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AN AUTOMATIC COMPARISON ALGORITMH OF AERIAL IMAGE FOR DISCOVERING LAND TRANSFORMATIONS IN GRASS GIS

Every day new images covering earth regions are available on Internet - i.e. as it happens on Google Earth (TM) -. Public institutions that deals with land and environment monitoring are strongly interested in automatic evaluation of land changes both for planning reasons and administrative tasks (i.e. illegal building discovering).

This kind of activity could be easily performed with instruments able to compare aerial representation of land picked in different times. In order to perform this evaluations our research group has been studying and developing procedures for automatic comparison of aerial photos.

The procedure illustrated in this paper, operating on GRASS GIS is a first tentative to register a new image comparing it with an existing one, searching subsequently homologue points (in order to georeferencing automatically the second image) and hence looking for corresponding building. The procedure is based on algorithms of image segmentation and image regions comparison on samples found by region growing calculations. In the general context, methodologies for correspondences searching are classified on the base of the entity involved: area based matching (ABM) by image gray levels, feature based matching (FBM) by edges and regions, relational by symbolic descriptions. In the present work, we propose a FBM approach that could be also a support for high level description of the objects detected on the images.

In particular, the implemented methodology is composed by the following computational phases:

* RGB colour thesholding in order to retain interesting objects;
* segmentation by region growing algorithm to find connected regions (it is used an automatic procedure to place seeds on image);
* description of each detected region (centroid coordinates, shape

factors by using Fourier descriptors, and area);

These computational steps are performed on various images related approximately to same land area taken at different time, position, or resolution. Given two images to process, in order to find corresponding areas, simple patterns of displacement of relevant regions are searched: triangles having as vertexes three near regions are described by normalized distances (considering areas) and angles. A matrix counts all the correspondences found between the triangles from each image in order to use them to compute the transformation. In this way, the two images could be registered with an acceptable error, and after a refinement based on the whole common area on two images, they could be georeferenced. Moreover, previous described methodology individuates regions relevant for successive evaluation of land changes or anomalies by simple difference, and it is suitable for symbolic description and analysis. In fact, different preliminary colour segmentation allows to insulate various land objects (i.e. roofs, streets, and so on), distinguishable by texture and hue.

Preliminary experimentations show good results also when the system deals with all the possible planar affine transformation (rotation, translation and scale), using both aerial and Internet images with different resolution.

The papers also deal with the construction of a library that is based both on functions already present in GRASS standard required libraries as on other open source libraries.

The presented research keep going in order to improve georeferencing results: new functions are going to be added with the aim to reduce computational times searching correspondence not only for objects with the largest area but also for objects with distinctive shape factors.

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