Abstract: Leveraging Open Source Software to Close Translational Gaps in Medical Image Computing

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Many imaging biomarkers (IBs) fail clinical translation. The main reason is not a lack of utility, but translational gaps [1] during validation and qualification. One important problem in this context is the landscape of existing IT systems in the clinical environment. Systems are highly heterogeneous and proprietary, causing significant translational challenges that are often purely infrastructural in nature.

We present a novel infrastructural solution that aims to facilitate the translation of state-of-the-art medical image computing research. The system was designed to fulfill a number of properties we deem essential for successful adoption: 1) It operates parallel to clinical routine and does not interfere with traditional diagnostics. 2) It is based entirely on existing open-source software and can be implemented without additional cost. 3) Deployment of novel tools requires minimal effort and does not require algorithmic knowledge from clinicians. 4) Intellectual property is protected as image data remains within the clinic and methods and models are exchanged in the form of Docker images with compiled routines. Additional benefits include scalability, both to other computing resources and to other clinical partners, and high comparability between algorithms/IBs, as they are tested in the same environment.

As a proof of concept, we applied the system to the problem of automatic segmentation and volumetry of complex brain tumors, a well-researched topic that has yet to make an impact in clinical routine. A prototype is currently being used at the Department of Neuroradiology at Heidelberg University Hospital. Segmentation algorithms can be seamlessly deployed on live clinical data, resulting in volumetric measurements that are used for standardized volumetric assessment in clinical research.

References

1. O'Connor JPB, Aboagye EO, Adams JE, et al. Imaging biomarker roadmap for cancer studies. Nat Rev Clin Oncol. 2017;14(3):169–186.