

PhD Video-presentation: “Automatic generation of software interfaces for supporting decision-making processes. An application of domain engineering & machine learning”

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Abstract

This is the presentation of the Andrea Vázquez-Ingelmo’s PhD “Automatic generation of software interfaces for supporting decision-making processes. An application of domain engineering & machine learning” that was defended on July 26th, 2022 in the University of Salamanca Spain. This PhD was graded with the maximum qualification “Sobresaliente Cum Laude” and received the University Excellence Award.

Data analysis is a key process to foster knowledge generation in particular domains or fields of study. With a strong informative foundation derived from the analysis of collected data, decision-makers can make strategic choices with the aim of obtaining valuable benefits in their specific areas of action. However, given the steady growth of data volumes, data analysis needs to rely on powerful tools to enable knowledge extraction. Information dashboards offer a software solution to analyze large volumes of data visually to identify patterns and relations and make decisions according to the presented information. But decision-makers may have different goals and, consequently, different necessities regarding their dashboards. Moreover, the variety of data sources, structures, and domains can hamper the design and implementation of these tools. This Ph.D. Thesis tackles the challenge of improving the development process of information dashboards and data visualizations while enhancing their quality and features in terms of personalization, usability, and flexibility, among others. Several research activities have been carried out to support this thesis. First, a systematic literature mapping and review was performed to analyze different methodologies and solutions related to the automatic generation of tailored information dashboards. The outcomes of the review led to the selection of a model-driven approach in combination with the software product line paradigm to deal with the automatic generation of information dashboards. In this context, a meta-model was developed following a domain engineering approach. This meta-model represents the skeleton of information dashboards and data visualizations through the abstraction of their components and features and has been the backbone of the subsequent generative pipeline of these tools. The meta-model and generative pipeline have been tested through their integration in different scenarios, both theoretical and practical. Regarding the theoretical dimension of the research, the meta-model has been successfully integrated with other meta-model to support knowledge generation in learning ecosystems, and as a framework to conceptualize and instantiate information dashboards in different domains. In terms of the practical applications, the focus has been put on how to transform the meta-model into an instance adapted to a specific context, and how to finally transform this later model into code, i.e., the final, functional product. These practical scenarios involved the automatic generation of dashboards in the context of a Ph.D. Programme, the application of Artificial Intelligence algorithms in the process, and the development of a graphical instantiation platform that combines the meta-model and the generative pipeline into a visual generation system. Finally, different case studies have been conducted in the employment and employability, health, and education domains. The number of applications of the meta-model in theoretical and practical dimensions and domains is also a result itself. Every outcome associated to this thesis is driven by the dashboard meta-model, which also proves its versatility and flexibility when it comes to conceptualize, generate, and capture knowledge related to dashboards and data visualizations.

Keywords

Data Visualization, Information Visualization, Information Dashboards, Model-Driven Development, Model-Driven Architecture, Software Product Lines, Meta-Modeling, Knowledge Discovery, Graphical User Interfaces, Human-Computer Interaction.

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