COMPARING CLASSIFIER PERFORMANCE FOR CROP IDENTIFICATION IN MULTI-TEMPORAL IMAGES, MIANEH, IRAN

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Abstract

The classification of crops from remote sensing has become an important part of agricultural management. In recent years, there is an increasingly trend toward use of more robust and more accurate image classification techniques. Among them, however, using machine learning classifiers has been proven to be more efficient and reliable in terms of accuracy, time needed, training sample size, etc. In this study, we assess the performance of three classifiers, i.e, Maximum likelihood, Random Forest and Support Vector Machine in a pixel – based method for crop identification in multi-temporal images in Mianeh county, northwest of Iran. RF and SVM are machine learning classifiers that in the past decade, use of them to classify remotely sensed data has increased (RF is a kind of ensemble classifier). ML procedure is, for many years, the algorithm of choice because of its ready availability and the fact that it does not require the extended training process. The use of multi-temporal images has been proven to be useful for crop identification in many researches, as it provides information of crop phenology. There are 7 crops cultivated in this region, including corn, rice, rain-fed wheat, irrigated wheat, fodder, summer crops and fallow. Our dataset consist of a two – date SPOT5 image, one early - spring image and a late - summer image. We test three classifier with a two-date image and once with each of these one-date images. Therefore, we have nine classification maps in this approach. Mapping was then evaluated applying the confusion matrix method to the independent testing dataset. Our results indicated that SVM classifier performed best in comparison with two other classifiers in all images (overall accuracy in two-date image with SVM is 80.9%, with RF 80.11% and with ML 77.05%). However, RF classifier performance in two-date image is comparable with SVM. Regarding time needed for each classifier, RF classifier has best performance, as it operates in less than a quarter of time needed for SVM classifier and its accuracy is moderate and acceptable. ML classifier has lowest accuracy in three classifications. In all classifications, the early-spring image has lowest accuracy and two-date image has highest

accuracy. The most increase in accuracy due to two – date image is with RF classifier (late – summer image overall accuracy is 70.26% and two – date image accuracy is 80.11%, about 10% absolute increase in accuracy). Meanwhile, we evaluated RF sensitivity to number of trees, using 1,10,50,100,500 and 1000 trees in each classification. The results indicated that the number of 100 is optimum number for all images. At the end, we conclude that SVM has highest accuracy, although it is computationally slow and time-consuming, but RF is computationally fast and has acceptable accuracy. Multi – temporal images is also necessary for achieving high accuracy levels in crop identification.

Keywords: classifier, machine learning, crop identification, multi-temporal images, overall accuracy