www.ijecs.in
International Journal Of Engineering And Computer Science ISSN: 2319-7242
Volume 4 Issue 9 Sep 2015, Page No. 14258-14260

Hyperspectral Image Denoising with a Spatial– Spectral View Fusion Strategy.

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Abstract: The paper discusses about the hyper spectral and MS-PAN fusion system, the first part discusses the introduction to fusion imaging and its types, and second part deals with work done by authors with respect to the fusion imaging, third section discusses the proposed system of MS-PAN image fusion with RDWT with reduced noise error and statistical comparison of results.

Keywords: ***DWT, PCA, PAN, MS, LMM, PRISMA***

1. Introduction

Hyperspectral imaging, because of giving high spectral determination pictures, is a standout amongst the most imperative apparatuses in the remote detecting field. Due to innovative limitations hyperspectral sensors [2] has a restricted spatial determination. Then again panchromatic picture has a superior spatial determination. Consolidating this data together can give a superior comprehension of the objective scene. Spectral unmixing of blended pixels in hyperspectral pictures results in ghostly mark and wealth divisions of end individuals however gives no data about their area in a blended pixel.

Pan sharpening, or picture combination, is the procedure of enhancing the spatial nature of a low spatial determination picture (HS or MS) by melding it with a high determination PAN picture. One of the principle challenges in picture combination is to enhance the spatial determination, i.e. spatial points of interest, while safeguarding the first unearthly data. This obliges expansion of related spatial subtle elements to every band of the picture. Because of the high number of groups the pansharpening of HS pictures results in expanded computational burden and many sided quality. In this manner a dimensionality diminishment preprocess, compacting the first number of estimations into a lower dimensional space, becomes obligatory. Against high spectral determination of hyperspectral pictures, these pictures have low spectral determination. This is a result of innovative confinements. To defeat this issue one methodology is utilizing PAN and hyperspectral sensor together. For instance PRISMA [3] perception framework (PRISMA, 2013) comprises of both hyperspectral and panchromatic sensors.

In hyperspectral pictures there are pixels comprising of more than one particular material called blended pixels. Unearthly unmixing routines separate ghastly marks of these particular objects (end members) and plenitude divisions of them. To tackle ghastly unmixing issue two models can be utilized: straight and nonlinear. Linear blending model (LMM) is generally utilized for unearthly unmixing of hyperspectral pictures since it is less complex and as a rule there is no association between materials in the scene [4]. Some direct unmixing systems include: VCA [5], NMF [6], and so on. An example of hyper spectral image fusion below shows spectral unmixing results and segmentation results of panchromatic image for data fusion.

2. Literature Survey

GemineVivone et al. in [7], concentrated some vital focuses as: the absence of all around perceived assessment criteria, inaccessibility of picture information sets for benchmarking and unlucky deficiency of institutionalized executions of the calculations to make an intensive assessment and examination of the distinctive pan sharpening techniques. Pan sharpening calculations having a place with the two more settled and tended to classifications viz. segment substitution (CS) and multi resolution investigation are considered by creators to be assessed and thought about more than five information sets gained by diverse satellites.

Andrea Garzelli et al. [8] while expanding this established part substitution methodology, propose to add to a quick non local parameter based pan sharpening system K-means bunching and overcoming window-based neighborhood estimation. In an attempt to take care of the issue of shading mutilation.

Hamid Reza Shahdoosti et al. in [9], address the planning of ideal channel that has the capacity remove important and non-repetitive data from the PAN picture. The execution is factually assessed utilizing relationship coefficient (CC), relative dimensionless worldwide mistake in blend (ERGAS), phantom edge mapper (SAM), all inclusive picture quality file (UIQI) and quality without reference (QNR). Utilizing Discrete Wavelet Transform (DWT), there are no imperatives about subtle elements that can be separated from PAN and in light of absence of orthogonality;

Kishor P. Upla et al. in [10], proposes a more propelled multiresolution combination methodology modeling so as to

utilize contourlettransform (CT), the MS picture as the corrupted and uproarious form of its high spatial determination form, a not well postured issue. Expecting better directionality from CT for introductory appraisal, creators show the methodology utilizing sub sampled and non-subsampled CT on information sets from Quick bird, IKONOS-2 and Worldview-2 satellites. Likewise, to locate the utilitarian connection between the PAN and MS pictures by common balance exchange capacity of the MS sensor which is ordinarily approximated as a Gaussian channel is frequently deficient for pansharpening.

Problem Objective

The proposed problem is the issue of noise occurring at the time of time of image capture, this increases the errors in the fusion of the MS-PAN image during the mixing of image components, to reduce this a new fusion approach is used which uses the reduced noise variation in the fusion process utilizing the Redundant properties of the wavelet transform.

Proposed system of work

Take input image. Detect the spatial components andcreate a PAN image with high sharp values. Denoise the PAN image using wavelet denoising. Detect the frequency bands in the original image for separating the noise coefficients. Calculate the noise in all individual bands obtained and determine structure value using sparse weighted mean calculation. Using the estimation apply fusion of the denoised sharp PAN image and the original image under Redundant Wavelet Transform Component. Perform the fusion using spatial component fusion with independent Colour Equalization. Objective assessment of proposed and previous image fusion techniques using various quantitative measures

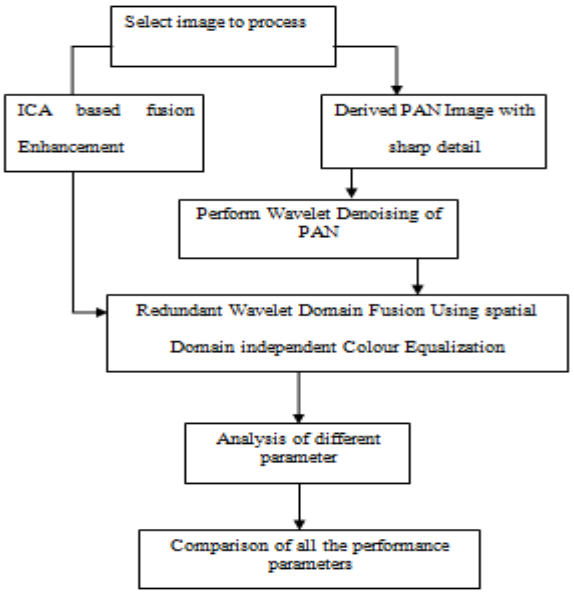

Figure 1 shows the proposed system flow diagram

Results

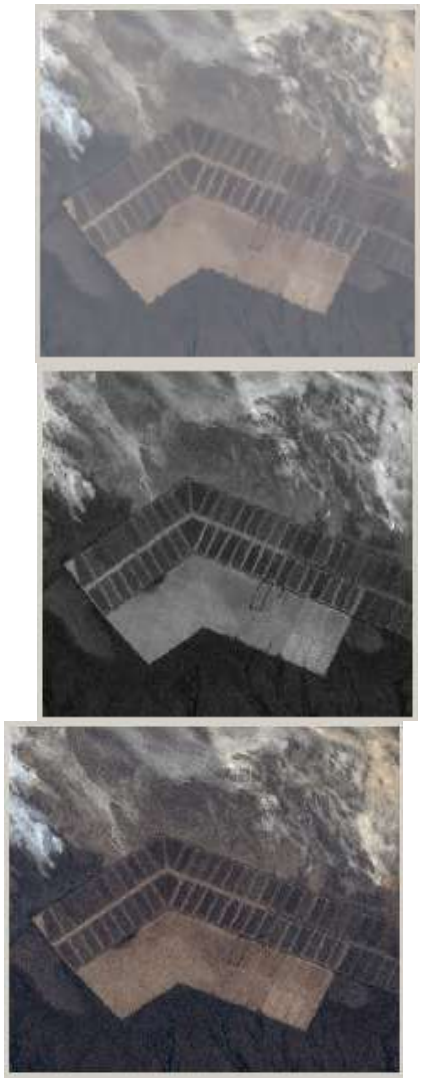

Figure 2 shows the output of the proposed system (top) MS image, (middle) PAN image and (bottom) fused image

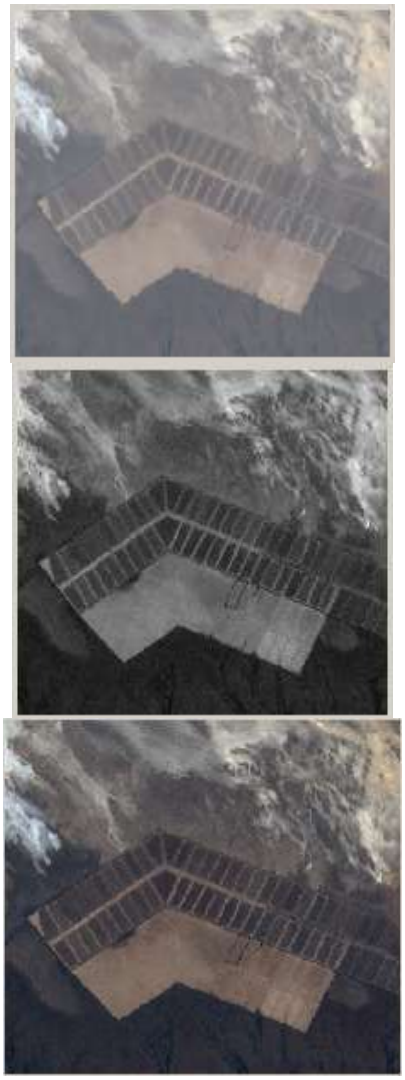

Figure 3 shows the output of the base system of fusion (top) MS image, (middle) PAN image and (bottom) fused image

Image Fusion System	RMSE	Standard Deviation	Correlation
Proposed system	35.6	0.99	0.0063
Base System	4.2	0.96	0.0006

The above table shows the performance comparison of the proposed RDWT and base fusion system on the basis of RMSE, Standard Deviation and Correlation.

Conclusion

In the proposed work the fusion of the MS and PAN image is performed under noise removal system, this task was tedious as the noise removal process also reduces he detail in the spatial image. Which will result in degradation of the fused image output, this is improved by adopting wavelet approach with reduced downscaling redundant wavelet transform, this is proved by the enhanced correlation and standard deviation.

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