MULTISENSENSOR MULTITEMPORAL DATA FUSION USING WAVELET TRANSFORM

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ABSTRACT:

Interest in data fusion continues to grow due to the increasing importance of obtaining both high temporal and spatial resolution data for many applications (e.g., ecosystem disturbance and recovery, ecological forecasting, and the like). Numerous fusion techniques for remotely sensed data have been presented in the literature. STAR-FM is one of the most widely used techniques. STAR-FM relies on the inclusion of MODIS imagery to supplement Landsat scenes using a linear model.

This study proposes a novel technique for multitemporal multisensor data fusion based on multiresolution analysis using wavelet transform. The novelty of this approach is two-fold. First, unlike STAR-FM, this technique does not predict the whole image in one linear stage but breaks it into "*approximations*" and "*details*" and then every portion is fed into a different prediction model to limit the effect of linear interpolation among images. Low frequency components are predicted by a weighted mixture of the MODIS images combined with the low frequency components of the available Landsat images. Meanwhile, the high frequency components are predicted by a weighted averaging of high frequency components of only Landsat images. Second, the method can rely on information from only one input Landsat and MODIS pair, which can be improved if more than one pair is used.

The technique was applied on Landsat and MODIS images of a study area from WRS-2 path/row 16/35 in Landsat and H/V11/5 in MODIS (Central North Carolina) acquired in 2001. The NDVI images calculated from the dataset were used as an input to the algorithm. To evaluate the prediction accuracy quantitatively, RMSE and R^2 of the predicted images were calculated for some already available Landsat images. Most of the R^2 values were between 0.8-0.94. These results suggest that the approach is quite promising and worthy of further investigation.