Report from CCP SyneRBI for the Period 01/10/2021 to 05/02/2022

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1. Highlights for the Current Reporting Period

We continued our software development and engineering efforts, maintaining our steadily growing mailing lists (we now have 104 members on the announcement list, 38 on the developers and 82 on the users' lists), organising online meetings, training courses and Hackathons.

On 23-26 Nov 2021, we held, jointly with the EPSRC-funded PET++ and CCPi teams, our 9th Hackathon, which consisted of face-to-face sessions on 23 and 24 Nov in Abingdon and online sessions on 25 and 26. The goal of this Hackathon was to investigate several options to solve inverse problems arising in medical imaging. We designed a software framework in CIL for randomized subset algorithms, implemented a small selection of such algorithms and tested them on a toy dataset jointly with already implemented algorithms. There was also a group working on subset data structures in STIR and SIRF to enable efficient computation based on subsets of acquisition data. This software implementations started at this hackathon are now being finalised.

Our work on SIRF Release 3.2 is nearing completion, with the release planned for the end of February. The new release will feature the capability of handling MR data with non-cartesian encoding, PET/MR simulation framework for dynamic data and basic handling of subsets of PET/MR acquisition data. We will also update some of SIRF crucial dependencies - STIR, Gadgetron, ISMRMRD etc. - to the latest versions.

Palak Wadhwa, a member of our CCP SyneRBI network, has won joint 3rd place in this year's CoSeC Impact award with a case study on her work on TOF-PET and Kernel Expectation Maximisation for PET/MR. CoSeC (Computational Science Centre for Research Communities) is the organisation that supports CCP SyneRBI, CCPi (and other CCPs/HECs), and therefore SIRF and associated projects including STIR.

Members of our network published 1 journal publication acknowledging SyneRBI in this reporting period.

1. Ž. Kereta, R. Twyman, S. Arridge, K. Thielemans, and B. Jin, 'Stochastic EM methods with variance reduction for penalised PET reconstructions', Inverse Problems, vol. 37, no. 11, p. 115006, Oct. 2021, doi: 10.1088/1361-6420/ac2d74.

2. Workshops and New Opportunities

We are in the final planning stage of the next joint hackathon (EPSRC-funded PET++, SyneRBI and CCPi) on further implementation of stochastic optimisation algorithms for image reconstruction and evaluation of these algorithms, which should lead to a journal submission. This will be held the first week of April.

We will hold our next training day associated to the 9th Conference on PET/MR and SPECT/MR & Total-Body PET Workshop (https://psmrtbp2022.df.unipi.it/). This training day will build on our previous training school and re-use some of its recorded material, as well as software.

We are investigating the organisation of Image Reconstruction Challenge open for international researchers.

We are part of an initiative in establishing a standard file format for raw data in PET, with participation of all manufacturers.

3. Issues and Problems

The CoSeC reduced funding impacts our work on translation. We will need to re-assign priorities. One (small) mitigation is the outsourcing of a re-design of our website, using travel money that has not been used. This should reduce future effort for CoSeC to maintain the website, as well as freshen its presence.

Our main stumbling block remains the installation of SIRF and its pre-requisites under various Operating Systems. While we provide a Virtual Machine and docker containers, this is still a hurdle for many users.

As before, we have not yet succeeded in the Windows installation of Gadgetron. This might become feasible after upgrading Gadgetron (planned for next quarter).

Our activities on integrating with the XNAT database for integration into clinical trials is now on hold due to CoSeC funding restrictions. We hope to restart this again soon.

In person visits and exchanges have been on hold due to COVID19. This is affecting progress on data from other scanners.

One of our CoIs (Charalampos Tsoumpas) has moved to the Netherlands (Univ Groningen). He has kindly agreed to remain active but some of his duties will have to be redistributed.

Our grant proposal to the (heavily oversubscribed) EPSRC Software for Research Communities call was not accepted. We will have to find other funding mechanisms for the proposed work, which is crucial for our network.