Urban Structure and Environmental Performances: a Framework for Discovering Corresponding Pattern (Extended Abstract)*

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Assessing sustainability in the urban environment is a complex task, mainly due to the enormous amount of heterogeneous data and variables, the presence of context-dependent measures, and the absence, in this domain, of recognised techniques for assessing the quality of the data and the proposed interventions [1, 2].

This research project aims to develop a multidisciplinary methodology to analyse urban data and optimise the sustainability of urban systems.

It focuses on improving the existing Integrated Modification Methodology (IMM) [3], designed by the architects of the IMMDesignLab[1], by establishing an integrated framework supporting the entire urban environment analysis cycle. By incorporating advanced data analysis techniques, this research aims to overcome the limitations of the current methodology and establish objective relationships between the structural characteristics of urban environments and their performance indices.

The proposed framework consists of three conceptual levels: project level, data level, and data analysis level. In particular, the data level involves the creation of a data model to incorporate contextual knowledge. The data analysis level, instead, focuses on utilising appropriate data mining techniques for descriptive and predictive analysis, studying relationships among variables, and identifying correlations and causality relationships.

For the data analysis level, a practical application of the framework was developed through the SiMBA (Systematic clustering-based Methodology to support Built environment Analysis) [4] system. SiMBA utilises clustering algorithms to analyse various data related to the built environment and environmental performance. Preliminary experiments in Milan showcased SiMBA's ability to select representative features, create meaningful clusters, and establish correspondence between city structural and environmental performance patterns.

In conclusion, this research project aims to develop an integrated framework that combines the IMM methodology with data science techniques to measure and enhance the environmental performance of cities. The framework's architecture, data model, and the initial development of the SiMBA system have laid the foundation for future research, focusing on further refining the analysis process.

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