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# Multi-Dimensional Categorization of Research Software

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Research software has been categorized in different contexts to serve different goals. We start with a look at what research software is, before we discuss the purpose of research software categories. We propose a multi-dimensional categorization of research software. We present a template for characterizing such categories. As selected dimensions, we present our proposed role-based, readiness-based, developer-based, and dissemination-based categories. Since our work has been inspired by various previous efforts to categorize research software, we discuss them as related works. We characterize all these categories via the previously introduced template, to enable a systematic comparison.

The categorization has been produced in the context of a task force of the special interest group on Research Software Engineering, within the German Association of Computer Science (GI e.V.) and the German Society for Research Software (de-RSE e.V.).

We envision the following benefits from using categories for research software, which may serve as a basis of institutional guidelines and checklists for research software development; to better understand the different types of research software and their specific quality requirements; to recommend appropriate software engineering methods for the individual categories; to design appropriate teaching / education programs for the individual categories; to give stakeholders (especially research software engineers and their management) a better understanding of what kind of software they develop; for a better assessment of existing software when deciding to reuse it; for research funding agencies, to define appropriate funding schemes; to define appropriate metadata labels for FAIR research software; in RSE Research to provide a framework for classifying research.

In the realm of RSE research, we hope that the categorization provides a framework for classifying research objects, supporting software corpus analyses, and enhancing our understanding of the different types of research software and their properties. This structured approach may aid in organizing and interpreting the vast landscape of research software, contributing to advancements in RSE methodologies and practices.

We report on a systematic mapping study to evaluate our role-based categorization, and the multi-dimensional categorization of selected research software examples.

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