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DIPARTIMENTO DI INFORMATICA

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DOTTORATO DI RICERCA IN INFORMATICA

XII CICLO - NUOVA SERIE



*Tesi di Dottorato in*

**3D data visualization techniques and  
applications for visual multidimensional  
data mining**

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# Abstract

Despite modern technology provide new tools to measure the world around us, we are quickly generating massive amounts of high-dimensional, spatial-temporal data. In this work, I deal with two types of datasets: one in which the spatial characteristics are relatively dynamic and the data are sampled at different periods of time, and the other where many dimensions prevail, although the spatial characteristics are relatively static.

The first dataset refers to a peculiar aspect of uncertainty arising from contractual relationships that regulate a project execution: the dispute management. In recent years there has been a growth in size and complexity of the projects managed by public or private organizations. This leads to increased probability of project failures, frequently due to the difficulty and the ability to achieve the objectives such as on-time delivery, cost containment, expected quality achievement. In particular, one of the most common causes of project failure is the very high degree of uncertainty that affects the expected performance of the project, especially when different stakeholders with divergent aims and goals are involved in the project.

The second data set refers to a novel display of Digital Libraries (DL). DL allow to easily share the contribution of each individual researcher in the scientific community. Unfortunately, the webpage-based paradigm is a limit to the inquiry of current digital libraries. In recent years, in order to allow the user to quickly collect a set of documents judged as useful for his/her research, several visual approaches have been proposed.

This thesis deals with two main issues. The first regards the analysis of the possibilities offered by a 3D novel visualization technique 3DRC to represent and analyze the problem of diverging stakeholders views during a

project execution and to address the prevention and proactive handling of the potential controversies among project stakeholders. The approach is based on the 3D radar charts, to allow easier and more immediate analysis and management of the project views giving a contribution in reducing the project uncertainty and, consequently, the risk of project failure. A prototype software tool implementing the 3DRC visualization technique has been developed to support the 3DRC approach validation with real data. The second issue regards the enhancement of CyBiS, a novel 3D analytical interface for a Bibliographic Visualization Tool with the objective of improving scientific paper search.

The benefits of using 3D techniques combined with techniques for multi-dimensional visual data mining will be also illustrated, as well as indications on how to overcome the drawbacks that afflict 3d visual representations of data.