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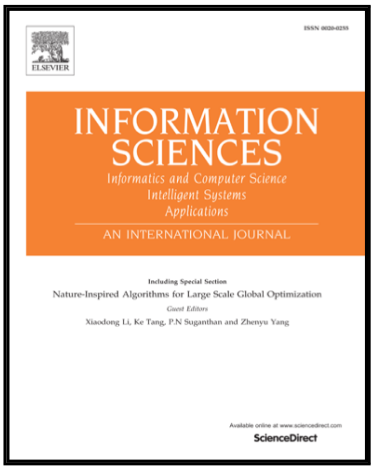

dynXcube – Categorizing Dynamic Data Analysis

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dynXcube – Categorizing Dynamic Data Analysis

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Abstract

Data analysis has gained strategic importance for virtually any organization. It covers areas like business analytics, big data, business intelligence, and data mining, among others. The past decades have also witnessed increasing efforts to capture, analyze, and interpret dynamic data instead of just static snapshot data. This is due to the fact that many real-life applications are characterized by changing data structures. Hence, analytic systems need to be able to adapt to changes. In recent years, many models for dynamic data analysis have been proposed and successfully applied in a diverse range of real-life projects. Since the number of respective algorithms has continuously risen, it has become increasingly demanding to keep track in this field. This is not only related to the algorithms that have been proposed so far and their relationships to each other. It also applies to the disclosure of gaps in research that need to be filled by appropriate new algorithms and, therefore, uncover new research opportunities. To contribute to the review of this field, we propose a holistic framework to categorize dynamic data analysis, the dynXcube-Framework. We show that dynXcube is very useful to present the state-of-the-art of dynamic data analysis in a consolidated way. Furthermore, it has the potential to disclose gaps in current research, thus providing a road map for future activities in the field of dynamic data analysis. Therefore, dynXcube is a significant step towards an improved accessibility of dynamic data analysis methods for academics and professionals alike and will help to stimulate future research in this important field.

Keywords: Data Analysis, Dynamic Data Analysis, dynXcube-Framework, *ADUR* Acronym.

1. Introduction

In the past decades, data has rapidly gained crucial importance for virtually any organization. For example, companies have discovered the value of customer data. Many business models of internet giants are to provide services like social networks free of any monetary fee to their users. Instead of paying money, the users concede that virtually any data they produce within the respective social network is collected and analyzed, e.g., with the goal to post user-specific and content-dependent advertisements. In bioinformatics, for instance, huge amounts of (gene) data are analyzed with the objective to find possible cures for diseases like cancer or diabetes. Further areas where data play a pivotal role include, for example, such diverse fields like meteorology and climate research or logistics besides many others.

The value of data is further underlined by terms like business analytics, big data, business intelligence, data mining, or data science [50]. It is not our goal to go into a detailed analysis of these terms, their definitions and relationships to each other. They have all in common that they deal with the *analysis* of *data*. Therefore, we use *data analysis* as a generic term encompassing the above and other related terminologies in the further course of our paper – see, e.g., Huang et al. [17] for the usage of the term data analysis or, for example, the special issue [35] on data analysis applied to life sciences.

So far, most data analysis methods are of static nature in the sense that they do not adapt to changes that occur in the data structure over time. These methods are suitable for data analysis applications where dynamic aspects are not relevant, e.g., in selected areas of image processing. However, in many real-life

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