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Automatic supervised classification of multi-temporal images using the expectation-maximization algorithm

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The impact of nonstationary phenomena is a challenging problem for analyzing multi-temporal remote sensing data. Spectral signatures are subject to change over time due to natural (e.g. seasonal phenology or environmental conditions) and disruptive impacts. For example, the same class shows quite different spectral signatures in two temporal remote sensing images. The phenomenon of evolving spectral features is referred as spectral drift in the remote sensing community, or data shifting in the machine learning community. Under the effect of spectral drift, we need to address the problem that the distributions of training and testing set are different, which is more difficult than for single-image classification. That is, a supervised model may not be capable of explaining the testing set. In this study, we utilize the expectation-maximization algorithm to classify multi-temporal sea ice images acquired by optical remote sensing sensors. The proposed technique allows the classifier's parameters, obtained by supervised learning on a specific image, to be updated in an automatic way on the basis of the distribution of a new image to be classified.