TOPOGRAPHIC INDEPENDENT COMPONENT ANALYSIS MODEL IN COMPARISON WITH GRADIENT BASED METHOD FOR UNDER METER HIGH RESOLUTION SATELITTE IMAGES CARACTERIZATION

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ABSTRACT

Many satellite images are being received every day from several satellite sensors. These images, especially Very High Resolution (VHR) satellite images (such as Ikonosand and Quickbird) provide valuable information for us. Among these, urban area and buildings have especial importance for researchers. However, since the amount of received data is enormous, for a human expert, manually extracting this valuable information is not possible. Recently, a wide variety of methods is used by researchers for satellite image indexing and classification, especially for urban area.

The most important methods that are usually used for satellite image characterization can be classified into two groups. The first group contains methods that use local features. SIFT is the most famous method representing this group. Other group includes methods that use global features of image rather than local ones. Usually these global features are related to texture features. Local features have an important advantage and a big disadvantage as well. Their advantage is their capability and their precision for describing objects and structures contained in the image. However, their disadvantage is that they usually don’t convey a global interpretation of the scene inside the mage in spite of the big total number of features needed for an image. Contrariwise, the advantage and disadvantage of global features are exactly inverse in respect of those of local features. Therefore, we are interested in finding some methods that can be replace between two groups such that they benefit advantages and prevent disadvantages of two groups as much as possible.

In this paper we propose a Topographic Independent Component Analysis (TICA) model for satellite image characterization. In ordinary Independent Component Analysis (ICA), the components are assumed to be completely independent, and they do not necessarily have any meaningful order relationships. Therefore, extracting some higher-level features from ICA components and reducing the dimension of feature vector is not easy and we have to consider the set of all components as the feature vector. However, in TICA the correlation or dependency between components can be used to extract features and reduce the dimension of feature vector.
Due to natural characteristic of TICA (ICA) components inside which lines and edges are presented, they are strongly related to gradient properties of image. Thus, one may be interested in studying gradient properties of satellite images, statistically, in parallel with visual words based on ICA components. Within the paper, we offer our second model on the base of gradient properties of satellite images.

Both of 2 proposed models will be applied to describe 0.6m resolution satellite images. We compare capabilities of our models (TICA, ICA, gradient) for characterization of satellite images.