

Satellite Image Contrast Enhancement Based On Discrete Wavelet Transform and Singular Value Decomposition

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1 What does this software package solves ?

This software package includes a Matlab program which reproduces the method of the article based on the article *Satellite Image Contrast Enhancement Based On Discrete Wavelet Transform and Singular Value Decomposition* by Demirel, H., Ozcinar, C., Anbarjafari, G. (2010) [1]. The program implements a new contrast technique for obtaining sharper satellite images by enhancing their illumination information. The technique decomposes the input image into the Discrete Wavelet Transform (DWT) subbands, updates the singular value matrix (SVD) of the LL subband and reconstructs the image by Inverse Discrete Wavelet Transform (IDWT).

2 What is included in this package ?

- Articles:
The original article on which this program was based as well as additional articles related to this methodology.
- Matlab Codes:
The following main file and functions are included:
 - 1) Main satellite contrast : Contains the main file that performs the proposed method. The code loads an image, performs DWT, SVD, reconstructs the image and shows the qualitative and quantitative results compared to other state of the art techniques (GHE, CLAHE, BPDHE and SVE).
 - 2) BPDHE: function that performs Brightness Preserving Dynamic Fuzzy Histogram Equalization of on an Image. This is a state of the art technique used to enhance contrast. It is called in the main file for comparison purposes.
 - 3) SVE: function that perform singular value equalization method. Another state of the art method. It is also called in the main file for comparing the results of the proposed method against the previous techniques.

- 4) Subbands: The Subband function performs DWT to obtain 4 subbands of an image.
 - 5) SVD DWT: Function that applies DWT and SVD to obtain a contrast enhanced image. The technique decomposes the input image into the Discrete Wavelet Transform (DWT) subbands, updates the singular value matrix (SVD) of the LL subband and reconstructs the image by Inverse Discrete Wavelet Transform (IDWT).
- Satellite images:
Contains a variety of images that can be used as examples for testing the Matlab code.
 - Report: A report in PDF format which contains detailed explanation of each of the functions described above.

3 How to use the files ?

- 1) Load all the contents of this package on your Matlab folder.
- 2) Open and run the Main satellite contrast.m file
- 3) Two windows will pop up. The first one compares the original image, the state of the art methods and the novel DWT, SVD method. The second window contains histograms of the original image and the different methods.
- 4) To input different images, the following files are suggested: sat1.png, sat2.jpg, space3.png, eye1.png, eye2.png, eye3.png. However the user can load any desired image.

References

- [1] Hasan Demirel, Cagri Ozcinar, and Gholamreza Anbarjafari. Satellite image contrast enhancement using discrete wavelet transform and singular value decomposition. *IEEE Geoscience and remote sensing letters*, 7(2):333–337, 2010.