

CCP SyneRBI Steering Panel

Friday 17th September 2021 – 12-2pm

Attendees- Andrew Reader (KCL), Anna Barnes (KCL), Ciprian Catana (MGH), David Atkinson (UCL), Edoardo Pasca (STFC), Evangelos Papoutselis (STFC), Gemma Fardell (STFC), Geoff Parker (UCL), Harry Tsoumpas (Groningen), Jamie McClelland (UCL), Jeff Fessler (U Michigan), Jorge Cardoso (KCL), Julian Matthews (Manchester), Kris Thielemans (UCL), Lefteris Livieratos (KCL), Martin Turner (Manchester), Matthias Ehrhardt (Bath), Robert Ackroyd (Leeds), Ross Maxwell (Newcastle), Simon Arridge (UCL)

Introduction-

Previous Steering Panel took place 6 months ago. No corrections to previous minutes.

Overview and governance update

The CCP has 3 aims:

- Networking and community: Bringing together expertise and training the next generation
- Expanding open-source software (OSS) infrastructure
- Translation towards biomedical research

Executive Committee:

Kris, Andrew, David, Harry, Julian, Matthias, Christoph

The above is responsible for the running of the network and software activities, keeping track of software licensing and keeping within the network budget.

Harry moved from Leeds to Groningen in July 2021 to the Nuclear Medicine Molecular Imaging Department. Harry will be keeping his appointment in Leeds as an unpaid lecturer for a short time.

Steering Panel:

Decide on network activities and software efforts, suggest and coordinate further application for funding and advocate SyneRBI and SIRF

External Advisors:

Jeff Fessler (University of Michigan) and Ciprian Catana (Harvard Medical School)

Funding update

Grant Awarded: 5-year grant (April 2020-March 2025). There is a £230K budget for networking activities and core support by CoSeC (A division within STFC).

EPSRC funding to CoSeC: The CoSeC support we receive is in terms of FTEs however, the funding is given by EPSRC directly to CoSeC as part of a service level agreement. There was previously a funding shortfall in SLA cycle (April 2016-March 2021) due to budget restrictions from EPSRC. In addition, the UK government has not decided on the UKRI

budget for the next cycle, meaning that CoSeC is still working under flat cash budget. The immediate consequence is that all CCP's and HEC's were asked to suggest ways to have a 10% cut in FTE for this financial year (April 2021-March 2022). This was discussed in the SyneRBI Exec Committee meeting and found the best way to action this was to fall back on our reduced-funding scenario which we indicated when submitting the grant. CoSeC have been told that integration of the software XNAT (CoSeC part) of pipelines have been put on hold. What the future will hold is unclear. It is not our intention to stop the XNAT development for the remainder of the grant. Once there is more clarity on future CoSeC funding, we will have to reprioritise.

Despite the cuts EPSRC have made, EPSRC have created a call: Software for research communities (3-year funding - £500-£600K per project) which is somewhat similar to the previous flagship call but open to all. The call is specifically targeted towards adapting or maintaining existing software to increase quality and add features. There is a proposal in preparation: 'Advancing Open-Source Software for Synergistic Reconstruction of Biomedical Imaging Data for Machine Learning' with the aims to make a step from the current software (some features missing) and high performant integration of SIRF and OSS dependencies.

CCP SyneRBI: status and (near) future:

WP1: Networking activities and Community Engagement (Andrew Reader)

The current approach for WP1 is the YouTube playlist approach. There was previously a 3-day event in Chester in 2019 which was successful, the plan is another three-day fully funded international workshop some time in 2022/2023. Bringing together expertise is not only around understanding of reconstruction and the various aspects, it is also centred on the common software platform. There are software developer meetings and the mailing list which are still in place. Hackathons are also mentioned, Matthias has a few hackathons in planning for the near future. There is funding in this grant for facilitating and supporting exchanges between UK & international groups. Training will be mostly in the form of tutorials for programming.

past event: Fully3D SIRF/CIL Training School

3-week training school over the Summer (2021). There were 100 spaces available, free of charge. The 100 spaces were filled up quickly, however, not all individuals joined, may be due to time zone in different parts of the world. During the 3-weeks there were three sessions each week. The sessions consisted of, 2-hr live session, plenary live presentations/problems settling, 3 overlapping support sessions (PET, MR, CT) and presentation of solutions.

Participants lost some time with software installation (including cloud set-up). Some attendees did prefer local installations, rather than the cloud (possibly for future use). All sessions were recorded for registered participants. Most sessions are to be publicly released, the recordings will need some editing.

A survey attracted 20 responses which are mostly very positive. Andrew summarised main results from the survey.

This material will form the basis for future online offering as well as future courses.

WP1.3 Dissemination & Outreach (Harry Tsoumpas & Kris Thielemans)

Special Issue: Synergistic Tomographic Image Reconstruction

There are 18 articles, which are particularly focused on software which is not very common. 11 of the articles included members of the CCP. The 2 special issues can be found online, some of the papers are open access, but not all.

Engagement

The website is regularly maintained but will undergo some major change by migrating to a different Content Management System that will allow it to be easier to manage and update (CoSeC effort). ResearchGATE is also maintained and updated. Whether there should be a LinkedIn or Twitter account is still being discussed (need active maintenance to be useful).

WP2: Research software development and deployment

WP2.1: Code maintenance, optimisation and HPC (CoSeC)

The major event was the release of version 3.0 and 3.1. For the summer 3.1 was released specifically with extra capabilities for the training school. Support for the GE PET data was merged into STIR and interfaced. Travis-CI for Continuous Integration testing has proven to be difficult due to limitations in free run-time and lack of support by the underlying company. We have replaced our test with GitHub Actions (still to be completed).

SIRF-SuperBuild is the software that allows you to build dependencies around it. Most work was related to Docker because Docker Interface was used on the cloud for training school using JupyterHub. It is yet to be merged; however, it is working.

Imminent SIRF improvements include merges of Non-Cartesian 2D read-outs for MR, including 3D Stack-of-stars and multi-slice 2D, by Johannes Mayer (PTB) and Johannes' simulation framework. Both rely on availability of Gadgetron toolbox when building SIRF (as opposed to just a running Gadgetron server when executing SIRF).

WP2.2: Integration of/interfacing with Open-Source Software packages (David Atkinson)

We are stuck on an old gadgetron version due to building issues and conflicts. We have an aim to resolve this issue by the end of this year/beginning of next year to upgrade. Upcoming is a merge of PET "block-detector" support in STIR which will be useful for the accurate modelling of geometry. There are a team of people interested in Siemens mCT and Vision support & Quadra.

WP2.3: Implementation of promising algorithms in the literature (Matthias Ehrhardt)

Aims: - Synergistic reconstruction: combine modalities

- Machine learning: learn optimal reconstruction, into SIRF to make them available for PET, MR and CT imaging.

- Enable translation of next generation recon algorithms to applications

The algorithm implementation was slower than expected, with results presented in the recent "SIRF/CIL and motion correction" paper published in the special issue. We are now planning a hackathon in November 2021 (organised by Claire Delplancke, Bath) in conjunction with the PET++ grant (Carola Schönlieb and Matthias) which aims to bring mathematic algorithms into PET imaging with the focus being optimisation algorithms. The November hackathon will focus on stochastic optimisation algorithms.

WP2.4: Testing on simulated and acquired data (Harry Tsoumpas)

Work in progress on GE RDF9 PET/CT data in STIR (as per last meeting). Planned acquisitions/simulations with/of Siemens Vision Quadra. Testing of commercial

scanners by Positrono and Bruker but steps needed to allow code release. We need to ensure we have the approvals and agreements from these companies.

WP2.5: Software deployment (CoSeC)

We have a number of ways to deploy the software. Work is in progress to add Conda support. Conda is a package management system for (mainly) Python. For CIL, Conda has proved to be quite useful on deploying different people's machines. CCPi has Linux, Windows build and Mac packages.

WP3: Translation towards biomedical researchers

The work that was done by Casper before creating the Docker Containers was extended considerably before the training school. There are now various containers on the Docker Hub with faster deployment than previous versions and better documentation. This will form the basis for the XCAT-SIRF docker instances.

WP3.2: Validation

This work package is around providing resources to enable validation. The idea is to make both data and phantoms and acquisition protocols available for people to acquire their own data. Work in Newcastle on acquisitions for a PET/MR phantom progressed, albeit delayed by the pandemic. Initial PET data reconstructions have been made. MR data needs work to install the "GE to ISMRMRD" convertor.

DPUK PET-MR harmonization study update

This project has now collected datasets for 12 participants. There are PET-MR datasets using flutemetamol. Imaging of 60-120 minutes are taking place post-injections and acquiring data with a variety of different sequences varying from standard sequences through to advanced sequences e.g., weighted imaging until spin labelling and quantitative susceptibility. For the 12 participants there are 24 scanning sessions, 16 Signa and 8 Siemens mMR. There is raw data for all of the Siemens and GE-data and raw MR data for 13/16 GE datasets.

Access to the DPUK datasets

The intention of the grant was to share the data with the wider research community with the main reason being the full methods development and the purpose of collecting raw data which is for this community. However, this is an ongoing study, so it is important to protect the interests of those individuals collecting the data. Those who would like access to the data can contact Julian. . SyneRBI intends to use this data for testing of the algorithms implemented in SIRF and CIL

Phantom kick off meeting

We have been discussing holding a phantom meeting for a while. This will be a virtual meeting for some time in the autumn. The plan is to invite 2-3 speakers regarding the ongoing phantom work that is relevant to synergistic image reconstruction. Contact Julian if you would be interested in speaking.

WP3.3 Training of biomedical researchers

Very little has happened with WP 3.3. Once we resource the tools to enable validation, it is important to engage with biomedical researchers in their training to provide the resources they need.

CCPi Overview

Core Imaging Library

We have two publications on core imaging library in the special issues. The core imaging library is ready for X-ray CT for lab and parallel beam. There are IO package to read, write and acquisition data. There are tools available for pre-processing, generic optimisation framework for optimisation algorithms which blends well with SIRF objects. The CIL is mainly used for non-standard geometries/ high noise data.

A.O.B.

If anyone has any ideas for future grant proposals, for the network but also for themselves and require help, do contact Kris if you would like our support or use the software.