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CONCEPTION OF A GIS-PLATFORM TO STUDY AND SIMULATE URBAN DENSIFICATION BASED ON THE ANALYSIS OF TOPOGRAPHIC DATA

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This abstract summarizes a full paper presented in Springer ICC 2011 publication. In the paper we present a current state of a research project named GeOpenSim funded by the French research funding agency (ANR) from December 2007. The aim of the project is to analyse the evolution of urbanization and to simulate it on specific areas. We focus on urban areas close to rural areas and we study the evolution over a time period from 1950 until now. It corresponds to an important urban growth period with densification of urban blocks and extension of towns on rural areas.

The first step of the project consisted in the creation a historical vector data bases by means of today vector data bases and old maps and photos. Specific processes were presented at the previous ICC conference in 2009. We also proposed a spatiotemporal model to represent the same location at different period.

The second part was then to compare the data to build evolution rules based on urban area characteristics including urban block classification. We also developed original methods to densify urban blocks with different patterns. Last but not least we proposed a mechanism to simulate urban densification and growth, based on agent paradigm. The agents are the buildings (for new buildings to respect contextual constraints) and the urban blocks (to densify itself).

The paper begins with presenting the process of simulation, then we present the densification method based on a relevant pattern library. During the project we created 6 patterns: individual and not planned houses, individual planned houses, large blocks of flats, very large blocks of flats, small blocks of flats and industrial patterns. We proposed a data modelling that allows to represent a large set of patterns and to use them during the simulation.

Last but not least we present methods to build relevant knowledge from historical data. This part is certainly the most complex but challenging task of the project. The aim is to build evolution rules that are used to simulate urban evolution from two dates. We present urban block classification based on supervised learning techniques that is necessary to find relevant class of urban block before and after simulation and a method to learn transitions from one step to another (what are the chance and conditions to become a “high density of specialised area” being before a “ low density of specialised areas”). Some important knowledge has been detected that allows first simulations but research work is still on going to improve the results.

The methods are implemented on dedicated open source software named GeOxygène. The interfaces are done to allow a geographer to test his own evolution rules or to test existing evolution rules on specific areas.