Title: Letting data analysis methods developed in different computing environments work together – case SMASH-HCM

Authors:
Nabid Faiem, Antti Kallonen, Mark van Gils

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Abstract

Establishing interoperability of methods presents a challenge in research projects that involve several programming languages, especially in consortium-based projects where different partners prefer working with their own established computing environment, and languages. Each environment's distinct data systems can create compatibility issues when methods need to be combined to solve larger research problems. To address this challenge, while allowing partners to continue research in their preferred environment, we developed a language-agnostic framework to exchange data across multiple languages, including Python, MATLAB, and R.

In our framework, each programming language environment is encapsulated within its own isolated Docker1 container to maintain separation of concerns. Communication between containers, for data and function calls, is implemented using a client-server approach using representational state transfer (REST) or remote procedure call (RPC) APIs. REST API uses HTTP methods, while RPC API allows a client to call server resources as local functions. Data is transferred as a bitstream, with serialization and deserialization handled using JSON format for timeseries and tabular data. Images are transferred as binary data. As a use case, this framework will be integrated into a clinical decision support system for hypertrophic cardiomyopathy disease (the SMASH-HCM EU-project2) so that different research groups can collaborate seamlessly by sharing metadata and computational results, to work together on an integrated digital-twin based solution.

This framework simplifies the integration of different research groups' work by allowing to use their preferred tools. It is currently being extended to include C and C++ and will be made available for wider use.

[1] Language-specific guides," Docker Documentation. Accessed: Oct. 03, 2024. [Online]. Available: https://docs.docker.com/guides/language/

[2] "SMASH-HCM." Accessed: Oct. 03, 2024. [Online]. Available: https://smash-hcm.eu/