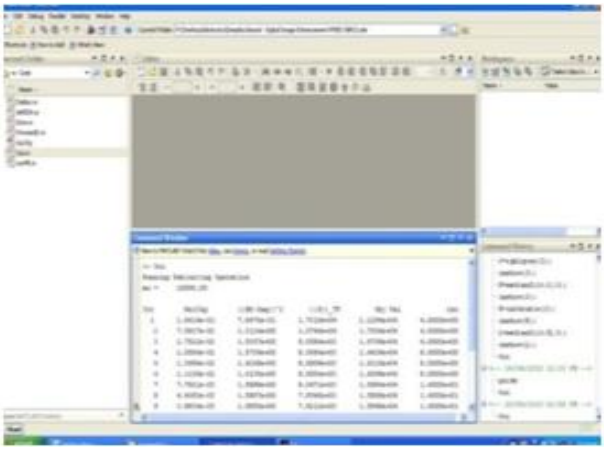


Fig9:defining the duration of the motion delay in the backdrop

6. CONCLUSION

Visual brightness, contrast, and clarity have been greatly enhanced with the creation of a new user interface. Two methods that improve the visual quality of photographs are adaptive histogram equalization (AHE) and histogram equalization (HE), which both work to increase contrast and sharpness. Adaptable variations of histogram equalization also produce remarkable results, however when compared directly, histogram equalization is the most successful method. Reducing noise effectively is a prerequisite for improving image quality with Wiener and median filters. Wearing a mask allows for more precise adjustments, leading to better results. In addition, there is a specific button on the interface that may be used to remove blur caused by motion, which results in clear photographs. Because each enhancement option is seamlessly integrated into the GUI, users may easily enhance their photographs with only one click.

REFERENCES

[1]. AmitKamra,KanchanRani,"AnImproved MethodforImageEnhancementUsingFuzzy Approach",InternationalJournalofComputerScienceandInformationTechnology&Security(IJCSITS),ISSN:2249-9555Vol.2,No.6,December2012

[2]. Rajesh Garg, Bhawna Mittal and Sheetal Garg, "Histogram Equalization Techniques ForImage Enhancement", International Journal of Electronics&Communication

DOI : https://doi.org/10.5281/zenodo.16900459

Technology,(IJECT)Vol.2,Issue1,March 2011

[3]. PavithraP,RamyashreeN,ShruthiT.V,"ImageEnhancementbyHistogramSpecificationUsingMultipleTargetImages",International JournalofElectronics&CommunicationTechnology,(IJECT)Vol.1 Issue2,3,4;2010

[4]. V.Jayaraj,D.Ebenezer,K.Aiswarya,"HighDensitySaltandPepperNoiseRemovalinImagesusingImprovedAdaptiveStatisticsEstimationFilter"(IJCSNSInternationalJournalofComputerScienceandNetworkSecurity, vol9,no. II)[November, 2009].

[5]. T.Chen,H.RWu,"Adaptiveimpulsedetectionusingcenterweightedmedianfilters,"IEEESignalProcessingLetters,200I(1),vo1.8,pp.I3.

[6]. M.Basu.Gaussianbasededge-detectionmethods–Asurvey.IEEETrans.Syst.ManandCybern.-PartC:Appl.Reviews,32(3),pp.252260,2002.

[7]. YuanfengJin,TinghuaiMa,DonghaiGuan,WeiweiYuanandChengminHou,"Reviewofapplicationsofpartialdifferentialequationsforimageenhancement", ScientificResearchandEssaysVol. 7(44),pp. 3766-3783, 12November, 2012

[8]. NyamlkhagvaSengeeandHeungKookChoi,"BrightnessPreservingWeightClusteringHistogram Equalization",IEEETransactionsonConsumerElectronics,Vol.54,No. 3,AUGUST2008Levin.Blindmotiondeblurringusingimage statistics.In*NIPS*,2006.

[9]. Levin,R.Fergus,F.Durand,andW.T.Freeman."Imageanddepthfromaconventionalcamerawithacodedapertures"*ACMTrans.OnGraphics(Proc.SIGGRAPH)*,2007.

[10]. M. Figueiredo and R. Nowak, "A bound optimization approach to wavelet-based image deconvolution," in *IEEEInternational Conference ImageProcessing-ICIP'05*, 2005,vol.II,pp.782{785.

DOI : https://doi.org/10.5281/zenodo.16900459