International Doctorate in Civil and Environmental Engineering

"THE DIGITIZATION OF THE BUILT:

FROM POINT-CLOUDS GENERATED THROUGH SURVEY TO THE ELABORATION OF DATA FOR ANALYSIS, MANAGEMENT AND MONITORING OF CULTURAL HERITAGE"

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Abstract

The work proposes a methodological system for semantic annotation transfer, data exchange and information retrieval on heritage complexes.

The studies of conservation, management and restoration of cultural heritage always require the involvement and participation of multidisciplinary research teams and therefore the production of a large number of documentary and analytical resources.

Due to the heterogeneous nature of the different studies, a plurality of methods and systems of representation, visualization, retrieval and organization of data is derived; this often leads to the dispersion of information, as well as to the difficulty in collecting the wide variety of heterogeneous material related to the study of a heritage object.

An open problem in current research is the development of digital information systems which, by exploiting three-dimensional representation, make it possible to gather and link the different data produced within the framework of studies and analyses carried out on the built heritage.

In addressing this issue, the objective of this work is to propose a digital information management system, which allows data entry and retrieval, and which is based on the insertion of semantic annotations in 2D / 3D representations of heritage objects. The challenge is to obtain a system to be:

- Independent of the program used for the spatialization of the data;

- Insensitive to changes in the real geometry of the study object (level of precision of the representation, type of model used),

allowing to locate data in space and time and to ensure their traceability, directly displaying all available information over a digital representation.

The proposed approach leverages a semi-automatic procedure for the semantic segmentation of 3D data, based on Machine Learning techniques, and proves to be very efficient even for the construction of Heritage-Building Information Modeling systems.

The methodological approach is especially applied to the study of the emblematic case of the Carthusian monastery of Pisa, a 13th century monastic complex whose extension and historical importance require:

- Standardized syntax and representation

- Coordinated management of research results

- Contextualization of the data produced in the context of restoration and conservation activities.

The constructed digital information management system guarantees the collection, updating and transfer of data between representations of different type, including the evaluation of temporal phenomena.