CCP SyneRBI 1st Steering Panel Meeting

18 May 2020. Held by Zoom

Participants

SyneRBI CoIs and CoSeC support: (in alphabetical order)

David Atkinson (DA) *UCL*, Matthias Ehrhardt (ME) *Bath,* Gemma Fardell *STFC*, Julian Matthews (JM) *Manchester,* Evgueni Ovtchinnikov (EO) *STFC*, Evangelos Papoutsellis *Manchester/CCPi* and *STFC*, Edoardo Pasca (EP) *STFC*, Andrew Reader (AJR) *KCL*, Kris Thielemans (KT) *UCL*, Harry Tsoumpas (ChT) *Leeds*

External: (in arbitrary order)

Andrew Robinson *NPL*, Brian Hutton *UCL*, Christoph Kolbitsch *PTB*, Daniel Lesnic *Leeds*, Edwin van Beek *Edinburgh*, Geoff Parker *UCL*, George Soultanidis *Mount Sinai NY*, Hannah Chandler *Cardiff*, Irene Polycarpou *Univ Cyprus*, Jakob Jørgensen *Tech Univ Denmark*, Jamie McClelland *UCL*, Jeff Fessler *Univ Michigan*, Josep F Oliver *Bruker*, Lefteris Livieratos *KCL*, Martin Graves *Cambridge*, Martin Turner *Manchester*, Milton Hoz *Sheffield*, Paul Marsden *KCL*, Philip (?) , Ross Maxwell *Newcastle*, Simon Arridge *UCL*, Simon Doran *ICR*, Simon Rit *Lyon*, Steven Sourbron *Sheffield*, Tryphon Lambrou *Lincoln*, William Hallett *Invicro*, Zahi Fayad *Mount Sinai NY*, Mattia Veronese *KCL*

Minutes content

These minutes only record comments and suggestions during the meeting. Information available on the slides is not repeated here.

Overview

SyneRBI [recording starts ~10:35am]

KT gave an overview of CCP SyneRBI, starting with the grant mechanism for Collaborative Computational Projects (CCPs), followed by the specific aims of CCP SyneRBI (see slides 10 onwards). As an important component of the CCP is open source software (OSS), KT describe our reasons why we emphasise this, and also mechanisms including contributing (which involves signing a contributor agreement) and licensing. CCP PETMR has chosen for the Apache 2.0 license as this maximises freedom to operator and facilitates commercial input. CCP SyneRBI will follow the same licensing rules as CCP PETMR. (CCPi also uses the Apache 2.0 license). For data (including phantom scans) the CCP recommends to use the CC-BY-ND license.

CCPi [Martin Turner 11:00]

CCPi is our “sister CCP”, concentrating on tomography for material science, covering different modalities. We work closely with them on their Core Imaging Library (CIL), a Python library for advanced regularisation and optimisation. See slides, presented by Martin Turner.

CoSeC [Edo Pasca 11:09]

CoSeC is a group within STFC. Part of CoSeC supports the CCPs. See slides for more information. Presented by EP.

CCP SyneRBI structure

This item was postponed to the end of the meeting.

Status of CCP PETMR [Kris 11:19, DA on Zenodo ~11:55, Kris ~12:00 (prizes announced!)]

See slides from slide 35

DA outlined Zenodo for storing data, code and software in an open access format. DA highlighted that we have a Zenodo Community called SyneRBI for storage going forward.

KT gave an overview of how far CCP PETMR got, including a brief list of activities as we plan to continue most of these in the renewed CCP SyneRBI, a status update on the data agreements obtained with GE and Siemens (PET data), the SIRF software architecture and status, and the Zenodo community for data distribution. The main difficulties encountered for software progress were also briefly discussed.

Edwin van Beek: It is good to see the well-attended meetings. However, as we move forward, you'll have to think about alternatives. Furthermore, for many people in the North, travel is an issue. KT: responded that most/all meetings have been virtual and recorded. We will keep doing that for the whole duration of the grant.

Geoff Parker: Any plans for data agreements with other manufacturers - e.g. Philips, Bruker, Varian? KT: Varian accessible via OpenRTK. Bruker is represented in this Steering Panel and has expressed interest. No reaction from Philips as my previous contacts have moved on.

Martin Turner: Re Zenodo; can cross link an entry to multiple communities; say to CCPi https://zenodo.org/communities/ccpi/

KT then went into the Awards section, first updating people on Richard Brown's 2nd place in the CoSeC impact award, and then announcing the CCP PETMR final yearly awards: Palak Wadhwa (gold), Casper da Costa-Luis (silver) and Nikos Efthimiou (bronze).

CCP SyneRBI: workpackage structure [Kris 12:04,]

KT started this part of the meeting by clarifying the different work-packages and overall structure. Each WP was then presented by its lead. See the slides for details.

WP1: Networking activities and Community Engagement

WP 1.3 Bringing together expertise and WP1.2 Training (AJR)

See slides starting at slide 65.

Geoff Parker: Better either only online or offline. With hybrid meetings, some group "suffers".

George Soultanidis: (12:13 pm) Online tutorials will be great as an introduction for new researchers. It would be easier to introduce the software to new people. It could be also a combination of YouTube videos with online discussions in slack, MS teams etc.

Simon Arridge: offline hackathon is better, mixed meetings can work, virtual hackathons can work (needs people getting used to it, experience, preparation)

Daniel Lesnic: (12:20 pm) Keeping a diary of open problems/challenges may be useful.

David Atkinson: (12:22 pm) TeamViewer allows you to give control of a computer to another person - might have a place in virtual Hackathons

George Soultanidis: (12:22 pm) Is the exchange program only for UK/EU? Does it cover the US? DA+KT: Yes, it does but there needs to be a link with the UK.

AR+KT: Add prize for training video?

Daniel Lesnic: (12:29 pm) Incorporating a couple of academic lectures on biomedical image reconstruction into a related MAGIC course for PhD students. MAGIC=Training course for PhD students in mathematics/applied mathematics. Manchester and Leeds included, who else? https://maths-magic.ac.uk/

WP1.3 Dissemination and outreach (ChT)

See slides starting at slide 69

Daniel Lesnic: (1:09 pm) Suitable conference: 10th International Conference on Inverse Problems: Modelling and Simulation, Malta, 16-21 May 2021. A suitable journal: Inverse Problems and Imaging

WP2: Research software development

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

KT: We use a number of different packages, and we struggle with getting them to 'talk' to each other. In some cases this requires copying of data – this is something we need to understand better in order to optimize performance. And the more synergistic our software becomes, the more overhead will be created.

WP2.2. Integration of/interfacing with Open Source Software packages (DA)

DA: The aim here is to try to get wider application for SIRF and to improve engagement with the community. This involves interfacing with other packages – CIL, NiftyPET, CASToR, OpenRTK, motion estimation and modelling software, and Machine Learning software – Tensor Flow, Keras, NiftyNET (now MONAI). The question is: how to engage with other projects? One idea is to provide exemplar applications. Another question is: what software packages or products could be useful?

EO: What about BART? (Berkeley Advanced Reconstruction Toolbox) for MR reconstruction. DA: Yes, definitely a possibility. There will be a slide at the end of my presentation outlining some tutorials they and Gadgetron people will be having in June, links will be shared near the end of today's meeting.

Geoff Parker: how big an undertaking would it be to agree on standards? KT. Agreeing on standards will be tremendously hard. Our STIR, Gadgetron and NiftyReg interfaces had been relatively independent, but at some stage we realized that there are many common components that should be isolated and clearly documented, so that if say OpenRTK expresses interest in adding a SIRF interface, there will be a clear way how this can be done. There should be a minimal set of requirements for our partner's software to get into SIRF.

WP2.3. Implementation of promising algorithms in the literature (ME)

ME presented his slide on the task, emphasizing that in addition to synergistic reconstruction that combines various modalities, the project also has another aspect: Machine Learning of optimal reconstruction. He noted that many reconstruction algorithms are based on optimization and hence require the user to define cost functions to be minimized. Last year there has been a lot of activity on stochastic algorithms, and we might want to implement a couple of those in SIRF and test them to find out whether they suit our purposes.

ME then outlined a plan for accomplishing the task, which included prototyping via hackathons (2-3 a year = ~10 in total plus 2 funded by EP/S026045/1), regular software developers meetings, employing CoSeC software developers (1.8 FTE), minimizing CCP SyneRBI/CCPi redundancies, with

algorithms implemented in CIL first, and connecting to open source Machine Learning frameworks (TensorFlow etc.).

ME mentioned that CIL software is Python only. Increasing the integration with CIL avoids duplication with SIRF but will leave MATLAB users behind. Asked for feedback.

EP mentions that CIL is not an independent effort as there is continuing collaboration between CIL and SIRF, with common design decisions etc. It would therefore be possible to go to the CCPi Steering Panel and suggest converting CIL optimisation algorithms to C++.

JM says CCP PETMR 5 years ago decided to support both Python and MATLAB. Python has moved to the forefront but dropping MATLAB will still have consequences.

EO urges to use C++ as much as possible, but would indeed create a lot of work for CCPi

KT suggests organising another survey to find user requirements (EO agrees, also asking for Windows support). This led to some discussion that a survey needs to be well-designed and made clear to respondents that we have limited resources and they cannot have everything.

WP2.4 Testing on simulated and acquired data (ChT, DA, JM, CoSeC)

Due to time limits, there was no discussion on this topic

WP2.5 Software deployment (CoSeC)

Due to time limits, there was no discussion on this topic

WP3: Translation towards biomedical researchers

WP3.1 Software development for translation [DA, ChT, CoSeC]

Simon Doran confirms that from the NCITA perspective, they are very happy to help us with XNAT efforts.

WP3.2 Validation (JM, DA, ChT, CoSeC)

JM mentions that there is some overlap with tasks in WP2 but also clear distinction as aims to go

Andrew Robinson asks about our plans for calibration. JM says that we would hope that the calibration will be performed as part of normal procedures. The suggestion would be to add to our protocols that this would be required. KT says that additional scans might be required (including spatial calibration for alignment for instance). JM agrees that this will need to be part of the protocol.

Will Hallett comments about the considerable amount of data that was already acquired for the DPUK harmonisation project. In addition, many institutions will have used the UK NCRI protocol for the PET scanners. This could be used as a starting point. JM comments that raw data was available for the harmonisation project (acquired with Pawel). In addition, there has been a NEMA phantom study, but we are not sure if the raw data is available for that.

Will Hallett also comments that many people including Invicro have written code that performs the NEMA evaluations. KT says that it would be great if people would contribute this.

Daniel (Lesnic?) comments that characterising errors in deadtime would be useful when selecting regularisation. JM says that they have looked at a collection of daily QC data which could be useful to characterise variations and errors, and that could then lead to optimisation regularisation.

WP3.3 Training of biomedical researchers (JM, AJR, ChT)

Ross Maxwell thinks that online training is something we are getting better at so this might be worth pursuing. He thinks the target audience needs to be clear (Ross promised to think about this more and provide feedback). He also suggests that it is important to engage soon and not at the end of the 5 year grant. One of the issues however is that it needs to be really easy to start and it needs to be easy enough to quickly do something useful with it. JM very much agrees and comments that this has been an issue in the past but that the software is getting closer to be able to achieve this. It would be important to be able to run this on own data.

EP asks if it would be necessary to supply easy interfaces/GUIs for this target audience. JM thinks this is not required. The target audience would be able to adjust simple scripts (that can hide a lot of complicated functionality behind them).

Governance structure

KT finished the meeting with a clarification with the roles of the executive committee and steering panel (this is covered on slide 30, but was rearranged to the end of the meeting). He clarified that we hope for some input from Steering Panel members during the year. Members can of course elect to drop out. The executive committee will review membership of the SP occasionally as well.

End

KT thanked everyone for their interest and attendance, and stressed that feedback by email or any means would be very welcome.