An Evaluation on Double Augmentation Methods

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Abstract- Image enhancement is a technique that has been widely used in various fields to improve the quality and clarity of images. It involves the manipulation of digital images to enhance their visual appearance, making them more appealing and informative.

Keywords- Image enhancement, Histogram equalization, Adaptive Histogram equalization(AHE), Contrast adaptive histogram equalization(CLAHE).

INTRODUCTION

Image enhancement is the practise of modifying digital images to make them more acceptable for display or further study. You can, for example, eliminate noise, sharpen, or brighten an image to make it easier to identify crucial characteristics. It has become an essential tool across various fields such as photography, medicine, and security. Enhancement of image is very challenging issue in many research and application areas.Image enhancement is a valuable tool utilized across various fields including medicine, law enforcement, and astronomy.

IMAGE ENHANCEMENT TECHNIQUES

Different techniques which are used for image enhancement are given below

HISTOGRAM EQUALIZATION

Histogram equalization is a widely used technique in image processing that aims to enhance the visual quality of an image by improving its contrast. This method works by redistributing the pixel intensities in such a way that the resulting histogram becomes more uniform.

The first step in histogram equalization is to compute the histogram of the input image, which represents the frequency of occurrence of each intensity level. Next, a cumulative distribution function (CDF) is calculated based on this histogram. The CDF provides information about how many pixels have intensities less than or equal to a given value.

Once the CDF is obtained, it can be normalized to span the entire range of possible intensity values. This normalized CDF is then used to map each pixel intensity in the original image to a new value, effectively stretching or compressing the histogram.

Adaptive Histogram Equalization (AHE)

Adaptive Histogram Equalization (AHE) is a widely used image enhancement technique that aims to improve the contrast and visibility of images. It is an extension of the traditional histogram equalization method, which redistributes the pixel intensities in an image to achieve a more balanced histogram. However, AHE takes into account the local characteristics of an image, making it more effective in enhancing details and preserving important information.

The basic principle behind AHE is to divide an image into smaller regions or blocks and apply histogram equalization independently to each block. By stretching the intensity range within each block, AHE enhances both dark and bright regions simultaneously, resulting in improved contrast.

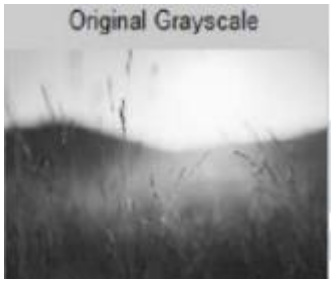


Image enhancement using adaptive histogram equalization

Contrast Limited Adaptive Histogram Equalization (CLAHE)

Contrast Adaptive Histogram Equalization (CAHE) is a widely used image enhancement technique that aims to improve the visibility of details in images by enhancing their contrast. It is an extension of the traditional Histogram Equalization (HE) algorithm, which redistributes the pixel intensities in an image to achieve a more uniform histogram.

The main advantage of CAHE over HE is its ability to adaptively enhance the contrast based on local image characteristics. Unlike HE, which applies the same transformation function to all pixels in an image, CAHE divides the image into smaller regions and applies different transformations to each region. This allows CAHE to preserve both global and local contrast information.

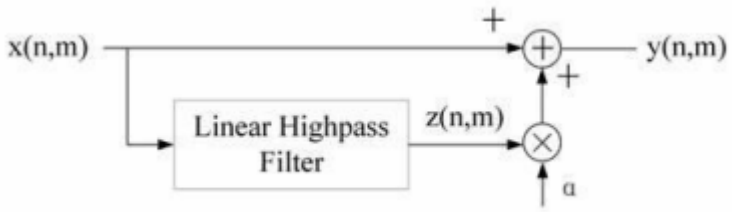
FUZZY LOGIC TECHNIQUES

Fuzzy logic techniques have gained significant attention in the field of image enhancement due to their ability to handle uncertainty and imprecision. Fuzzy logic techniques can be applied at various stages of image enhancement, such as contrast adjustment, noise reduction, and edge detection. By considering both local and global information, fuzzy logic algorithms can effectively enhance details while preserving important features in an image. Moreover, fuzzy systems can adaptively adjust their parameters based on the characteristics of each specific image, resulting in personalized enhancements that cater to individual preferences.

Fuzzy image enhancement principle

UNSHARP MASKING

Un sharp masking is a widely used technique in image processing to enhance the sharpness and detail of an image. It works by creating a sharpened version of the original image through a process of subtracting a blurred version from the original. This technique has been employed in various fields, including photography, medical imaging, and computer vision. To apply unsharp masking, three steps are typically involved: first, a blurred version of the original image is created using a low-pass filter; second, this blurred image is subtracted from the original to obtain a mask; finally, this mask is added back to the original image to produce the final sharpened result.



Structure of unsharp masking

THRESHOLDING

Thresholding is a widely used technique in image processing for enhancing the quality of digital images. It involves dividing an image into two regions based on a certain threshold value, which separates the pixels into foreground and background. The pixels with intensity values above the threshold are considered as foreground, while those below it are considered as background. One of the main applications of thresholding is in image enhancement. By selecting an appropriate threshold value, we can enhance specific features or details in an image. For example, if we want to highlight the edges of objects in an image, we can set a high threshold value to separate the foreground from the background. This will result in a binary image where only the edges are visible Thresholding can also be used to remove noise from images. By setting a low threshold value, we can eliminate pixels with low intensity values that may be caused by noise or artifacts. This helps to improve the overall clarity and quality of the image.

EDGE DETECTION

Edge detection is a fundamental technique in image processing that aims to identify and highlight the boundaries between objects or regions within an image. It plays a crucial role in various applications, including image enhancement. By accurately detecting edges, images can be improved by enhancing their sharpness, contrast, and overall visual quality. Once edges have been detected, they can be further enhanced using techniques such as thresholding or morphological operations. Thresholding involves setting a certain intensity value as a threshold and classifying pixels above.

IMAGE SEGMENTATION

Image segmentation is a crucial step in image enhancement, as it allows for the isolation and manipulation of specific regions within an image. By dividing an image into meaningful segments, various enhancements can be applied to each segment individually, resulting in improved overall image quality.

One of the main challenges in image segmentation is accurately identifying the boundaries between different objects or regions within an image. This can be achieved through various techniques such as thresholding, edge detection, or region growing algorithms. These methods analyze pixel intensities, gradients, or texture information to determine the boundaries between segments. image segmentation also plays a vital role in object recognition and tracking applications. By isolating specific objects within an image through segmentation, further analysis and processing can be performed on those objects alone.

CONCLUSION AND FUTURE SCOPE

Image processing is a rapidly growing field that has revolutionized the way we perceive and analyze visual data. The conclusion of image processing can be summarized as a powerful tool that enables us to extract valuable information from images, enhance their quality, and manipulate them for various applications. One of the most significant contributions of image processing is its impact on medical imaging. It has enabled doctors to diagnose diseases more accurately and non-invasively, leading to better patient outcomes. Image processing has also played a crucial role in fields such as astronomy, remote sensing, and robotics.

However, there are still challenges that need to be addressed in image processing. One of the major issues is the lack of standardization in image formats and algorithms used by different software programs. This can lead to inconsistencies in results and hinder collaboration between researchers

While it can be useful for artistic purposes or enhancing certain features, it can also be used for unethical practices such as altering evidence or misleading people.

In conclusion, despite its challenges, image processing has made significant contributions to various fields and will continue to do so with further advancements in technology and research. It remains an essential tool for analyzing visual data and improving our understanding of the world.

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