

# Summary

This research work is a part of a global project related to urban scene modeling from high resolution satellite images with focus on building reconstruction. This work has been carried out as a collaboration among the IGN (French National Geographical Institute), the CNES (The French National Space Center) and the University of Paris 5. The input data consist of a panchromatic stereo pair of satellite images, with a submetric resolution of 50-70 cm and a low Base to Height ratio  $B/H$  [0.05 - 0.2]. Since a detailed extraction and description of building rooves is complex in a satellital context, we propose to describe the scene by means of a 3D surface which provides either raster or vector information and thus different description levels. A "Hypothesis-and-verify" strategy is used. 3D-primitives are extracted from images. Two complementary approaches are proposed which are based on 3D-segments for the first one and on region matching for 3D-facets estimation. The originality of our approach is a global matching of multiscale segmentations which provides reliable 3D-facets.

Primitives validation is done by means of a 3D-surface modeling process. 3D-surface computation can be formulated as an energy minimization process based graph cuts. 3D hybrid graph is constructed on raw correlation information and extracted primitives. Minimal capcity cut will provid the 3D surface model. The main contribution of our approach is the use of 3D-primitives such as 3D-segments and 3D-facets as well as the introduction of information from external database such asroad database or cadastral maps, to guide the optimization process. We propose an improvement over the graph cut method for stereo computation. The main idea is that to insert depth constraints based know 3D primitives. Then the graph cut problem is reformulated to enable better discontinuity computation and surface regularization. The obtained product is an hybrid DEM (Digital Elevation Model) which provides the highest level of reliable primitives for each scene region.

keywords : satellital images, stereoscopy, 3D-surface modeling, 3D-primitives, segmentation, multi-scales region matching, graph cuts optimization, Photogrammetry, Digital Elevation Model.