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An Approach to Optimize the Fusion Coefficients for Land Cover Information Enhancement with Multisensor Data

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This paper explores a novel data fusion method with the application of Machine Learning approach for optimal weighted fusion of multisensor data. It will help to get the maximum information of any land cover. Considerable amount of research work has been carried out on multisensor data fusion but getting an optimal fusion for enhancement of land cover information using random weights is still ambiguous. Therefore, there is a need of such land cover monitoring system which can provide the maximum information of the land cover, generally which is not possible with the help of single sensor data. There is a necessity to develop such techniques by which information of multisensor data can be utilized optimally. Machine learning is one of the best way to optimize this type of information. So, in this paper, the weights of each sensor data have been critically analyzed which is required for the fusion, and observed that weights are quite sensitive in fusion. Therefore, different combinations of weights have been tested exhaustively in the direction to develop a relationship between weights and classification accuracy of the fused data. This relationship can be optimized through machine learning techniques like SVM (Support Vector Machine). In the present study, this experiment has been carried out for PALSAR (Phased Array L-Band Synthetic Aperture RADAR) and MODIS (Moderate Resolution Imaging Spectroradiometer) data. PALSAR is a fully polarimetric data with HH, HV and VV polarizations at good spatial resolution (25m), and NDVI (Normalized Difference Vegetation Index) is a good indicator of vegetation, utilizing different bands (Red and NIR) of freely available MODIS data at 250m resolution. First of all, resolution of NDVI has been enhanced from 250m to 25m (10 times) using modified DWT (Modified Discrete Wavelet Transform) to bring it on the same scale as that of PALSAR. Now, different polarized PALSAR data (HH, HV, VV) have been fused with resolution enhanced NDVI separately i.e. three fusions (HH & NDVI, HV & NDVI, VV & NDVI), employing different combinations of weights (fusion coefficients) like (60, 40), (70, 30) etc. for each of the three fusions such that the sum of weights is 100. Henceforth, many fusion combinations are obtained for each fusion. Exhaustively, the effect of NDVI index on PALSAR data has been tested by computing and observing accuracies of vegetation regions as it should enhance by utilizing NDVI. After that, best weighted combinations of all the three fusions are stacked together to get all the fully polarimetric and NDVI information in a single image. Obtained stacked images are classified using SVM. The proposed technique is better than traditional methods like Genetic Algorithm because of more complexity. The proposed fusion approach is able to achieve improved vegetation region accuracy than that obtained by using stacked HH, HV, VV polarized data only. Quantitative and visual results show the superiority of the proposed technique over the others. Hence, other indices such as NDWI (for water) and UI (for urban) can also be utilized further for obtaining utmost land cover information.