



Downscaling multi-band satellite images without co-located high-resolution data: a new approach based on training images

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Last-generation satellite imagery offers extremely sharp representation of the Earth surface up to submetric resolution. These products are useful to monitor earth-surface natural processes and human activity, but they are still very expensive and limited in coverage, since they require the use of specific space-borne devices. Conversely, lower-resolution images are available with larger spatial and temporal coverage.

We propose a technique to downscale coarse-resolution multi-band satellite images using the information contained in a limited training set of coarse-to-fine resolution images (TI). The technique, based on the Direct Sampling algorithm [1], simulates the fine-scale image by sampling data from the TI where a similar coarse-scale data pattern is found. The peculiarity of the method is that it avoids the use of co-located fine-resolution predictive variables, a limiting requirement for data fusion.

The method is tested on the downscaling of a series of 4-band (R,G,B,NIR) satellite images from the Planet Lab product (3m resolution). Co-registered WorldView-3 and -4 images (4 bands, 1.2m resolution) are used as hi-res equivalents. The presented application examples include a forest in Botswana, a deltaic landscape in the north-west of Australia, and the urban area of Alice Springs, central Australia.

The results show that the technique can generate realistic images with respect to the hi-res reference, allowing a better estimation of the multi-band intensity histogram and object classification. The method is only at its early stage of development, but it holds great potential to extend the space/time coverage of hi-res images for detailed studies of natural and anthropic process, such as vegetation coverage, water bodies extension, and urban growth.

[1] G.Mariethoz et al. (2010), Water Resour. Res., 10.1029/2008WR007621.