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AERIAL IMAGE ENHANCEMENT USING WDRC ALGORITHM

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ABSTRACT

Recently we proposed a wavelet-based dynamic range compression algorithm to improve the visual quality of digital images captured in the high dynamic range scenes with nonuniform lighting conditions. The fast image enhancement algorithm which provides dynamic range compression preserving the local contrast and tonal rendition is a very good candidate in aerial imagery applications such as image interpretation for defence and security tasks. This algorithm can further be applied to video streaming for aviation safety. In this paper the latest version of the proposed algorithm which is able to enhance aerial images so that the enhanced images are better than direct human observation, is presented. The results obtained by applying the algorithm to numerous aerial images show strong robustness and high image quality.

INTRODUCTION

An image is a two-dimensional picture, which has a similar appearance to some subject usually a physical object or a person. Image is a two-dimensional, such as a photograph, screen display, and as well as a three-dimensional, such as a statue. They may be captured by optical devices such as cameras, mirrors, lenses, telescopes, microscopes, etc. and natural objects and phenomena, such as the human eye or water surfaces.

The word image is also used in the broader sense of any two-dimensional figure such as a map, a graph, a pie chart, or an abstract painting. In this wider sense, images can also be rendered manually, such as by drawing, painting, carving, rendered automatically by printing or computer graphics technology, or developed by a combination of methods, especially in a pseudo-photograph.

An image is a rectangular grid of pixels. It has a definite height and a definite width counted in pixels. Each pixel is square and has a fixed size on a given display. However different computer monitors may use different sized pixels. The pixels that constitute an image are ordered as a grid (columns and rows); each pixel consists of numbers representing magnitudes of brightness and color.

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Image file formats are standardized means of organizing and storing images. This entry is about digital image formats used to store photographic and other images. Image files are composed of either pixel or vector (geometric) data that are raster zed to pixels when displayed (with few exceptions) in a vector graphic display. Including proprietary types, there are hundreds of image file types. The PNG, JPEG, and GIF formats are most often used to display images on the Internet.

In addition to straight image formats, Metafile formats are portable formats which can include both raster and vector information. The metafile format is an intermediate format. Most Windows applications open metafiles and then save them in their own native format.

IMAGE ENHANCEMENT

Image enhancement is basically improving theinterpretability or perception of information in images for humanviewers and providing `better' input for other automated imageprocessing techniques. The principal objective of imageenhancement is to modify attributes of an image to make it moresuitable for a given task and a specific observer. During thisprocess, one or more attributes of the image are modified. Thechoice of attributes and the way they are modified are specific toa given task. Moreover, observer-specific factors, such as thehuman visual system and the observer's experience, will introducea great deal of subjectivity into the choice of image enhancementmethods. There exist many techniques that can enhance a digitalimage without spoiling it.

In spatial domain techniques, we directly deal withthe image pixels. The pixel values are manipulated to achievedesired enhancement. In frequency domain methods, the image isfirst transferred in to frequency domain. It means that, the FourierTransform of the image is computed first. All the enhancementoperations are performed on the Fourier transform of the imageand then the Inverse Fourier transform is performed to get theresultant image. These enhancement operations are performed inorder to modify the image brightness, contrast or the distributionof the grey levels. As a consequence the pixel value (intensities)of the output image will be modified according to thetransformation function applied on the input values.

Spatial domain: $g(x,y)=f(x,y)*h(x,y)$

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image enhancement applications:

Some of the areas in which IE has wide application are noted below.

•In forensics, IE is used for identification, evidence gathering and surveillance. Images obtained from fingerprint detection, security videos analysis and crime scene investigations are enhanced to help in identification of culprits and protection of victims.

•In atmospheric sciences, IE is used to reduce the effects of haze, fog, mist and turbulent weather for meteorological observations. It helps in detecting shape and structure of remote objects in environment sensing. Satellite images undergo image restoration and enhancement to remove noise

•Astrophotography faces challenges due to light and noise pollution that can be minimized by IE. For real time sharpening and contrast enhancement several cameras have in-built IE functions. Moreover, numerous software, allow editing such images to provide better and vivid results.

•In oceanography the study of images reveals interesting features of water flow, sediment concentration, geomorphology and bathymetric patterns to name a few. These features are more clearly observable in images that are digitally enhanced to overcome the problem of moving targets, deficiency of light and obscure surroundings.

PROPOSED METHODOLOGY

Aerial images captured from aircrafts, spacecrafts, orsatellites usually suffer from lack of clarity, since theatmosphere enclosing Earth has effects upon the images suchas turbidity caused by haze, fog, clouds or heavy rain. Thevisibility of such aerial images may decrease drastically andsometimes the conditions at which the images are taken mayonly lead to near zero visibility even for the human eyes. Eventhoughhumanobservers may not see much than smoke, theremay exist useful information in those images taken under suchpoor conditions.

Captured images are usually not the same as what we seein a real world scene, and are generally a poor rendition of it.High dynamic range of the real life scenes and the limiteddynamic range of imaging devices results in images withlocally poor contrast. Human Visual System (HVS) deals withthe high dynamic range scenes bycompressing the dynamicrange and adapting locally to each part of the scene. There aresome exceptions such as turbid (e.g. fog, heavy

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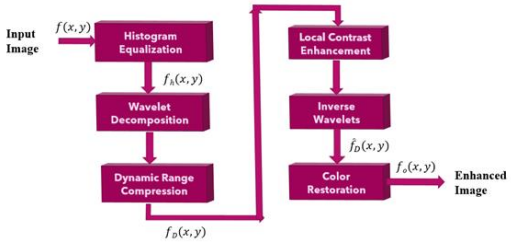
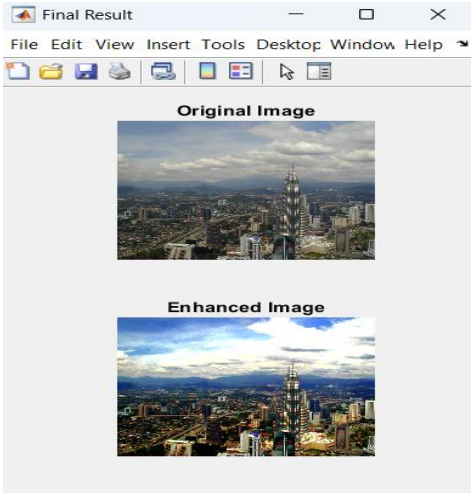
rain or snow)imaging conditions under which acquired images and thedirect observation possess a close parity. The extremenarrow dynamic range of such scenes leads to extreme lowcontrast in the acquired images.

To deal with the problems caused by the limited dynamic range of the imaging devices, many image processing algorithms have been developed. These algorithms also provide contrast enhancement to some extent.

Recently we have developed a wavelet-based dynamic range compression (WDRC) algorithm to improve the visual quality of digital images of high dynamic range scenes with non-uniform lighting conditions. The WDRC algorithm is modified in by introducing an histogram adjustment and non-linear color restoration process so that it provides color constancy and deals with "pathological" scenes having very strong spectral characteristics in a single band. The fast image enhancement algorithm which provides dynamic range compression preserving the local contrast and tonal rendition is a very good candidate in aerial imageryapplications such as image interpretation for defence and security tasks. This algorithm can further be applied to video streaming for aviation safety. In this paper application of the WDRC algorithm in aerial imagery is presented. The results obtained from large variety of aerial images show strong robustness and high image quality indicating promise for aerial imagery during poor visibility flight conditions.



RESULT



ADVANTAGES

1. This method improves the visual qualities of images.
2. This algorithm has better visibility, the details are clear, and the colors are vivid and natural.
3. In the paper, the adaptive filter referred proposes a solution in

reducing halo and achieves a better visibility.

4. The new algorithm treats the color well and improving the quality of the image at the edges.

APPLICATIONS AND FUTURE SCOPE:

1. Satellite & Research (NASA) Applications.
2. Text information extraction in images and videos.
3. This will be further useful in medical image processing.

CONCLUSION

In this paper application of the Wavelet-Based Dynamic Range Compression algorithm foran aerial image enhancementis presented. The algorithm is related to human visual properties and developed to improve the visual qualities of enhanced images. In this paper application of the WDRC algorithm in aerialimagery is presented. The results obtained from large variety ofaerial images show strong robustness, high image quality, andimproved visibility indicating promise for aerial imageryduring poor visibility flight conditions. This algorithm can further be applied to real time videostreaming and the enhanced video can be projected to thepilot's heads-up display for aviation safety.

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