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Effect of pixel purity in the training and testing stages of supervised crop classification using MODIS time series

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ABSTRACT:

Monitoring of agricultural production at regional to global scales requires the use of sensors with a high revisit frequency. Crop specific monitoring is possible with instruments such as MODIS (~250 m at nadir), but depending on the agricultural landscape the spatial resolution can be of the same order of magnitude as the field sizes, leading to the mixed pixel effect and increased misclassification. Classification accuracy is important information for users of such maps. However, it is often calculated based on a subset of pure test pixels, and this can positively bias the accuracy assessment. In this study, the effect of pixel purity in the training and testing stage of supervised crop classification using MODIS time series was investigated.

The support vector machines (SVM) algorithm was applied for crop classification in two agricultural landscapes in Central Asia, using data sets from MODIS in 2011. A mask of the agricultural fields at fine spatial resolution was used to calculate the crop specific purity of each MODIS pixel using a model of the instrument's point spread function. This purity indicates the contribution of the agricultural surface to the signal recorded by the instrument.

Overall classification accuracies above 90% are obtained in both landscapes. The inclusion of mixed pixels in the training did increase the accuracy of mixed test pixels by more than 10%, whilst the accuracy of pure test pixel was almost unaffected. Further, the classification accuracy was plotted as a function of pixel purity, which enabled a spatialized assessment of map quality. When mixed pixels in a landscape were abundant, their inclusion in the training stage resulted in higher accuracies and thus a more meaningful evaluation of map quality. This study demonstrates how taking into account pixel purity in all stages of classification allowed for a more appropriate accuracy assessment.

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