From Images to Knowledge with ImageJ & Friends
virtual conference

Nov 30 - Dec 2, 2020

Stephan Preibisch, Stephan Saalfeld, Anna Kreshuk, Pavel Tomancak and Virginie Uhlmann
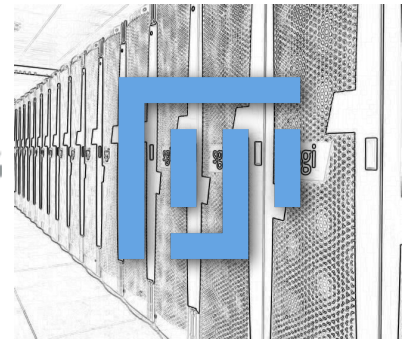
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Conferences

Bridging Fiji and OpenMPI for Easy-to-Use Parallel Processing of Images

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Session 1:   2020-12-01 07:00 UTC – 2020-12-01 11:00 UTC
**Session 2:**   2020-12-02 13:00 UTC – 2020-12-02 17:00 UTC

Bridging Fiji and OpenMPI for Easy-to-Use Parallel Processing of Images

A tutorial for the "From Images to Knowledge with ImageJ & Friends (I2K) Conference"

Motivation

Running image processing algorithms in parallel is desirable for image analysts and a major challenge for developers. As microscopy technology advances, users are facing larger and larger data volumes One way to tackle the analysis of big image data is to split the image processing tasks into smaller sub-tasks and organize them for parallel execution in a High-Performance Computing (HPC) facility. While the cost of computational equipment decreases, making it possible to readily build or simply gain access to large HPC resources, the software able to exploit such hardware in a straightforward and user friendly manner is lacking. We addressed this problem in Fiji by building a bridge to a prevalent HPC parallelization framework - the OpenMPI.

In recognition of the diversity of ImageJ usage by the biology community, we enable OpenMPI parallelization at two distinct levels within Fiji. Firstly, we enable parallelization of ImageJ macros. Secondly, we implemented new OpenMPI versions of some ImageJ2 Ops -- atomic image processing commands that experienced developers can use to build complex image analysis solutions.
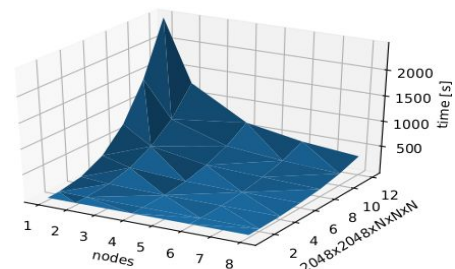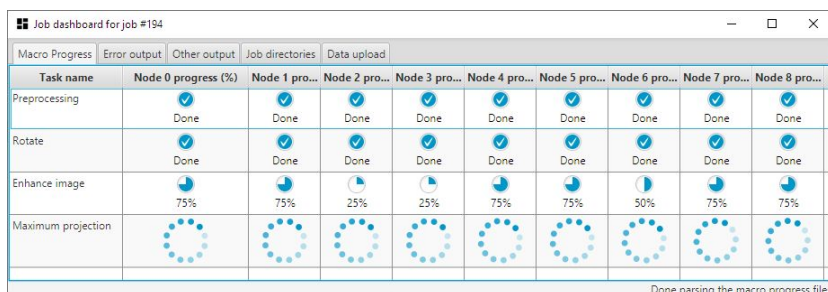
The newly developed Fiji-OpenMPI framework delivers flexibility in parallelizing image processing tasks on large image sets or spatially large individual images without introducing additional complexity for casual users of ImageJ macro language or for experienced Java developers.

Content

This tutorial will introduce the use of Parallel Macro with its OpenMPI Extensions from the Fiji graphical interface. We will briefly describe the basic ideas behind the parallelization approach and then move to the practical tasks demonstrating how to parallelize your macro scripts.
The execution of the demonstration applications and macros will be hosted by the IT4I Infrastructure (https://www.it4i.cz/en). Before the tutorial, participants will be instructed how to obtain the supercomputer accounts to participate in the demonstration.

The outline is:

- Installation and configuration of the plugin, gaining access to remote HPC
- Uploading and downloading data to and from HPC resource
- Running simple macros remotely
- Simple parallelization by splitting processing of many images to multiple nodes
- Monitoring progress, output and error reporting
- Advanced parallelization of processing on large images by use of MPI-aware Ops
- Discussion and demonstration how to parallelize your macros

Target Audience

This tutorial is aimed at end-users dealing with large datasets and with access to some HPC resources (MPI is industry standard and, as such, is available at almost all HPC installations).

- We require up-to-date Fiji and some applications to access HPC (SSH / Putty / WinSCP) and plugins that are available at Fiji Update Site (P2E-IT4Innovations)

- Users should have basic knowledge of Fiji Macro scripting

Links to Github repositories with source codes:
https://github.com/fiji-hpc/scijava-parallel-mpi
https://github.com/fiji-hpc/hpc-workflow-manager

Tutors

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