Report from CCP_PETMR for the Period 08/12/15 to 06/06/16

Dr Kris Thielemans – 17 June 2016 http://www.ccppetmr.ac.uk/

1. Background

The recent integration of positron emission tomography (PET) and magnetic resonance (MR) imaging into a single simultaneous imaging system opens up exciting potential for synergistic imaging. This EPSRC-funded collaborative computational project (CCP) aims to bring together the best of the UK's PET and MR image reconstruction expertise.

Work has progressed according to the job plan: creation of content for the website (www.ccppetmr.ac.uk) and user lists (three lists: 143 names); organising kick-off/ start-up and working group meetings, organise a series of well attended Developers Days' (eight in total – avg 20 att) to construct an API for the new software (agreed to be incorporated within a Python/MATLAB development environments), and management of minutes and bookings, etc. within a OneDrive account.

Core team staffing within STFC includes; **Ron Fowler, Evgueni Ovtchinnikov and Martin Turner**. The core team is funded (1.16 FTE) where Martin Turner (0.08 FTE) has a secretariat position. The focus is creating a framework for different software toolkits combining PET and MR (initially STIR and Gadgetron software).

2. Highlights for the Current Reporting Period

Summary of main achievements in this six month period:

- Three software framework meetings have been coordinated: these developers' workshops have been held at various user locations (UCL, Leeds and Manchester) – 10 Jun 2016, 4 Mar 2016; 18 Jan 2016
- CCP poster accepted and presented at PSMR (PET/MR and SPECT/MR hybrid systems) 23–25 May 2016 http://psmr.hut-gmbh.net/, a focussed international conference with about 150 attendants.
- Progress on data formats: Further contributions to the specification and publication of ISMRM Raw Data Format for MR have occurred (https://github.com/ismrmrd/ismrmrd-paper). Discussions are ongoing with GE and Siemens on making their PET data formats more open and/or providing converters. GE has contributed code for reading most of their data. More to follow.
- Organised open discussion on the Software Framework via online editable documents (OneDrive), email list and meetings. A User Specification document (finalised on Sep 2015 but evolving) and a Pseudo-code document are informing the development process.
- Leeds medical imaging seminar 10 February 2016: Professor Terry Jones, Visiting Professor at the University of California Davis, "Improving the Sensitivity of Positron Emission Tomography"
- First funded exchange scheme (Leeds PhD student visiting UCL)

Schedule for software releases:

- Jan 2016: first release for developers only
- Feb 2016: first release of Virtual Machine for developers with pre-installed software
- Mar 2016: first release for users (alpha only) – mainly semi-developers

Progress in software development:

- Most developments were on the MR side
    - Acquisition modelling and reconstruction for normal fully-sampled Cartesian data and basic Parallel Imaging sequences (Cartesian (sub)sampling)
    - Interface to Gadgetron chains for lower-level but higher-performance computing
- Generic functionality added
    - Basic image manipulation
    - Reading raw data, images, conversion to MATLAB/Python arrays
- Creation of (VirtualBox) Virtual Machine with preloaded software and easy update mechanism (~2GB, distributed via CCP PETMR website).
- Multiple simple software demos are now included in the distribution, though there is only limited documentation available. This gets continuously updated.
- All software on Github under Apache 2.0 license

3. Future Events

Future networking and sustainability opportunities:

1. Continued software framework meetings (~6 weekly)
2. Educational workshop at the Annual Meeting of the British Chapter of ISMRM, Leeds, 7 Sep 2016
3. ~Oct 2016: first user-friendly software release version
4. STIR Meeting at IEEE Medical Imaging Conference, Strasbourg, France, Nov 2016: 30 min slot with a sponsored/catered network session
5. CCP PETMR workshop: Issues in PET-MR Reconstruction and Quantification – possible link with next WG (December 2016)
6. Training school on PET-MR – proposal stage (January 2017)
7. Workshop on synergistic reconstruction (joint with CCPi) – proposal stage
8. Establishment of databases for phantom data (collaboration with the Dementia Platform UK.

4. Issues and Problems

- Applications for ‘good’ new exchange visits are difficult and needed.
- There has been a planned underspend at STFC in the first year (of 0.4 FTE) and a new recruit is planned and has been actioned (by STFC/CSD) for the next three years of the project.
- CCP Flagship grant needed to be able to make progress on the scientific front.

Ed. Martin Turner - 15 June 2015