



Image Detection And Restoration

¹Humera Taskeen, ² Dr.Savitha Patil,

¹Student, ² Assistance professor,

¹Artificial Intelligence & Data Science, ^{2,3}Computer Science and Engineering,

¹Sharnbasva University, Kalaburagi, Karnataka, India

Abstract: Image restoration and enhancement are major areas of digital image processing aimed at improving the quality of degraded images and increasing their visual appeal for better human or machine interpretation. Restoration techniques consume issues such as noise, noise blur and distortion are addressed, using blurring and denoising techniques to recover the original image. Image enhancement techniques focus on improving parts of the image, using techniques such as contrast adjustment and sharpening. Recent advances use deep learning and artificial intelligence, especially neural networks and generative anti-networks (GANs) to improve the image quality dramatically. These innovations are important for applications in areas such as medicine interior photography, satellite photography and photography, where image quality is needed. Despite the improvements, challenges such as maintaining detail while removing noise and ensuring real-time performance remain, providing ongoing research for edge development a wonderful and highly effective remedy.

Index Terms – Digital image processing, Noise reduction, Canny Edge, SSR, MSR, Retinex

I. INTRODUCTION

Especially in high-energy environments, irregular lighting poses significant imaging challenges. Photos taken with a variety of devices—from flagship cameras to mobile phones and tablets—often suffer from inconsistent lighting, causing problems such as overexposure or underexposure at specific locations. This variety can make it difficult to detect details, and affects the overall image quality. Several methods including histogram equalization, gradient field enhancement, isotropic filtering and Retinex theory have been developed over time to overcome this address these issues.

Among these, the Retinex principle has gained much interest due to its ability to effectively balance dynamic range compression, edge enhancement, and color matching. Retinex techniques, especially Single-Scale Retinex (SSR), Multi-Scale Retinex (MSR) has restored color fidelity, thereby improving visual sensitivity and image processing.

Generally, digital image processing involves the use of computer techniques to process two-dimensional images to improve their quality. Typical functions include noise removal, contrast enhancement, and correction of distortions due to camera movement or lens imperfections. An important step in image enhancement is histogram equalization, which improves the contrast and brightness of irregularly bright images by changing the image histogram. Color image enhancement is of particular importance in Digital Image Processing.

Techniques such as intensity transformation, histogram modeling, isotropic filtering, and Retinex-based methods are used to address issues such as irregular illumination from fluorescent light or sunlight that produce images that are too bright or dark in certain areas.

II. Related works

Article [1] Ying Sun^{1,2,3} et al., [12], 2022: An Improved Multi-scale Retinex-based Low-light Image Enhancement Algorithm Optimized by Artificial Bee Colony Algorithm In this paper, the problems of image quality, loss of information, and excessively enhanced brightness during image enhancement in low light are considered. First, it creates a duplicate of the original image. After that, it extracts the irradiation component from the original image through structure extraction from the texture via relative total variation for the first image.

Article [2] Bin Wei, [13], 2021, Most image enhancement methods of foggy images are normally dim and have halo artifacts by using the algorithms of MSRCR. In the paper, it is proposed a foggy image enhancement algorithm, which combines MSRCR with adaptive gamma correction.

Article [3] Chaoran Wen,, 2023, Under low-light conditions, the image quality of the sensor is extremely poor, and images collected by the sensor show serious problems with noise, artifacts, and brightness reduction.

Article [4] Alexander Zotin,[16],2018, The present paper provides a fast algorithm for image enhancement based on Multi-Scale Retinex in the HSV color model; however, the application of Multiscale Retinex in the HSV model for enhancement is computational due to the nonlinear color conversion. We propose an algorithm for calculating RGB color components: the proposed algorithm makes use of linear color dependencies from the V-component of the HSV model and makes it possible to obtain results close to the ones applying nonlinear processing in the HSV model.

Article [5] Jinxiang Ma,, 2017, a new improved multi-scale retinex with color restoration (MSRCR) image enhancement algorithm based on Gaussian filtering and guided filtering was put forward in this paper for restoring image color and enhancing the contrast of remote sensing image without suffering from color cast and insufficient detail enhancement.

Article [6] F Marin,, 2017[19], This paper introduces, a novel method for the image enhancement using multiscale retinex and practical swarm optimization. Multiscale retinex is widely used image enhancement technique which intemperately pertains on parameters such as Gaussian scales, gain and offset, etc. To achieve the privileged effect, the parameters need to be tuned manually according to the image. In order to handle this matter, a developed retinex algorithm based on PSO has been used.

Article [7] Ruaa Hussein, 2019[20], This paper presents a limited yet comprehensive review on Retinex. The theory of Retinex is an explanation for human color perception. Moreover, its derivation about the modification of reflectance components presented effective methodologies for image contrast enhancement.

Problem Statement

Convolutional Neural Networks (CNNs) require large amounts of training data to produce accurate results, which can consume significant system memory and computing resources. They often struggle to provide the most salient parts of images has grown and is generally more effective for low complexity images. Data discrepancies can negatively affect performance, and systems can be computationally expensive, especially when processing large images or dealing with real-time tasks. Furthermore, CNNs rely on a wide variety of training data, making them less effective in limited or biased data. The need for manual parameter tuning adds complexity and can make optimization difficult for images. High hardware and memory requirements may limit their usefulness on low-power devices, and the black-box nature of some CNN algorithms may obscure the decision-making process and reduce clarity and interpretability. High hardware and memory requirements may limit their usefulness on low-power devices, and the black-box nature of some CNN algorithms may obscure the decision-making process and reduce clarity and interpretability.

OBJECTIVES

- **Reduce Noise:** Reduce unwanted artifacts and pits in the image to ensure crisp and clear viewing, and improve overall image quality.
- **Correct Distortion:** Correct any distortion or irregularity in the image to restore its true position and maintain fidelity.
- **Increase detail:** Improve the visibility and dynamics of priorities, making priorities more prominent and informative.
- **Improve visual appeal:** Create an aesthetically pleasing copy of the original scene to enhance the user experience and visual appeal.
- **Optimize contrast and brightness:** Adjust contrast and brightness levels to ensure a balanced and accurate picture in various lighting conditions.
- **Restore Color Enhancement:** Correct color imbalances for more accurate and natural color representation, thus improving overall image fidelity.
- **Edit uneven lighting:** Address issues with uneven lighting and high dynamic range to ensure uniform display throughout the image.
- **Ensure real-time processing:** Develop efficient algorithms that allow real-time image processing, and make the system suitable for dynamic processing and interaction
- **Reduce computational complexity:** Optimize the processing system to standardize performance and resources, making it useful for devices with different capabilities.
- **Enhance user interface:** Create an intuitive and user-friendly interface for ease of use and effective interaction with the graphics system.

III. SYSTEM ARCHITECTURE

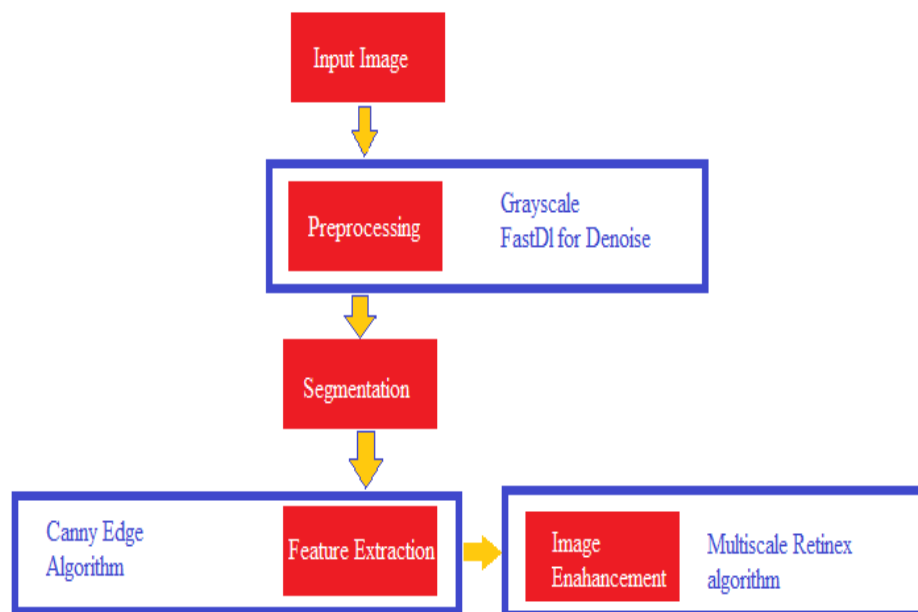


Fig 1: System Architecture

The proposed system is developed by using following modules.

1) **Input Image:**

Low light picture which needs to be enhanced. In this module selecting the image for enhancement purpose.

2) **Pre-Processing:**

Includes Blurring the input image. This module converts the color image into grayscale and denoises the image.

3) **Segmentation:**

Used to divide the image into number of parts.

4) **Feature extraction:**

Using this displays the edge of the image using canny Edge algorithm.

5) **Image Enhancement:**

Operations to perform enhancement.

In the diagram, the input image selects an image, then denoises the image using Fast dldenoised algorithm. Then divides the image into number of parts using segmentation. Further extracts the edges of an image using canny edge algorithm in Feature extraction and finally using multi scale Retinex algorithm giving enhanced Image Retinex has taken a big part of being used in medical imaging applications. Retinex was applied to be used in automatic analysis correctness of skin lesions. In this regard, MSR was used to enhance the image of the brain for medical purposes. Here, the core of this algorithm is the design of Gaussian surround function. In this regard, image improvement in medical applications mostly consider the brain images. This is because enhancing the details of the brain images lead to an increase in the accuracy of the diagnosis.

IV. EXPERIMENTAL RESULTS



Fig 2: Menu Screen

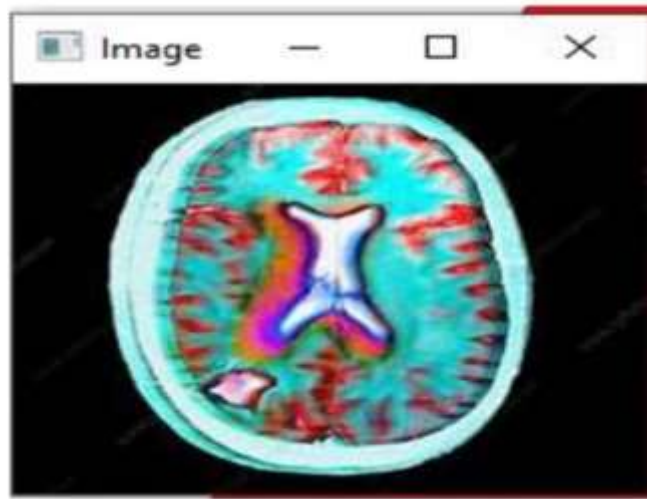


Fig 3: Input Image Selecting the brain input image for study purpose



Fig 4: Preprocessing

This module preprocesses the image which converts the color image to gray scale. And denoises the image using Fast DLdenoised algorithm. Morphological image processing (MIP) is a group of non-linear operations that correlate to the shape or morphology of features in an image.



Fig 5: Enhanced Image

Using multi-scale Retinex the image enhancement is shown above.

V. CONCLUSION

Here we first used single scale retinex but that method do not enhances the edges or corners of the image and the output image produced are not enhanced at edges, so the edges are still dark and not visible. So next here we used multi scale retinex and by using that the corners of images are also enhanced, and the output image is fully enhanced but the colours of the image are vanished by applying multi scale retinex so the output image is visible in the form of a gray scale image. So here we used multi scale retinex with colour restoration and this enhances the colours of an image by balancing the colours and the colours of the output image are clearly visible and the output of the multi scale retinex with colour restoration is fully enhanced and clearly visible to the user. In worldwide Retinex strategies, light is extricated by smoothing the first picture through certain sorts of Gauss mask, and how to remove illumination precisely is a key issue. In light of the point that the foundations of picture grouping in video's nearby casings are normally comparative and firmly related, we propose a superior Retinex calculation. In the strategy, the enlightenment of some neighboring casing pictures is melded by greatest technique, and utilized as these nearby edge pictures'

REFERENCES

- [1] Zhao, T. Overview of Image Restoration Techniques authors: Zhang, H. Reference: Zhang, H.et al. "A Survey of Image Restoration Techniques." IEEE Signal Processing Magazine, 2017.
- [2] Deep Learning Approaches for Image Restoration authors: Liu, Y. Reference: Liu, Y.et al. "Deep Learning for Image Restoration: A Comprehensive Survey." Journal of Computer Vision and Image Understanding, 2018.
- [3] Image Enhancement through Histogram Equalization authors: Sharma, P. Reference: Sharma, P. et al. "Histogram Equalization Techniques for Image Enhancement: A Review." Journal of Image Processing and Computer Vision, 2019.
- [4] Adaptive Filtering for Image Restoration authors: Chen, X. Reference: Chen, X. et al. "Adaptive Filtering Methods in Image Restoration." Pattern Recognition Letters, 2020.
- [5] Multi-Modal Image Fusion for Enhancement authors: Li, M. Reference: Li, M. et al. "Multi-Modal Image Fusion Techniques for Enhanced Visualization." Journal of Image and Vision Computing, 2021.
- [6] Low Light Image Enhancement for Dark Images" International Journal of Data Science and Analysis, authors: Akshay Patil , Tejas Chaudhari, Ketan Deo, Kalpesh Sonawane, Rupali Boras.
- [7] Image Enhancement Using Convolutional Neural Networks, authors: R. Alaguselvi; Kalpana Murugan.

- [8] Low-light image enhancement using CNN and bright channel prior, authors:Li Tao, Chuang Zhu, Jiawen Song, Tao Lu, Huizhu Jia, Xiaodong Xie.
- [9] Log-transformation and its implications for data analysisChangyong FENG,1,, Hongyue WANG,1 Naiji LU,1 Tian CHEN,1 Hua HE,1 Ying LU,2 and Xin M. TU1.
- [10] Investigation on the effect of a Gaussian Blur in image filtering and segmentation ,Estevao Gedraite, M. Hadad.

