Introduction

Urban sprawl is a Europe-wide serious problem, not only due to total area taken, but also because of its spatial distribution patterns (leading often to landscape fragmentation) and the composition of land taken (mostly agriculture and natural areas are converted to artificial landuse zones). Land is a finite resource and therefore urban planners need to select land for further development wisely applying the concept of land recycling.

There is a need for user-oriented services facilitating the identification of suitable sites for redevelopment. To achieve this goal, the European Urban Atlas, the High Resolution Layer of Imperviousness degree together with other related global Copernicus data sets provide unique information for developing EO based information services. The aim of such services is to provide detailed information to policy makers and practitioners on potential land to be (re)developed within existing urban areas. This work focuses on the recent results obtained from the exploitation of these data sets, and especially from EO image analysis, within the “URBAN land recycling Information services for Sustainable cities” (URBIS) project funded by the European Union as a part of the 2007-2013 Competitiveness and Innovation Framework Program (Grant Agreement n°621125).

Within URBIS, a service for exploiting the aforementioned data sets to create and temporally update an inventory of potential development areas (PDAs) on the European territory is defined and experimentally validated on three pilot sites.

Methodology

We employ the following pixel and region-based classification and multi-temporal image analysis techniques:

- Region-based random field models
  Standard and multi-scale region-based Markov Random Fields (MRF) to integrate multi-source imagery and features.

- Pixel-wise classification methods
  Random Forest (RF), an efficient and flexible tools to perform classification based on multiple spatial, spectral, and textural image features.

- Domain adaptation and transfer learning
  Graph-based techniques to minimize training requirements by transforming image data without training samples to match image data that are endowed with training samples and were collected under different acquisition conditions.

Employed Features

The intended analysis relies on the use of the following urban-sensitive features:

- Morphology and structural features to extract geometrical patterns;
- Texture description via (semi-)variograms and Grey Level Co-occurrence Matrix (GLCM) like contrast, dissimilarity and entropy features, for surface classification based on statistical contextual dependence properties;
- Vegetation and water indices for the identification of vegetation and water classes based on reflectance properties of the multispectral data.

Larger Urban Zone

The analysis is performed on European cities with agglomerations of over 300,000 inhabitants, which are covered by the Copernicus Urban Atlas. Three pilot sites are the focus of the study:

- City of Osnabruck (Germany);
- Moravian-Silesian Region (Czech Republic);
- The Greater Amiens (France).

The results are produced on SPOT-5 HRG satellite images at 2.5 m, Urban Atlas maps, and ancillary data, in reference years 2012 and 2006 (not exhibited here). The accuracy is around 90%.