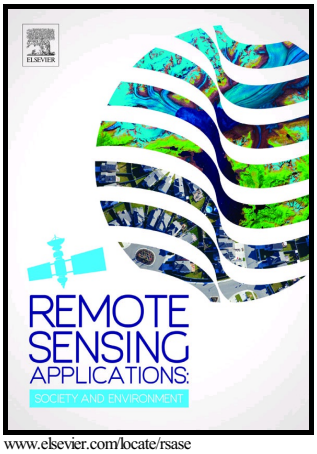
Image Quality Restoration Framework for Contrast Enhancement of Satellite Remote Sensing Images

Shilpa Suresh, Devikalyan Das, Shyam Lal, Deep Gupta



www.elsevier.com/locate/rsase

PII: S2352-9385(17)30280-X
DOI: https://doi.org/10.1016/j.rsase.2018.03.008
Reference: RSASE125

To appear in: *Remote Sensing Applications: Society and Environment*

Received date: 2 December 2017
Revised date: 16 March 2018
Accepted date: 22 March 2018

Cite this article as: Shilpa Suresh, Devikalyan Das, Shyam Lal and Deep Gupta, Image Quality Restoration Framework for Contrast Enhancement of Satellite Remote Sensing Images, *Remote Sensing Applications: Society and Environment,* https://doi.org/10.1016/j.rsase.2018.03.008

Image Quality Restoration Framework for Contrast Enhancement of Satellite Remote Sensing Images

Shilpa Suresh[1], Devikalyan Das[2], Shyam Lal[3*], Deep Gupta[4]

[1,3]Department of Electronics and Communication Engineering, National Institute of Technology Karnataka, Surathkal, Mangaluru-575025, Karnataka, India (shilparagesh89@gmail.com, shyam.mtec@gmail.com)
[2]Department of Electronics and Telecommunication Engineering, Veer Surendra Sai University of Technology, Burla, Sambalpur-768018, Odisha, India (devikalyandas9067@gmail.com)
[4]Department of Electronics and Communication Engineering, Vishvasaraya National Institute of Technology, Nagpur, Maharashtra, India(er.deepgupta@gmail.com)
*Corresponding author Tel.: +91-8242473522

Abstract: Researches in satellite remote sensing images mainly revolves around enhancement of contrast and removal of noise in image, which affects the data comprehensibility and clarity. Hence, it is always a challenge to process the satellite remote sensing images in order to obtain better quality images with enhanced visibility and minimum image artifacts for improving their application value. In this paper, an effective quality enhancement framework is proposed, which mainly focuses on contrast enhancement of satellite remote sensing images. Several satellite remote sensing images were tested to ratify the effectiveness of the proposed method over other existing remote sensing enhancement methods and their quantitative results are borne out by NIQMC (No Reference Image Quality Metric for Contrast distortion), BIQME (Blind Image Quality Measure of Enhanced images), MICHELSON (Michelson Contrast), DE (Discrete Entropy), EME (Measure of enhancement) and PIXDIST (Pixel distance) along with qualitative results comparison. Results depict that the visual enhancement obtained using the proposed method is superior to other existing enhancement methods. Finally, the simulation results unveil that proposed method is effective and efficient for satellite remotes sensing images.

Keywords: Remote sensing, Contrast, Restoration, Quality.

1. Introduction

Satellite remote sensing images are popularly used in multifarious disciplines like space and geoscience departments, agriculture for crop identification, crop area determination and crop condition monitoring**,** and other humanitarian applications (Cheng et al., 2015; Zhang et al., 2015). But these images are often tarnished in terms of visual quality owing to various factors like the environmental noises and other intermeddling factors during their acquisition. So, processing and analysis of these images are necessary to facilitate amelioration in the visual attributes of these images. Image contrast is one of the important visual attributes which provide significant contribution to the image quality. Since the sensitivities of human visual system are more towards the image contrast as compared to absolute luminance, it is seen as the difference in the color and brightness of the objects. Low-contrast regions are darker and regions owing to high contrast are visible as artificially illuminated. Hence, both will lead to loss of significant information. So, the challenge is to optimally enhance the image contrast so as to improve the visibility, and at the same time preserving the information present in the input image. Hence, image enhancement is a rudimentary step in all digital image processing and analysis applications, which improves the interpretability or information perceived by humans.

Furthermore, a satellite sensor must capture a very wide range of scenes from different location on the earth surfaces, from very low radiance (i.e. oceans, low solar elevation angles, high latitudes) to very high radiance (i.e. snow, sand, high solar elevation angles, and low latitudes) (Schowengerdt,1997; Lisani et al., 2016). As a result, the quantization can be coarse, and any given satellite image will generally occupy only a limited portion of the available dynamic range, therefore having low contrast (Lisani et al., 2016). Moreover, the energy reaching the satellite must