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Challenges for automatic dashboard generation systems in the context of novice users

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Data is a key point for decision making, and over the last decade, data volume has increased exponentially. To understand and interpret data, people now need visual systems. Such systems can support single view or multi-view visualizations, the latter begin also called a dashboard. Design and development of automatic dashboard generation systems (ADGSs) consists in providing a system that can automatically recommend/suggest to users relevant choices (i.e., turn user data and objectives into a set of relevant visualizations, with their screen layout, and with interactions). This is not an easy task, and it is even more complex for novice users.

Every system for data visualization is developed for a particular type of users: students, BI experts, novices, etc. Novices have no advanced abilities in visualization design and interpretation, and have no technical keyword awareness in BI. Hence we consider that there are several major features of ADGSs that should be considered for novice users: easier dashboard terminology, understanding the users objectives and abilities, automatic generation of multi-view dashboards (selection of data, selection of visualizations, layout, interactions) including the proposal of predefined dashboards templates, GUI based interactions (with as less user intervention as possible). The last point also includes the study of the user behavior and collecting user feedback, so as to improve the system suggestions in a short or longer term.

Zhu et al. (2020) and Qin et al. (2020) are surveys about automatic recommendation of infographics and visualizations, and about making data visualization more effective and efficient. Both surveys include all types of automatic visualization generation systems independently of view types (single or multi-view systems). These surveys show that few ADGSs already exist, especially for dashboards.

Based on those observations, we also conducted a deep study of 17 state-of-the-art ADGSs that we identified out of 1032 papers. These systems are both commercial tools and scientific prototypes, and are developed with a certain purpose and for certain types of users. When considering novices, and after studying these systems along different dimensions (degree of automation in visualization recommendation, visualization complexity, advanced interface and user feedback, technical keyword difficulty, etc), we found that these systems have limitations and suggest challenges for ADGSs (for novices but also advanced users).

In summary, such limitations are: (i) these systems do not support the complete automatic recommendation of dashboard (i.e., without user intervention); (ii) these systems use difficult terminology, complex interfaces, and advanced visualizations (i.e. heat map, radar chart, etc) to describe dashboard and its components. Because of these problems it is very difficult for novices to analyze and interpret data using these systems.

For instance, DynSpace (El Meseery et al., 2018) is developed for novices using a basic suggestion mechanism (i.e. direct matching). DynSpace supports only 3 basic types of visualization. On the other hand, Tableau (Mackinlay et al., 2007) is a commercial system developed for BI experts and researchers. It supports more than 14 types of visualizations. It shows that both systems have different features but none of them completely supports novices expected features.

In conclusion, we consider that there is a need to develop an ADGS with new features and that can support complete automation for visualization recommendation and reduces human interventions. These are important challenges to help novices, and more generally citizens, to better understand their own data or open data.

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Résumé

In this paper we highlight the challenges of automatic dashboard generation systems (ADGSs) for novices. We consider important features of ADGSs for novices: automatic generation of visualizations (data selection, visualizations selection and layout), a multi-view user interface with simple user interactions and user feedback, simplistic terminology to describe dashboard components. From a survey that we have performed (17 ADGSs out of 1032 papers), we show that such systems are not so numerous, and that they generally do not take into account novice users. We conclude by considering that ADGSs should be further developed, especially for novices.