CCPi Working Group Meeting – Wednesday 15th Nov. 2017

Atlas Visualisation Facility, Rutherford Appleton Laboratory, and ICAM, University of Manchester

Minutes

Attendees – in person at RAL:

- Daniil Kazantsev (DK)
- Edoardo Pasca (EP)
- Srikanth Nagella (SN)
- Erica Yang (EY)
- Graham Davis (GD)
- Mark Basham (MB)
- Nghia Vo (NV)
- Daniel Poole (DP)
- Enzo Liotti (EL)
- Paul Quinn (PQ)
- Genoveva Burca (GB)

Attendees – in person at Manchester:

- Philip Withers (PW)
- Parmesh Gajjar (PG)
- Martin Turner (MT)
- Jakob Sauer Jørgensen (JJ)
- Bill Lionheart (BL)

Attendees – Remote VC links:

- Thomas Blumensath (TB)
- Stefan Mairhofer

Apologies:

- Jay Wartnett (JW)
- Stefan Mairhofer (SM)
- Peter Lee (PL)
- Winfried Kockelmann (WK)
- Hamid Dehghani (HD)
- Farah Ahmed (FA)
- Ron Fowler (RF)
- Andrew Ramsey (AR)
- Kris Thielemans (KT)
- Manuchehr Soleimani (MS)

Minute	Item
15.11.00	Meeting began with the introduction of the attendees.
15.11.01	Agenda item: Minutes and Actions (MT) MT started with couple of slides on the introduction and general activities of CCPi. MT has submitted proposal to EU COST in September and will get the result in March/April 2018. MT said that CCPi had provided various letters of support for Fellowship; Llion Evans and Marcus Hanwell in Jan 2017; for Ben Thomas (CCPPETMR) and Lee Margetts (CCPi) in Jun 2017 (RSE fellowships). MT mentioned CCPi's inclusion in an EPSRC Panel to determine an equipment roadmap in Tomography. First meeting is on the 26 June 2017. PW raised concerns that this consultation process is dragging out. Initially EPSRC were going to make the call for a Tomography Medium Scale Facility in autumn 2017. He would like to know when the committee is due to report back. Action – MT to give a talk on EPSRC XCT Technology roadmap at RAL. **Request for funds/resources:** - Support of CPC Journal paper proposal for 2019 from DK. It's more for CCPi staff support in writing the proposal. Action – DK/EP to coordinate the CPC paper proposal for 2019 - Someone to coordinate the Avizo-Amira software licensing at RAL. The licenses will run out in March 2019. EY has raised concerns with the time to arrange the money from the license partners. Action – EY to coordinate the Avizo – Amira software licenses between DLS, RCaH, ISIS and SCD. - Nick Brierley (MTC Group) want to do a show and tell session at RAL. Action – EP to coordinate visit by Nick Brierley for software show and tell. - Paul Dunn from University of Huddersfield is working on additive manufacturing has invited the CCPi team to visit their lab. There is possibility for collaborations. Action – MT to coordinate and organise a CCPi developer's day at University of Huddersfield. - Lee Margetts to give a video talk to link up image-based modelling. There is a request for funds of £1K to travel and food. ParaFEM workshop planned for Feb 2018. Action – MT to coordinate an invitation for Lee Margetts. - MT is coordinating EPSRC Roadmap Town Hall meetings and he would be visiting sites/groups to ask few questions during Dec 2017 – Feb 2018. MT is requesting resources to be made available for this activity. - CCPi Exec team need to make finance decisions for ToScA and dimensional XCT. PW indicated that we should support those conferences. It has large number of exhibit and an important venue to bring community together. CCPi Team has to plan ahead for these conferences and be involved in them to showcase/publicise CCPi activities rather than just last minute funding. Action – EP to prepare pull-ups and material for CCPi stand at ToScA, dimensional XCT. - PG has requested funding for Nikon Hacking session training courses mainly for setup and travel expenses. - Exchange program: EPSRC UK-USA invited Tomviz developer was successful and MT to coordinate the last bits this program.

	• Exchange program: IMAT/ISIS data capture and uploaded on to Zenodo with license.
	
	Papers/Impacts:
	  • BSI is coordinating the ISO standard for XCT. It is half way through the 6 year process and an international meeting is planned for the last week of January 2018. MT is currently a reader.
	Action – MT to give update on ISO standard for XCT.
	  • More papers and posters are required with a more systematic publication pipeline proposed e.g. SoftwareX, EGUK, ToScA.
	  • EPSRC software collaboration calls are popular and they are announced at regular basis.

15.11.02	Agenda item: CoSeC Updates **Licensing: (SN/MT)** SN has raised the issue with the current licensing of software developed as part of CCPi. The choice is between Apache 2.0 and GPL v3. MB has mentioned that SAVU is currently using dual licensing both Apache 2.0 and GPL v3. Industry users/partners are reluctant to use GPL. The decision was made to use Apache 2.0 except for the codes which are in GPL v3. CIL will be dual license similar to SAVU. **CCPi Work updates (SN/EP)** CIL version 0.9 was released in June 2017 and the CIL is integrated into SAVU using SAVU plugins. MB has acknowledged that it is a good way to integrate into SAVU and the SAVU team doesn't have to worry about library dependencies. Simpleflex segmentation implementation and working on improving the features. Cone beam reconstruction algorithm is now available. Action – SN to write up and make available one page documentation on cone beam reconstruction algorithm. Action – SN to make a small downloadable open dataset for CIL reconstruction algorithms. Possibly using Sophia beads dataset **CIL Work plan/priorities for the next 6 months** Action – SN to give estimates of the staff effort required to carry out each work. SN has estimated that to bring in DVC code into CIL will take 1 month staff effort. BL raised a question regarding the ability to forward project a segmented dataset using Simpleflex. Closing the loop problem (blind spot in CT reconstruction). Just to demonstrate the problem to the community here is a dataset, here is a segmentation but we don't know from reconstruction whether they are touching. A little case study to highlight this would be useful. Action – EP to estimate efforts to compare trees; and to illustrate the problem by comparing two trees of the same images (with different number of projections, limited angle reconstruction) Action – EP to coordinate a programme (whoever interested to involve) to put together a work plan that leads to a paper MB has requested SuRVoS to be supported by CCPi team as a temporary measure. It doesn't require any development effort but general maintenance. CCPi is already involved in the build process of SuRVoS and won't be a major work. Training: SN will be running some training sessions for CIL at Manchester and RAL. PW

	would like to see more users attending the training session rather than just the MXIF staff. **DVC- Code:** SN: There are not many DVC codes available out there and collaborating with Brian Bay would provide an advantage to the community. **SAVU Update:** MB: The developer community for SAVU is growing and there are quite a few people from i12, i13, i18 staff who are contributing to SAVU. Started working with IMAT instrument and reconstructed their dataset. Started working with Lund University who are contributing to the code base. MB**:** BL wants to move away from building the framework for new reconstruction algorithms, If PhD student wants to do a new reconstruction algorithm then "how can SAVU can get a PhD/RA to contribute to it" – it is new individual plugin. MB has a YII student to simulate phantom dataset with scatter, phase contrast etc. rather than needing real data. **Case Study:** • **Segmentation using Simpleflex (EP)** Action – EP to add tree comparison to work in progress. • Root dataset with missing projections – GB/SN The dataset is from Southampton University about Root/Soil dataset. Root dataset did not work with FBP reconstruction using tomopy. All the angles are know for projections but some of the projections were missing and dead pixels in the dataset. The results were quite good.
15.11.03	Agenda item: FISTA Reconstruction **(EP)** FISTA code is fast iterative reconstruction codes developed by DK. The code uses CPU and GPU for optimisations. EP has worked on pythonisation of FISTA codes and integrating into CIL code. There is dependency on Astra toolbox (which is GPL v3 licensed) and EP has worked on removing Astra dependency. This is part of reengineering the existing code and this is taking considerable amount of effort. DK has explained FISTA in much more detail. He has implemented the MATLAB version of the code and it takes in the input as geometry described as an abstract routine (it works on parallel, cone, fan-beam). It calls CPU and GPU regularizers for reconstructions. This will be useful in CCPi Flagship project for 4D reconstruction. EP has developed a tomophantom package that can create phantom datasets of 2D/3D in Sinogram or Projection space. The phantom definitions are specified as a group of analytical objects. This can be used for testing/benchmarking the reconstruction algorithms. GD has worked on algorithm that turns mesh into projections. Action – EP to get in touch with GD to send the paper and code.
15.11.04	Agenda item: Denoising techniques (**NV**) NV started with the review of the pre-processing techniques currently available. There are several different packages/tools available at the synchrotron facilities. He have variety of algorithms developed and made available in packages such as tomopy, SAVU etc. he has worked on algorithms to do alignment, PSF correction, Helical scan correction, file format converter, ring artefact removal, phase retrival, sinogram correction for limited angles and sinogram generation on tilted planes. NV had recently worked on two experiments. The first one was on 3sec per tomogram experiment and second 0.5 sec per tomogram. Due to the experiment restriction they had to work on lower number of projections. This has led to under exposed projections. The noise is quite high on the projections. FBP didn't result in acceptable reconstructions. SIRT gave a good reconstructions but it was very slow. It was estimated that using SIRT would take 380 days to process data from experiment. The new denoising technique he has developed has improved the quality of reconstruction without using iterative

	reconstructions.
	Action – SN to explore how to apply/try NV's denosing/pre-processing algorithms on IMAT data.
15.11.06	Thomas Blumensath, Southampton University Parallelising reconstruction on rotation based projector system (rotational tomography). This talk is about solving linear equation problem. The main idea is to bring in small problem and do reconstruction computation on subvolume and subprojections as submatrix. The master node does the breaking down of the problem space into smaller chunks of subvolumes to be reconstructed and are passed on to the compute nodes. Compute nodes then does the processiong and return the reconstructed volume back to the master node. This avoids any intercommunications between compute nodes. The problem is turned into MapReduce problem or MPI based solution. The iterative algorithm used is gradient descent. With the simulations a 2D phantom, 64x64 360 projections. The results are the algorithm converges faster by 20%. Action – EY to get in touch with TB for using MapReduce for tomo reconstruction.
15.11.06	Agenda item: Imaging needs at Diamond (PQ) PQ give update on the imaging needs for Diamond. There are two new beamlines (i08, and B24) and the new facilitiles (ePSIC and eBIC). There two new institute Rosalind Frankin Institute and Faraday Institute. There are common themes such as DIAD looking into corrosion and microscale stress/cracking and nanoscale corrosion. There are two categories within DLS Imaging. Firstly the Full field imaging such as i13, i08, i14 which is quite mature in terms of software, data management and problem space is very well understood and the other category is scanning probes (Ptychography) which is in early stages and takes more time to perform experiment and analyse the results. The mathematics of Ptychography is currently under development. To get a one projection 250K spectra to be fitted and 250K diffraction patterns and 25 million spectra need to be analysed. It currently takes 6 hours to acquire a ptychography experiment and takes further 6hours to reconstruction. DLS is looking to improving the ptychography algorithms and integrating with SAVU.
15.11.07	Agenda item: AOB

Minute	Action	Person Responsible	Date due to be completed by
15.11.01	Coordinate a CPC paper proposal for 2019	DK	
15.11.02	Coordinate with Nick Brierley/MTC on show and tell for 2018	EP	
15.11.03	To coordinate the Avizo – Amira software licenses between DLS, RCaH, ISIS and SCD.	EY	
15.11.04	Prepare pull-ups for ToScA/D-XCT roadshow and talks	EP	
15.11.05	Make a small dataset working with DK on phantom dataset for CIL	EP	
15.11.06	Coordinate and organise a CCPi developers' day at University of Huddersfield.	MT	
15.11.07	Coordinate an invitation for Lee Margetts.	MT	
15.11.08	To give update on ISO standard for XCT	MT	
15.11.09	To write up and make available one page documentation on cone beam reconstruction algorithm	SN	
15.11.10	To make a small downloadable open dataset for CIL	SN	

	reconstruction algorithms. Either using Sophia beads dataset		
15.11.11	To estimate efforts to compare the trees and to illustrate the problem in compare two trees of the same images (with different number of projections, limited angle reconstruction)	EP	
15.11.12	To coordinate a programme (whoever interested to involve) to put together a work plan that leads to a paper on comparing the blind spot in CT reconstruction.	EP	
15.11.13	To get in touch with GD to send the paper and code on mesh to projection software.	EP	
15.11.14	To explore how to apply/try NV's denosing/pre-processing algorithms on IMAT data.	SN	
15.11.15	To get in touch with TB for using MapReduce for tomo reconstruction	EY	