Integrating OLAP/SOLAP in E-Business Domains: An Empirical Study

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ABSTRACT

E-business domains have been considered killer domains for different data analysis techniques. Most researchers have examined data mining (DM) techniques to analyze the databases behind E-business websites. DM has shown interesting results, but this technique presents some restrictions concerning the content of the database and the level of expertise of the users interpreting the results. In this paper, the authors show that successful and more sophisticated results can be obtained using other analysis techniques, such as Online Analytical Processing (OLAP) and Spatial OLAP (SOLAP). Thus, the authors propose a framework that fuses or integrates OLAP with SOLAP techniques in an E-business domain to perform easier and more user-friendly data analysis (non-spatial and spatial) and improve decision making. In addition, the authors apply the framework to an E-business website related to online job seekers in the United Arab Emirates (UAE). The results can be used effectively by decision makers to make crucial decisions in the job market of the UAE.

Keywords: Business Intelligence, Data Analysis, Data Fusion, Data Mining, Decision Making, E-Business, Geographic Information System (GIS), Online Analytical Processing (OLAP), Spatial OLAP (SOLAP)

INTRODUCTION

E-business domains, such as E-commerce, E-government, E-learning, E-banking, are growing fast, and with this growth, companies are willing to spend more money and time to analyze the data behind their websites. Based on our literature review, E-business companies have been using either primitive measures to analyze their data or more sophisticated analysis techniques, such as DM or OnLine Analysis Processing (OLAP), to generate useful data and knowledge for decision makers (Kohavi & Provost, 2001; Kohavi et al., 2004). DM and OLAP techniques have shown interesting results, but they present some restrictions concerning the size, the structure, and the type of the data to be analyzed, as well as the level of expertise of end-users who will be interpreting the results. With growing pressure to make E-business companies more profitable, additional analysis techniques are required to analyze the data which are becoming more and more complex.

Current studies have examined the effect of what is called Business Intelligence (BI), which
is a combination of data analysis techniques such as DM with OLAP, to analyze fused data coming from different sources. Some researchers have used only textual and numerical data (Codd et al., 1993; Youngworth, 1995; Lau et al., 2008; Zhou et al., 2009) and ignored the geographical features of the data which are presented through text and numbers. In these studies, the analysis lacks visualization or mapping of the analysis results. Other researchers have conducted data analysis based on spatial (geographical) data only, which results in limited and incomplete data analysis (Kouba et al., 2000; Stefanovic et al., 2000; Ferreira et al., 2001; Shekhar et al., 2001; Fidalgo et al., 2004; Bédard et al., 2005; Scotch & Parmanto, 2005; Silva et al., 2005).

Although one cannot deny the importance of previous studies, limited research has considered integrating multiple data analysis techniques to improve the process of decision making and provide comprehensive, easier and friendlier data analysis in an E-business domain. Decision makers, in this rapidly changing world, are demanding faster and more detailed results. To address this issue, more research is needed in investigating the infusion of GIS (Geographic Information System), spatial analysis and non-spatial analysis applications and tools in business. Thus, our research addresses the following question: how can applying different useful analysis techniques to analyze fused and complex data coming from different sources and using different formats (spatial and non-spatial) benefit decision makers? In other words, will the integration of multiple data analysis techniques be more useful and more appropriate in the decision-making process?

In our research, we examine how the infusion of different analysis techniques may be applied in order to help decision makers make better decisions. Thus, we suggest the integration of the following well-known data analysis techniques: OLAP and SOLAP (Spatial OLAP) (for spatial data) in order to analyze fused data coming from E-business websites (non-spatial data) and GIS (spatial/geographical data). First, we have developed a framework which integrates the OLAP and SOLAP analytical techniques to analyze fused data coming from different sources (E-business databases and GIS) to perform comprehensive, easier, and more advanced and sophisticated analyses of E-business websites’ databases. Then, we have tested this framework using actual data from an E-business website related to online job seekers in the UAE. Our study provides more comprehensive data analysis of numerical, textual, and spatial data, which can help the decision makers to make better decisions. Based on our review of literature, no similar framework has been proposed, which makes our framework unique and can be considered as a contribution to the fields of E-business, data analysis, and BI.

The remaining sections of the paper are divided as follows. In the next section, we present our review of the literature concerning E-business, DM, OLAP and SOLAP techniques, and BI. We also present in detail our conceptual framework and its components, and then, apply our proposed framework to an E-business website related to online job seekers in the UAE, analyze the data, and interpret the results. In the following section, we present the discussion and the practical implications of our study. In the final section, we present the contributions of our work and suggestions for future research.

LITERATURE REVIEW

Before presenting our proposed framework, we review the literature for the following concepts which we have used in our framework: E-business, DM, OLAP, SOLAP, and BI.

E-Business

E-business is a broader definition of E-commerce that includes not just the buying and selling of goods and services, but also providing services to customers, collaborating with business partners, and conducting electronic transactions within an organization (Phan, 2003; Mokhtarian, 2004). In general, E-business has changed the face of most business functions in competitive enterprises. It has enabled online
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