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Visualizations for the Evolution of Variant-Rich Systems: A Systematic Mapping Study*

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Abstract. Context: Variant-Rich Systems (VRSs), such as Software Product Lines or variants created through clone & own, aim at reusing existing assets. The long lifespan of families of variants, and the scale of both the code base and the workforce make VRS maintenance and evolution a challenge. Visualization tools are a needed companion.
Objective: We aim at mapping the current state of visualization interventions in the area of VRS evolution. We tackle evolution in both functionality and architecture. Three research questions are posed: What sort of analysis is being conducted to assess VRS evolution? (Analysis perspective); What sort of visualizations are displayed? (Visualization perspective); What is the research maturity of the reported interventions? (Maturity perspective).
Method: We performed a systematic mapping study including automated search in digital libraries, expert knowledge, and snowballing.
Results: The study reports on 41 visualization approaches to cope with VRS evolution. Analysis wise, feature identification and location is the most popular scenario, followed by variant integration towards a Software Product Line. As for visualization, nodelink diagram visualization is predominant while researchers have come up with a wealth of ingenious visualization approaches. Finally, maturity wise, almost half of the studies are solution proposals. Most of the studies provide proof-of-concept, some of them also include publicly available tools, yet very few face proof-of-value.

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Conclusions: This study introduces a comparison framework where to frame future studies. It also points out distinct research gaps worth investigating as well as shortcomings in the evidence about relevance and contextual considerations (e.g., scalability).

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