Integrated Dominant Brightness Level Analysis and Guided Image Filter for Satellite Image Enhancement

Richa Bhatia
M.Tech Research Scholar

Jagdeep Singh Aulakh
Assistant Professor

ABSTRACT
In digital image processing, image enhancement contributes a vital role. It is a procedure used for the modification of digital images. It is one of the essential vision applications which have ability to improve the visibility of images. It is used to enhance the superiority of poor images and low quality images into the high-quality images so that images can be much clearer for human observation. The key purpose of this dissertation has been to explore and verify the limitations of the existing image enhancement procedures. Several techniques have been predictable so far to enhance the superiority of the digital images. To enhance the photograph quality, image enhancement improves and bound various facts available in the input image. Several procedures have been projected so far for improving the satellite image enhancement; which may decrease the intensity of the original satellite image. To overcome this problem we have introduced an integrated approach. To evaluate the performance of dominant brightness level based image enhancement technique, several parameters has been used like Bit Error Rate, Cross Correlation and Average Difference.

Keywords
Contrast Enhancement, remote sensing, satellite images.

1. INTRODUCTION
The discussion will be focusing on analysis of satellite images. These Images are shown in digital form. When represented as numbers, brightness can be added, subtracted, multiply, separated and, in general, subjected to arithmetical manipulations that are not possible if an image is offered only as a photograph. Earlier, digital satellite data could be analyzed only at specialized satellite laboratories. Specific equipment and trained Personnel necessary to conduct routine machine analysis of data were not widely available, in part because of limited availability of digital satellite data and a lack of appreciation of their qualities. Image processing can be separated into two categories:

1.1 Analog Image Processing
It is finished on analog signals. Analog Image processing can be proceeded on two dimensional analog signals. In this type of processing technique, pictures are handled by varying the electrical signal. The most usual illustration is the television image.

1.2 Digital Image Processing
This processing method allocates with building a digital system that proceeded on digital images.

2. IMAGE ENHANCEMENT
Image enhancement is really a preprocessing part of many image processing applications. The basic aim of image enhancement is to enhance the interpretability or perception of data in images for human viewers, or to supply better input for other automated image processing techniques. There are various reasons for low quality of a graphic such as for instance distortion being introduced by the imaging systems, insufficient expertise of the operator or the adverse external conditions at the time of image acquisition.

Mainly, Image enhancement includes intensity and contrast manipulation, noise reduction, edges sharpening and filtering, etc. Contrast Enhancement is dedicated to the situation of improving the contrast in a graphic to produce various features quicker perceived. Contrast of a graphic is determined by its dynamic range, which is defined because the difference between lowest and highest intensity level. Contrast enhancement techniques have various application areas for enhancing the visual quality of low contrast images. Contrast enhancement is one of many important research issues of image enhancement.

3. APPLICATIONS OF IMAGE PROCESSING
Following are some applications of images processing.

3.1 X-Ray Imaging
X-Ray is among the oldest source of EM radiation used for imaging. X-Ray is used in medical diagnostics. Another use of X-Ray in medical imaging is computerized axial to zoography.

3.2 Imaging in ultra violet Band
Ultra violet is used in fluorescence microscopy.

3.3 Digital camera images
Digital cameras have digital image processing pieces which are used to alter row data from picture sensor into color corrected picture in an ordinary picture file format .The photographs collected from cameras are additional processes to progress the quality.

3.4 Intelligent Transportation System
Digital image processing has broad role in transportation system like number plate recognition.

3.5 Electron Microscopy
It uses a microscope that can amplify very minute details with very excessive resolving power.

3.6 Ultra sound
It is used for medical purpose where excessive frequency breed bead sound waves are returned by tissue.

3.7 Gamma Ray Imaging
It is used for complete several scan acquired by using gamma ray picturing but while these photographs are selected by using gamma ray detectors, then from time to time noise is passed due to fault detectors. Due to this recognition of fault

bones is complex to get better this problem. In this difficulty we can use image processing to resolve the troubles.

4. REMOTE SENSING

Remote sensing can be defined as any process whereby information is gathered about an object, area or phenomenon without being in contact with it. Our eyes are an excellent example of a remote sensing device. It is possible to gather information about our surroundings by gauging the amount and nature of the reflectance of visible light energy from some external source (such as the sun or a light bulb) as it reflects off objects in our field of view. Contrast this with a thermometer, which must be in contact with the phenomenon it measures, and thus is not a remote sensing device. Given this rather general definition, the term remote sensing has come to be associated more specifically with the gauging of interactions between earth surface materials and electromagnetic energy. However, any such attempt at a more specific definition becomes difficult, since it is not always the natural environment that is sensed (e.g., art conservation applications), the energy type is not always electromagnetic (e.g., sonar) and some procedures gauge natural energy emissions (e.g., thermal infrared) rather than interactions with energy from an independent source.

Figure 1: Remote Sensing Images

4.1 Applications of Remote Sensing Images

Following are some applications of remote sensing images.

4.1.1 Meteorology
It means weather forecasting or Weather Prediction.

4.1.2 Climatology
Weather situations over an averaged phase of time.

4.1.3 Oceanography
Also called as ocean logy and marine science, it is a subdivision of earth science that investigates the oceans.

4.1.4 Costal Studies
A private non-profit association for investigation, conservation, and education in the coastal and marine domain.

5. LITERTURE SURVEY

R. Raji et al. [1] provides recommended the story consistency dependent color image enhancement technique of which targets the computerized technique of targeted image age group. The particular photographs from the data source with best histogram relationship with suggestions image are determined regarding taking out different features. Goal image can be obtained through fusing photographs selected dependent on bare minimum Euclidean range involving produced features. The particular recommended procedure is often a simple color image enhancement technique in which the selection of the particular R,G,B channels can be optimally conserved. Kanwal and Navdeep [2] handled form a contrast enhancement involving X-Ray photographs and gifts here a new strategy regarding form a contrast enhancement dedicated to Adaptive Neighborhood method. Any corner technique regarding enhancement have been presented.

Evaluation research involving recommended method versus today's important form a contrast enhancement strategies have been executed and final results involving recommended method are guaranteeing. V. L Jaya and G. Kumari [3] include discussed of which fluffy strategies provide a brand-new and flexible framework for the growth involving image enhancement algorithms. There're nonlinear, knowledge-based and robust. The particular possibilities involving fluffy collection concept regarding image enhancement remain certainly not perused which have a practical some other established strategies. An study of fluffy procedures with alter sector is considered. Fluffy tip dependent form a contrast enhancement from the Sequency dependent Mapped Authentic Enhance (SMRT) sector regarding obstruct level finalizing can be looked into. Ehsani and Seyed R. [4] recommended the adaptive and iterative histogram related criteria regarding chromosome form a contrast enhancement specifically with banding patterns. The particular guide histogram, with that the initial image has to be harmonized, is done dependent on several operations in the initial image histogram. Using of uncooked information from the histogram involving initial image may result in additional reliance on the suggestions image and getting better form a contrast progress. Moreover, the particular iteration treatment brings about the continuous form a contrast enhancement and obtaining the most efficient effect. Zhao and Weiguo [5] include recommended a picture enhancement procedure dependent on Gravitational Lookup Formula (GSA) to raise the particular adaptability and result involving image enhancement, which can be employed for optimizing the particular details on the normalized partial Beta operate with all the qualities on the unique image, the particular obtained operate is required to boost the particular degraded image. The particular simulation results demonstrate the process can correctly increase the global form a contrast on the image and imaginative and prescient vision. Which means this procedure is sensible in the field of dreary level image adaptive enhancement. Jha and R. Kumar et al. [6] recommended the form a contrast enhancement method applying scaling involving central noises of an dim image with under the radar cosine alter DCT sector. The particular system involving enhancement can be a result of noise-induced transition involving DCT coefficients through the poor condition to an superior condition. This transition can be enacted because of the intrinsic noises found because of insufficient adequate brightness and could possibly be modeled by having an total bi stable technique demonstrating energetic stochastic resonance. The particular recommended method followed the neighborhood adaptive finalizing and drastically promotes the particular image form a contrast and color information whilst ascertaining beneficial perceptual top quality. Demirel et al. [7] provides discussed of which satellite photographs are now being utilized in quite a few fields involving study. On the list of important issues involving these types of photographs can be their own quality. A whole new satellite image quality have been recommended in order to enhancement method while using interpolation on the high-frequency subscription artists obtained through under the discrete wavelet transform (DWT) and also the suggestions image. The particular recommended quality enhancement method employs DWT in order to break down the particular suggestions image into various subscription artists. In order to achieve the sharper image, the intermediate stage regarding price the particular high-frequency subscription artists have been recommended. The particular recommended method have been tried in satellite standard photographs. Cheng et al. [8] recommended a strategy for the prognosis involving over-enhancement. The important thing

benefits on the papers are as follows. The reasons regarding generating over-enhancement are perused and analyzed deeply. An objective qualification regarding uncovering over-enhancement can be recommended. The particular experimental results display how the recommended strategy can discover the particular above superior locations properly and correctly, and gives the quantitative qualification in order to measure the particular over-enhancement ranges well. The particular recommended strategy could possibly be perfect for dynamically overseeing the grade of the particular superior image, and optimizing the particular parameter configurations on the form a contrast enhancement criteria. Verbesselt et al. [9] provides monitored high cover adjustments with warm places is vital regarding dealing with just how deforestation and wreckage can be impacting on hard drive, biodiversity, and other socio-ecological operations. Satellite out of the way realizing allows cost-effective and appropriate overseeing involving high adjust in repeated time period methods above big locations. Even so, there's a need for procedures of which permit rapidly and appropriate research involving satellite image time period series in order to detect high adjust with close to real time. An increasing number of adjust prognosis strategies come to be accessible of which has the capacity to course of action satellite image time period series information in order to detect adjustments applying traditional satellite image time period series. Shelter, Eunsung et al. [10] presented the form a contrast enhancement strategy predicated in predominant lighting level research and adaptive intensity transformation regarding out of the way realizing photographs. The particular recommended criteria computes brightness-adaptive intensity transport features making use of the particular low-frequency luminance aspect from the wavelet sector and changes intensity ideals while using transport operate. A lot more especially, they primary executed under the radar wavelet alter around the suggestions photographs after which break down the particular LL subscription music group into low-, middle-, and high-intensity tiers with all the log-average luminance. Strength transport features were being adaptively projected making use of the particular leg transport operate and also the gamma adjusting operate around the foundation on the predominant lighting level of each coating. Kurita et al. [11] provides recommended a picture finalizing approach to taking out car or truck lines in a very satellite image through step wise finalizing, so that you can get downtown road targeted traffic congestion above wide locations. With step one, applying satellite image and a electronic digital chart, the particular writers calculate car or truck density through how many motor vehicles in each road segment through depending the front and raise sides on the motor vehicles. Within the next phase, the particular writers get car or truck lines from the road lane by car or truck range. By this specific step wise finalizing, the particular writers omit pointless calculation and lower different industrial noise to raise the particular precision involving removal. Kil, Tae Ho et al. [12] recommended the dehazing criteria predicated in dim station preceding and form a contrast enhancement approaches. Then, the materials dim station preceding procedure takes away haze and therefore restore hues involving objects from the scene; nevertheless it usually isn't going to take into account the enhancement involving image form a contrast. On the other hand, the particular image form a contrast procedure increases the neighborhood form a contrast involving objects, however hues are usually distorted due to the over-stretching involving form a contrast. The particular recommended criteria mixes the particular options that come with both of these standard approaches regarding keeping along side whilst dehazing.

Using this certain the optimization operate can be recommended in order to harmony involving the form a contrast and hues distortion. Rasti et al. [13] provides recommended a new interpolation method while using Stationery Wavelet Enhance (SWT) and iterative back projection (IBP) regarding satellite photographs. Firstly the reduced quality image can be interpolated by using bicubic interpolation after which decomposed into various subband photographs through SWT. Each subband can be decimated in order to several reduce reduced quality photographs. The particular several reduced quality photographs are interpolated and documented by using bicubic interpolation and IBP respectively. Chen, et al. [14] recommended the competitive form contrast enhancement criteria which in turn mixes histogram equalization dependent procedures and the multi-scales un sharp hiding dependent procedures. This recommended criteria employs HEBM to realize global form a contrast enhancement and UMBM to realize community multi scale form a contrast enhancement. 1st, they examined the particular strategies created from the materials regarding form a contrast enhancement. Right after subsequently, they introduced the most up-to-date criteria with specifics. Guangmeng et al. [15] provides found thermal flaws through satellite information are broadly documented. Nearly all the particular flaws are documented following your tremble. A few earthquake prophecy happen to be documented with France and Iran based on satellite cloud flaws. These types of cloud flaws usually demonstrate the linear style, remain generally there for hours and do not go with wind gusts. In line with these kinds of flaws, the rough evaluation about impending earthquake pursuits have been offered. Nercessian et al. [16] presented the multi-scale image enhancement criteria specialized in an entire brand-new parametric form a contrast measure. The particular parametric form a contrast measure features besides the particular luminance hiding characteristic, but the particular form a contrast hiding characteristic on the man aesthetic technique. The particular formulation on the form a contrast measure might be modified for every multi-resolution decomposition system so that you can produce brand-new man aesthetic system-inspired multi-scale changes. Cao, Gang et al. [17] recommended a couple of story algorithms in order to detect the particular form a contrast enhancement engaged manipulations with electronic digital photographs. 1st, they predicated around the prognosis involving global form a contrast enhancement placed on the particular in the past JPEG-compressed photographs, that are wide-spread with real programs. The particular histogram peak/gap artifacts accrued because of the JPEG data comparison and pixel benefit mappings are analyzed theoretically, and known through discovering the particular zero-height difference fingerprints. Minute, they recommended to distinguish the particular upvc composite image created by enforcing form a contrast adjusting in each one of these or maybe both origin places. Huang et al. [18] recommended the hardware-oriented form a contrast enhancement criteria which can be generally carried out correctly regarding computer hardware layout. In order to become seen regarding computer hardware enactment, approximation strategies are recommended to cut back these kinds of difficult computations in the course of functionality on the form a contrast enhancement criteria. The particular recommended hardware-oriented form a contrast enhancement algorithms defines beneficial image top quality through calculating the outcome involving qualitative and quantitative examines.

6. FLOWCHART PROPOSED ALGORITHM

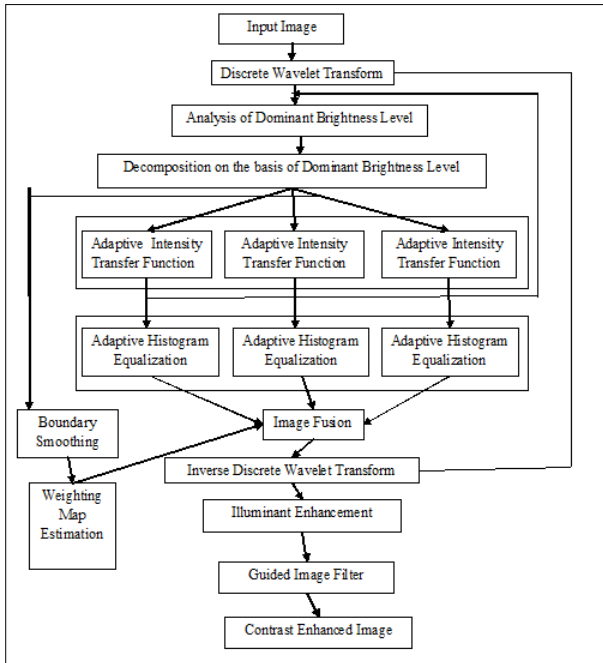The flow chart of the proposed algorithm has been described below in figure 2.

Figure 2: Flowchart of Proposed Algorithm

7. RESULTS AND DISCUSSION

The experiment has taken on different satellite images. Satellite image is input in simulation environment i.e. Matlab 2013 and results on different images has been shown in figure 3 and 4 respectively and values of different parameters also be calculated parameters like Bit error ratio (BER), Average error (AE) and Cross-Correlation (CCR).
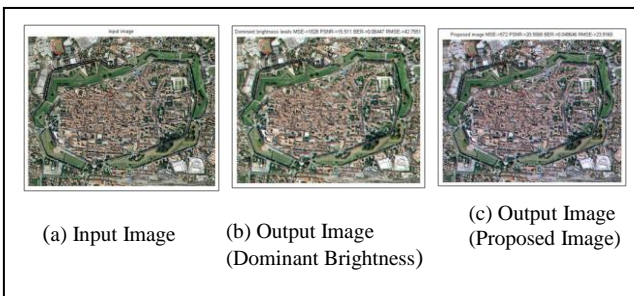

| (a) Input Image | (b) Output Image (Dominant Brightness) | (c) Output Image (Proposed Image) |

Figure 3: Input and Output Images

| (a) Input Image | (b) Output Image (Dominant Brightness) | (c) Output Image (Proposed Image) |

Figure 4: Input and Output Images

Table 1. Bit Error Ratio

Images	Proposed BER	Existing BER
1	0.0329	0.0042
2	0.0277	0.0413
3	0.0379	0.0432
4	0.0387	0.0469
5	0.0355	0.0433
6	0.0377	0.0502
7	0.0347	0.0492
8	0.0329	0.0415
9	0.0486	0.0645
10	0.0358	0.0444
11	0.0409	0.0536
12	0.0381	0.0476
13	0.0423	0.0549
14	0.0378	0.0463
15	0.0441	0.0508

Table 1 contains the values of Bit Error Ratio (BER) of the proposed and existing algorithm corresponding to the 15 different images. The BER of the proposed algorithm has less value than existing algorithm. According to these values graph 1 has plotted.
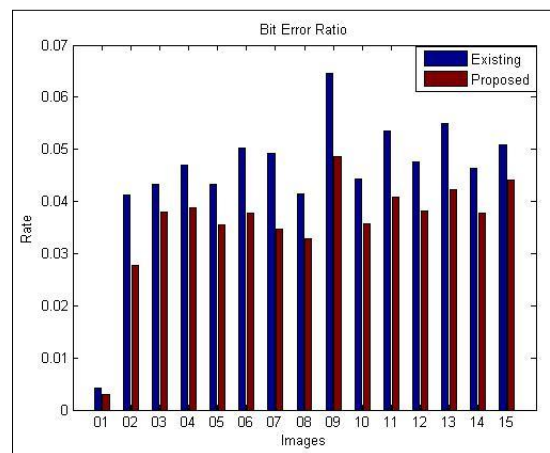

Graph 1: Bit Error Ratio

Table 2. Average Error (AE)

Images	Proposed AE	Existing AE
1	3.7377	12.7779
2	2.3365	14.4247
3	10.7259	15.6170
4	9.3728	15.9557
5	7.5821	13.3128
6	8.6144	19.4674
7	6.3534	15.6380
8	5.4528	12.7061
9	18.4495	32.8730
10	7.7518	15.1919
11	11.1530	22.3255
12	8.9914	16.0029
13	12.4705	23.6428
14	11.5825	26.0806
15	15.3537	19.8490

Table 2 contains the values of Average Error (AE) of the proposed and existing algorithm corresponding to the 15 different images. The AE of the proposed algorithm has more

value than existing algorithm. According to these values graph 2 has plotted.
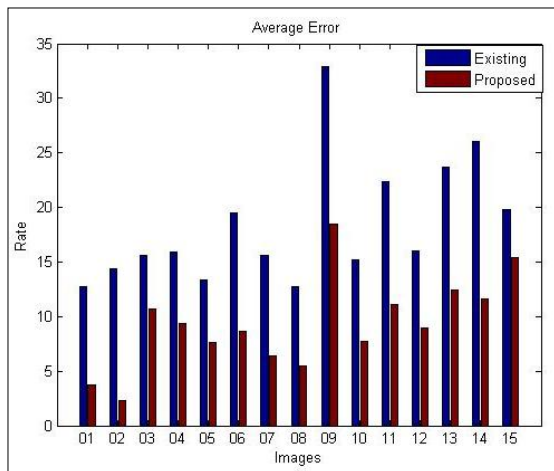
Graph 2: Average Error (AE)

Table 3. Cross-Correlation

Images	Proposed CCR	Existing CCR
1	0.9957	0.9150
2	0.9992	0.9107
3	0.99374	0.9120
4	0.9580	0.9243
5	0.9833	0.9416
6	0.9918	0.9216
7	0.9932	0.9220
8	0.9927	0.9176
9	0.9649	0.9946
10	0.9915	0.9285
11	0.9789	0.9497
12	0.9742	0.9378
13	0.9746	0.9514
14	0.7546	0.9335
15	0.9072	0.9389

Table 3 contains the values of Cross-Correlation (CCR) of the proposed and existing algorithm corresponding to the 15 different images. The CCR of the proposed algorithm has less value than existing algorithm. According to these values graph 3 has plotted.
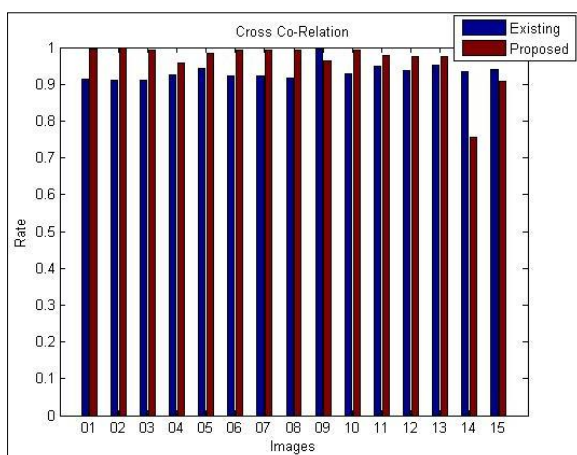
Graph 3: Cross-Correlation

8. CONCLUSION AND FUTURE SCOPE

In this paper, a survey on some of the image Enhancement techniques and remote sensing for improving images has been done. Moreover a comparison table has been developed which shows the various techniques like Bit error ratio, Average error and cross correlation their features and limitations. From the survey, it has been concluded that proposed technique performs better in every field. Therefore, in near future, new integrated Contrast Enhancement technique for satellite Images using Dominant Brightness Level Analysis can be developed for better results.

9. REFERENCES

[1] Raji, R., Deepak Mishra, and Madhu S. Nair. "A Novel Texture Based Automated Histogram Specification for Color Image Enhancement Using Image Fusion." *Procedia Computer Science* 46 (2015): 1501-1509.

[2] Kanwal, Navdeep, Akshay Girdhar, and Savita Gupta. "Region Based Adaptive Contrast Enhancement of Medical X-Ray Images." In *Bioinformatics and Biomedical Engineering, (iCBBE) 2011 5th International Conference on*, pp. 1-5. IEEE, 2011.

[3] Jaya, V. L., and R. Gopikakumari. "Fuzzy Rule Based Enhancement in the SMRT Domain for Low Contrast Images." *Procedia Computer Science* 46 (2015): 1747-1753.

[4] Ehsani, Seyed P., Hojjat Seyed Mousavi, and Babak H. Khalaj. "Chromosome image contrast enhancement using adaptive, iterative histogram matching." In*Machine Vision and Image Processing (MVIP), 2011 7th Iranian*, pp. 1-5. IEEE, 2011.

[5] Zhao, Weiguo. "Adaptive image enhancement based on gravitational search algorithm." *Procedia Engineering* 15 (2011): 3288-3292.

[6] Jha, Rajib Kumar, Rajlaxmi Chouhan, Prabir Kumar Biswas, and Kiyoharu Aizawa. "Internal noise-induced contrast enhancement of dark images." In*Image Processing (ICIP), 2012 19th IEEE International Conference on*, pp. 973-976. IEEE, 2012.

[7] Demirel, Hasan, and Gholamreza Anbarjafari. "Discrete wavelet transform-based satellite image resolution enhancement." *Geoscience and Remote Sensing, IEEE Transactions on* 49, no. 6 (2011): 1997-2004.

[8] Cheng, H. D., and Yingtao Zhang. "Detecting of contrast over-enhancement." In*Image Processing (ICIP), 2012 19th IEEE International Conference on*, pp. 961-964. IEEE, 2012.

[9] Verbesselt, J., A. Zeileis, and M. Herold. "Near real-time change monitoring in tropical forest using MODIS satellite image time series." In *1st Forestry Workshop: Operational Remote Sensing in Forest Management, Prague, Czech Republic, 02-03 June, 2012*. 2012.

[10] Lee, Eunsung, Sangjin Kim, Wonseok Kang, Doochun Seo, and Joonki Paik. "Contrast enhancement using dominant brightness level analysis and adaptive intensity transformation for remote sensing images." *Geoscience and Remote Sensing Letters, IEEE* 10, no. 1 (2013): 62-66.

[11] Kurita, Keisuke, Fumito Shinmura, Akira Yokoi, and Hitoshi Saji. "Extraction of Vehicle Queues using a Satellite Image Considering Vehicle Density." In *20th ITS World Congress*. 2013.

[12] Kil, Tae Ho, Sang Hwa Lee, and Nam Ik Cho. "A dehazing algorithm using dark channel prior and contrast enhancement." In *Acoustics, Speech and Signal Processing (ICASSP), 2013 IEEE International Conference on*, pp. 2484-2487. IEEE, 2013.

[13] Rasti, Pejman, Iiris Lusi, Hasan Demirel, Rudolf Kiefer, and Gholamreza Anbarjafari. "Wavelet transform based new interpolation technique for satellite image resolution enhancement." In *Aerospace Electronics and Remote Sensing Technology (ICARES), 2014 IEEE International Conference on*, pp. 185-188. IEEE, 2014.

[14] Chen, Xiaoming, and Lili Lv. "A Compositive Contrast Enhancement Algorithm of IR Image." In *Information Technology and Applications (ITA), 2013 International Conference on*, pp. 58-62. IEEE, 2013.

[15] Guangmeng, G., and Yang Jie. "Three attempts of earthquake prediction with satellite cloud images." *Natural Hazards and Earth System Science* 13, no. 1 (2013): 91-95.

[16] Nercessian, Shahan C., Karen A. Panetta, and Sos S. Agaian. "Non-linear direct multi-scale image enhancement based on the luminance and contrast masking characteristics of the human visual system." *Image Processing, IEEE Transactions on* 22, no. 9 (2013): 3549-3561.

[17] Cao, Gang, Yao Zhao, Rongrong Ni, and Xuelong Li. "Contrast enhancement-based forensics in digital images." *Information Forensics and Security, IEEE Transactions on* 9, no. 3 (2014): 515-525.

[18] Huang, S., and W. Chen. "A New Hardware-Efficient Algorithm and Reconfigurable Architecture for Image Contrast Enhancement." (2014).