Detecting Conflicts and Recommending Actions for Urban Planning

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At regional level, knowledge management enables decision-makers to take relevant actions [4]. In the context of urban planning, many rules are defined and applied to lead and constrain the development of territories such as the Right to Build [3]. These rules are produced at different levels, for instance national and local (city). Besides they are mainly scattered into numerous textual documents (e.g., *PLU-H* in France, which stands for Urban Local Plan), thus making them difficult to use for non-experts. Yet, modelling urban rules could have many benefits such as an enhanced planning with automatic checking and recommendations, the reuse and sharing of rules, better transparency for citizens, an improved understanding of the past or a comparison between territories through spatial analysis.

To enable the transition towards *semantic urban rules*, several challenges need to be tackled. First, a generic model has to be established for representing rules [5, 6], which takes into account the hierarchy (e.g., rule inheritance from the top-level) and exemptions at local level. Exchanges between domain experts (urbanists, computer scientists, decision-makers, etc.) and agreements on the concepts definition are crucial for a successful data representation. Besides, such representation is different according to the actors' level. For example, when projecting to build an industrial facility, security rules are not applied on the same spatial objects: regional decision makers focus on seismology while local decision makers are interested in distances to surrounding residences.

A second issue deals with the extraction of rules from textual documents or from data. Natural language processing or pattern recognition with a strong analysis on spatial concepts enables rule extraction from documents [1]. Many works on spatial data mining have been conducted for extracting knowledge from data [2]. Besides, some rules are not formally written (e.g., mimicry between close cities, best practices). Evaluation of generated rules is a challenge since both techniques do not guarantee a perfect quality, and a human validation is required (e.g. inconsistency between rules). The definition of a new visual language for designing and correcting these rules could be a major improvement for practitioners. Since many rules are produced at local level, a regional authority could be created between existing levels in order to facilitate the organization and standardization of this information.

Once the rules are available, another challenge is the data collection and integration, which mainly requires specific development. Although the Open Data initiative promoted a better availability, especially in large cities, an effort has to be made on data quality (updates, semantics). Besides, many cities are located on a border. Thus, it is necessary to ensure data and rules continuity between adjacent administrative areas.

Finally, the previous points should lead to the development of applications that enable this transition, for instance by proposing various cartographic visualizations to decision-makers, recommendations to urban planners, impact predictions of a given project (e.g., pollution, traffic, environmental consequences), etc. For a new urban project, an application should store necessary data and enable the selection of relevant and/or prioritized rules. The system can automatically check some of the rules, but others require human interaction to be validated. Therefore the process needs to be incremental. We could also imagine an application which checks the final decisions, especially in terms of inconsistencies and relevance.

Our current work focuses on the last points, i.e., data integration and visualization of rules' application for the city of Lyon. Due to lack of common framework the data integration task is specifically tailored for Lyon using their API[1]. Our set of rules is basic without a specific model. For instance, we aim at checking when a road cuts through a building or when two roads cross without a junction node[2]. The height of buildings is also verified with regards to the maximum allowed height defined at the local level. We also detect pavements or cycling lines which are not wide enough, which may often occur in old cities, and to suggest possible roads for new cycling lanes. If the development has reached an advanced stage, our prototype could be demonstrated during the workshop.

References

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[1] Grand Lyon API, https://data.grandlyon.com/

[2] These examples could be normal situations (e.g., architectural element, hoppers).