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Using HPC as a Service for Remote Parallel Processing on the Fiji Platform

Tackling current biomedical challenges calls for in-depth understanding of biological systems, particularly their structures, functions, and interactions on both the molecular and the cellular level. Biological imaging constitutes an important field of scientific investigation and one of its most valuable techniques is fluorescence microscopy. State-of-the-art imaging devices, such as light sheet microscopes, produce datasets so large that they can only be effectively analyzed by employing methods of image processing on high-performance computing (HPC) clusters. To address this issue, an HPC plugin for Fiji, one of the most popular open-source software tools for image processing, has been developed. The plugin enables end users to make use of HPC clusters to analyze large scale image data remotely and via the standard Fiji user interface. Seamless interaction between the remote HPC infrastructure and the user is substantially facilitated by the HPC as a Service Middleware. To demonstrate the performance of the plugin, it has been benchmarked on a Snakemake pipeline, performing complex registration and fusion tasks on sizable Selective Plane Illumination Microscopy (SPIM) time-lapse in toto recordings of developing embryos. The presented plugin offers a graphical user interface which allows the user to smoothly define pipeline job parameters, start execution, monitor progress, download results, and debug errors of the SPIM image processing pipeline. The presented framework will form a foundation for parallel deployment of any Fiji/ImageJ2 command on a remote HPC resource, greatly facilitating big data analysis.

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