A NEW SATELLITE IMAGE FUSION METHOD BASED ON DISTRIBUTED COMPRESSED SENSING
Project ID: 36

GITHUB LINK

https://github.com/sakethkhandavalli/dip-project

TEAM MEMBERS

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Main goal(s) of the project

Fusion of **low-resolution multispectral (LRM)** image and high-resolution panchromatic (HRP) image to obtain **high-resolution multispectral (HRM)** image based on **distributed compressed sensing (DCS)**. This is called as pan-sharpening.

Problem definition:

What is the problem?

Due to constraints of received energy and physics of sensors, the multispectral image detected by multispectral sensors is of high spectral resolution and low spatial resolution, named as LRM image, while PAN image (panchromatic) detected by PAN sensors is of low spectral resolution and high spatial resolution, named as HRP image. We can see that multispectral band images will typically be of a coarser spatial resolution than a panchromatic image. Hence we define a method to fuse the LRM image and the HRP image to obtain a high-resolution multispectral image(HRM) using distributed compressed sensing (DCS).

How things will be done?

Traditional methods like component substitution and multiresolution analysis (MRA) already exist to solve this problem but they do not consider the inter-signal correlation in LRM and HRM bands due to which the detail information of either the spectral or spatial characteristics are compromised. This method uses DCS and JSM-1 to exploit the inter-correlation to give a better performance.

The steps in the proposed Algorithm are :

- For the LRM image, each LRM band is decomposed into the common component and innovation component over approximation dictionary learned from the low-pass version of the HRP image
- Then the sparse coefficients are calculated from JSM-1 of LRM bands.
- For the HRM image, each HRM band is constructed by adding detail band over the detailed dictionary generated from the high-pass version of the HRP image to the corresponding LRM band.

Results of the project

Given an LRM image and corresponding HRP image we will generate the HRM image using the above algorithm, we will compare the results of the algorithm with the HRM images generated using other methods. The proposed method is profitable for utilizing the correlation among multispectral bands and preserving the spectral features of each band.

Team members and tasks for each member along with the expected timeline:

Task	Assigned To	Timeline
Read DCS theory, JSM theory, OMP algorithm and about satellite image fusion procedure	Both	15th October
Upsample and convert LRM image into the required form	Pradeep	20th October
Low-pass version of the HRP image	Saketh	20th October
Compute Approximation dictionary	Saketh	27th October
Compute detail dictionary	Pradeep	27th October
Find Sparse coefficients using JSM-1	Pradeep	4th November
Use OMP algorithm to find the HRM image	Saketh	16th November
Validate the results	Both	20th November

* In the last task the work distribution would be to distribute the datasets and validate independently.