Notes on 4th software framework meeting

20/11/15 12:30pm; Held at the University of Leeds

Attendance: 16

Remote (4): Claudia: Pawel, Ron Fowler, Ju-Chieng (Kevin) Cheng, Andrew Reader

Physically (12): Evgueni Ovtchinnikov, Kris Thielemans, Harry Tsoumpas, Martin Turner, Christoph Kolbitsch (Berlin), Alaleh Rashidnasab, David Atkinson, Giorgos Papanastasiou, Daniel Deidda, Nikos Efthimiou, Julian Matthews. Floris Jansen (GE)

Agenda Items:

1. Harry Tsoumpas: Review of the Recent Workshop on Open Source Software: Saturday 7/11/2015: ~55 attendance. Users' experience covered a range of different areas; PET/SPECT/some CT/very few MR/and a few industrial imaging.

The focus was on reconstruction software:- including the following code sets; STIR/Occiput/ CASToR/ ODL (python library)/ ASTRA/ and Gadgetron. Each toolkit was described (to be made available as a webcast on websites), and have potential cross-collaborator opportunities. Some overlap opportunities were described, but some differences were also described; early-development/specific tools/specific gui/specific hardware exploited. Main question was how to exploit opportunities to share workload over the coming years?

ACTION :- Monitor the situation and also link to a Strasburg event HT/MT – for an ASTRA toolbox; introduction and tutorial: with EU COST involvement.

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2. Aside a discussion (brief) on Python vs MATLAB – ongoing debate with rational for dual system described.

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3. Kris Thielemans: Image reconstruction course at IEEE MIC– these had exercises using STIR based on a VirtualBox (VM manager) lubuntu system (a 1-2GB file was required to be downloaded that had all the files and exercises in one place). Worked on trainees' own laptops etc. Feedback recently received and included some very good comments. Note that this took about two weeks to setup and check.

ACTION the next stage is to add gadgetron on the same VM.

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4. David Atkinson, Kris Thielemans and Floris Jansen: Data formats were discussed. David mentioned ISMRMRDF publication nearly accepted. Convertors from Philips and Siemens raw formats are available (open source). GE - described a research agreement that is currently needed for access and then a discussion on what detail is required for us to be handle GE PET data [likely access to listmode, norm, deadtime, singles, crystal locations etc. but to be confirmed]; Philips and Siemens is ongoing in negotiations.

Extra Discussion on Clocks: PET and MR are independent imaging devices but have synchronised clocks: GE is accurate for start to the second but there is an aim towards subsecond times (ms). Discussion on non-synchronised clocks methods that would synchronise by image.

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5. Current status of software framework for PET.

UoL: a 'Time of Flight' presentation showing progress in STIR and results using simulation with multiple rays (raytracer) / different bin size (Due for completion 13 Jan 2016) For code described new keywords (e.g. Number of TOR bins=) and new classes (e.g. iterative_reconstruction; ProjMatrixByBin;) and new functions(e.g. get_line_connecting_dets etc.) all need to be created. Future plan include reading GATE ROOT files (Monte Carlo output for PET).

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6. Current status of software framework for PET.

Evgueni Ovtchinnikov showed example (in python and then in Matlab) of creating a phantom test image with simple geometry; setting parameters for reconstruction; and then reconstruction iteratively with STIR.

There was a discussion over the use of step-by-step examples/ and how could be released (VM) and used by experienced and naïve users.

- Next stage was to add forward & back-projection and data transfer modes.

- Release on git hub should be imminent for specific individuals as required.

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7. Christoph Kolbitsch and David Atkinson: Described various mode of interfaces between Gadgetron and Matlab / python:-

- Showed, using an XML file, the transfer between gadgetron to Matlab and then back to gadgetron, with each stage processing different stages of the data flow pipeline. Current limitation is that MATLAB process is started by the Gadgetron so involves delays.
- Reverse process was also showed so from Matlab that called gadgetron (with configuration script for reconstruction) and then display back in Matlab.
- Hypothetical MR and PET example utilising a hdf5 file format – showing a gadget (applying a specific translation – phase change: implemented in Matlab) in the data stream. Then use Matlab with hread() for viewing.
- Iterative reconstruction with a mixture of various gadgets
- Gadgetron example with Python console integrated to the scanner pipeline –changed filters on subsequent scans so 'live' interactive operation.

Discussion: showed the "python notebook" process for step by step execution (jupyter - http://jupyter.org/) and then compared with https://github.com/spyder-ide/spyder

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8. Pseudo-code document: updates available at onedrive: (https://onedrive.live.com/?id=FC7F1F047070063F%211519&cid=72A74068C3E522C8&group=0)

General discussion on edition of document and the content for release. Note this document needs to go to the Working Group (Mon 7 Dec 2015) – and the document needs updated by all before end of Monday 30 November 2015. Some notes from this discussion:-

- Q: What is a STIR Object as it is in construction a Library, compared to an MR Object that is defined and this then knows where the data is and where the gadgets need to run etc. Is this needed for STIR for complete integration.
- Q: Do you need to be able to run several instances of the gadgetron? This then may allow for more abstractions by creating a queuing mechanism, with different queues, if we would allow for an asynchronous service level operation. This defined a difference between a research tool and a research service.
- The use of a Matlab callback mechanism was considered and an example case proposed.
- Discussed was a next part of the MR sub-layer in the pseudo-code to be similar to the STIR examples presented (see above). This will be further refined in smaller meetings before the end of November.
  ACTION KT organise meetings
- Examples were given from the existing Python interface to gadgetron (cf notebook)
  - Can we make a list of gadgets that would be useful for iterative reconstruction?
  - Do we need to split existing gadgets (e.g. forward and backward projections in the iterative reconstruction).
  - Need to communicate with Gadgetron developers on existing framework, new gadgets, differences between MATLAB and Python interface
    ACTION: Christoph Kolbitsch (and others) to make 1 page document to send to Michael Hansen
- Gadgetron integration within a python STIR library: Evgueni Ovtchinnikov and Ron Fowler combine work to produce a route forwards.
- ACTION: Evgueni Ovtchinnikov to make available the scripts presented.

Future date for next meeting: Week commencing: 11 January 2016, a Doodle poll for the next meeting is to be sent out: ACTION MT

--- Meeting closed 4:15pm ---