

Go-Smart Glossia: A Tool to Separate Web-user, Manufacturer and Researcher Concerns Through Extensible Simulation Containerization

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Abstract

The Go-Smart project provides a generic, open-ended, web-based treatment simulation interface for clinicians, manufacturers and biomedical researchers in the field of Minimally Invasive Cancer Treatments (MICTs)[1]. To achieve open-endedness, manufacturers and researchers must be able to extend the set of numerical models, simulatable equipment and clinical protocols through the web interface. In doing so, a sandboxed environment must be provided to process numerical and protocol algorithms input by technical users, as part of the simulation. This is achieved by use of a Python open source simulation orchestration tool, called Glossia, which connects to standardized Web Application Messaging Protocol (WAMP) middleware from one or more physical nodes. It receives generic simulation definitions based on user input, including segmented geometry, from the web application, and translates them into workflow-specific configuration for execution inside individual Docker sandbox containers.

Sandbox images based on FEniCS (fenicsproject.org) and Elmer (elmerfem.org), allow Python and templated SIF files, respectively, to be entered by users. In the case of Python, a module is provided to transparently give technical users access to dynamically defined parameters from the web interface, geometric regions or manufacturer equipment. Integrated volumetric meshing is provided in these containers using CGAL (cgal.org). Additional sandbox images and conversion modules may be added on the physical node - this has been tested with a Python/OpenFOAM sandbox (openfoam.org). Thanks to the modular nature of the design, a researcher can subsequently add a numerical method that transparently re-uses equipment data and existing patient cases, or vice versa, and simulate using the new model and/or sandbox image.

References

1. P. WEIR AND D. REUTER AND ET AL. Go-Smart: Web-based computational modeling of minimally invasive cancer treatments . E-Health and Bioengineering Conference (EHB), 2015 , vol., no., pp.1-4, 19-21 Nov. 2015 doi: 10.1109/EHB.2015.7391385.