

Pattern Recognition Techniques in Remote Sensing

Joint EuroSDR/ISPRS Test

ISPRS ICWG III/VII

Appendix B to Call for Data Provision

Goal of the Test

The test aims at empirically evaluating the current status of supervised and semi-supervised classification methods applied to remote sensing data. Interested researchers from the remote sensing and pattern recognition community, in the following called *participants*, are asked to apply their classification techniques to image data provided by remote sensing organisations or research teams, in the following called *data providers* via the organizers of the test, in the following called the *investigators*.

Form of the Test

The test has two phases, one *online-phase* and one *workshop-phase*. Whereas the online phase is performed by the participants within their own environment, the workshop-phase is performed at a joint meeting of the participants at a workshop, probably 2013 in Bonn, Germany.

In both phases the classification is performed in three steps. (1) Based on training data, which are provided by the data providers, i.e., the participants train their classification algorithms, without having access to additional test data. (2) They apply the trained classification procedure to test data, without having access to the reference information (i.e., ground truth data) and provide the results via a web page. (3) The investigators evaluate the results, using the reference information, which was provided by the data providers.

Reference Information: Class Specification

In order to be able to compare the different results, the relevant classes need to be specified. This *specification is done by the data providers*, as they know the usefulness of the data for the identification of the classes based on the data. In order to make the test interesting as well as feasible, a minimum and maximum number of classes seem recommendable. Therefore we aim at having data sets with ideally *8-20 classes*.

The classes should ideally be *land cover classes*, i.e., the classes refer to the physical material at the surface, e. g. grass, asphalt, trees, etc. We only want to consider *land use*, in case spectral or geometric image feature can be expected to support class discrimination.

In case of a larger number of classes, it is useful to arrange them in a thematic hierarchy. Neighbouring classes, which are perhaps difficult to separate and belong to the same super-class, may be merged into a single class. Thus, a brief *description of the classes* and (whenever possible) a provision of a *thematic hierarchy* should be provided by the *data providers*.

Data Specification

The remote sensing data may be of **any type of sensor**, i.e., *optical* or *radar*, *airborne* or *space-borne*. *Laser range data* may be added. The pre-processed image data should be provided in a standard image file format (TBA). The data include the *annotation*, i.e., *ground truth information added* as additional band. Therefore the reference information should be spatially registered to the corresponding remote sensing data set of the same size. For each pixel the class membership is specified by 1 to K, with K as the number of classes. The class 'unknown' is an admissible class. An additional file includes the class names and the potential class hierarchy.

Amount of provided data

The results of the whole test are only of scientific relevance in case the amount of processed data is large enough. We refer to *one data set* as *one remote sensing image* including the registered reference data. The requirements concerning the amount of data refer to *the number of data sets* and the *amount of reference data per class*.

Number of data sets: The reader of the final report wants to know, whether the result derived from one data set is representative for a certain type, the data set belongs to. As a data set refers to a specific sensor or sensor combination, to a certain geographic region, a certain acquisition date etc. we would prefer *different data sets of a certain type*, but not more than about ten. The data sets should have clear properties in common, while vary in only one property. E. g. they may refer to the same sensor combination, and the same time (e. g. spring 2002) but to different geographic regions - this certainly will be the most relevant variation -, or, they may refer to the same sensor combination and region but at different dates.

Amount of reference data per class: Therefore the amount of reference data per class need to be large enough to perform two tests, each with independent training and testing data, as described in Appendix A

Classifiers usually refer to a set of local characteristic features of the pixel. This will be usually the spectral information of that pixel. However, certain types of classes cannot be identified solely based on the (multi-)spectral information of single pixels and require information about their neighbourhood.

The reference data need to allow a reliable training of the classifiers. Thus the amount of data with known reference classes needs to be large enough in order to allow for training and testing in the two phases of the project. The following example should indicate what size of reference data we expect per class:

When mapping areas, which are characterized by typical spatial patterns, such as e.g. agricultural field plots, the reference information is usually acquired at plot basis. Thus, reference information on polygon basis is preferred. In this case app. 100 regions are required for our test at minimum. Alternatively approximately 400 individual pixels per class can be provided as minimum.

Terms and conditions / Rights for distribution

The *data including the reference information need to be freely available*. The test wants to reach an as large number of researchers as possible in order to identify the limits of today's performance of classification procedures. Therefore the data need to be made available to the whole research community. The idea is to have the data on the server of the investigators,

make their existence known to the community, by individual invitation but also by mailing groups, such as 'imageworld' (<http://lists.diku.dk/mailman/listinfo/imageworld>). There will be *no contract* at all concerning the use of the data, except that the participants are obliged to the scientific ethics, i.e., cite/acknowledge the person/organisation who provided the data. Also the data is available *free of charge*. In order to keep track of the users of the data, the data will be password protected. The password will be sent to everyone who wants to participate, where we need to accept that (1) the participant is able to have co-workers helping in performing the test and (2) we as principle investigators cannot be made responsible for any further dissemination of the password and/or the data.