Image Analysis and Processing in the Clouds using Scalable eResearch Workflow-Based System

Yulia Arzhaeva, Ryan Lagerstrom, Pascal Vallotton, Dadong Wang, Neil Burdett, Alex Khassapov, Piotr Szul, Shiping Chen, Darren Thompson, Tim Gureyev, John Taylor and Tomasz Bednarz

1CSIRO, Sydney, Australia, contact details: tomasz.bednarz@csiro.au

GENERAL INFORMATION

The workshop will run for half a day. Ran by the NeCTAR funded *Cloud-Based Image Analysis and Processing Toolbox* project team http://cloudimaging.blogspot.com.au/p/about-team.htm. The workshop will include hands-on components; there are no constraints on number of attendees. Access to wireless network would be required.

DESCRIPTION

With the Software as a Service becoming an increasingly prevalent delivery model, we have developed a cloud-based image analysis toolbox to provide a wider user base with easy access to the software tools that we have developed over the last decade. This workshop will discuss our work on the design and implementation of the cloud-based image analysis and processing services on an Australian national cloud infrastructure, including the architecture, workflow management framework, image analysis and visualization examples, and will explained in details challenges we faced. Key components of this free service will be described, showing the capabilities of the service engine for real-world cloud-based biomedical image analysis applications.

Also, the hands-on tutorial will be carried out to demonstrate of use of our toolboxes for:
- Automating the process of quantifying cell features in microscopy images (to reproducibly analyse complex cell morphologies)
- Reconstruction and simulation of X-ray phase-contrast CT, including phase retrieval, parallel filtered back projection (FBP), etc.
- Clinical applications using the framework that includes standard imaging functions such as windowing, histogram inspection, panning, slicing, zooming, metadata inspection etc., and a large number of plug-in components that add visualization, image analysis functions and complex image processing pipelines.

See sample demo of the system: http://www.youtube.com/watch?v=CZMDyqQwJLY

RATIONALE

The tutorials will present how we unified imaging software packages in the form of libraries for image analysis, processing and 3D reconstruction algorithms to run in the cloud environment for high computation tasks and/or large image datasets. The tutorial showcases how it would be possible to dramatically increase the productivity of designing processing pipeline and accelerate scientific discoveries. By providing user-friendly access to cloud computing resources and new eResearch workflow-based interfaces, our solution will enable the researchers to carry out many challenging image analysis and reconstruction tasks that are currently impossible or impractical due to the limitations of the existing interfaces and the local computer hardware.

NOVELTY

The workshop will showcase our project, which is concerned with designing a novel cloud-based image analysis, and processing toolbox on a national cloud infrastructure, including its architecture and implementation. The project is directly inspired and funded by the Australian Government initiatives of National eResearch Collaboration Tools and Resources (NeCTAR), www.nectar.org.au. The initiatives are aimed at building a new infrastructure using existing and new information and communications technologies. NeCTAR has four main program areas including Virtual Laboratories, Research Cloud, eResearch Tools and The National Servers program. The research cloud is a highly scalable, cost-effective and self-service platform, comprising eight distributed nodes and up to 30,000 CPU cores. Our cloud-based image analysis toolbox is designed as eResearch Tools to run on the Research Cloud.

OUTLINE

Please provide an outline of the workshop content using the following format.

1. Introduction to Cloud Based Image Analysis and Processing Toolbox and Galaxy Project. The toolbox and its components will be introduced in short presentations.

    45 minutes

2. Tools and workflows to automate the process of quantifying cells features in microscopy images. This part will be presented as hands-on interactive session.

    50 minutes

3. Tools and workflows for 3D medical imaging and visualisation. This part will be presented as hands-on interactive session.

    50 minutes

4. Tools and workflows for advances X-ray image analysis and Computed Tomography. This part will be presented as hands-on interactive session.

    50 minutes

WHO SHOULD ATTEND

Scientist and researchers interested in using novel eResearch cloud-based architectures for image analysis and processing tasks.

WHAT TO BRING

Workshop session will be run in a very interactive, hands-on manner with each participant encouraged to bring along their own laptop so they can follow along with the class.

ABOUT THE PRESENTERS

The presenters are listed here: http://cloudimaging.blogspot.com.au/p/about-team.html