Report on

Joint MRC/INCF/SICSA Workshop on Atlas Informatics,

15-16 May 2012, Edinburgh

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Meeting Summary:

A Joint MRC/INCF/SICSA Workshop on Atlas Informatics was held on May 15 and 16, 2012, at the SHSC Conference and Training Centre in Edinburgh. The goals of this workshop were to strengthen the field of Atlas Informatics as a tool for novel biomedical science, to identify related open computational challenges, and to discuss avenues of knowledge transfer from the basic computer science research community to the biomedical end users of atlas applications through the development of tools and informatics infrastructures.

The morning of the first day provided a general introduction to Atlas Informatics and described a range of existing atlas systems. Specifically, the Virtual Fly Brain (Prof Armstrong), the Edinburgh eMouse Atlas (Dr Armit), and the Scalable Brain Atlas and the 3d Brain Atlas Reconstructor (Dr Majka) were discussed. This first session was concluded by Dr Zaslavsky explaining INCF efforts to develop a Digital Atlas Infrastructure for cross-resources interoperability.

The second session could broadly be summarised under the heading of "clinical atlasing applications", with presentations on Toshiba's work on applying atlases in the segmentation of medical datasets (Dr Poole), the use of anatomical atlases on neuroimaging in clinical research (Dr Hernández), and an NHS perspective on how atlas informatics could improve cancer treatment (Dr Nailon).

The following session introduced the possible use of atlasing for mouse brain transcriptome analysis at the RIKEN institute in Japan (Dr Okamura-Ohu), and current work on using atlases for the Wnt pathway gene expression analysis (Dr Murphy). The final presentation of the day (Dr Bjaalie) highlighted issues of large-scale data production and discussed the central role atlases are given in The Human Brain Project.

Participants then split into three groups discussing the following topics: 1) Annotation and Standardization, 2) Accuracy and Image Processing, and 3) Multi-resolution Atlases. Some of the key questions/observations that were made include: What makes sense to standardize and how to come up with annotation community agreement? Would it be easier to standardize nomenclature for annotation or coordinate spaces? Any standardization process should be open, transparent, based on consensus, but limited in time. On the topic of accuracy, it was pointed out that it is not a universally definable property, but depends on context. Any accuracy evaluation should be task-based. In addition to some notion of accuracy, a so-called "blunder rate" should be recorded; a blunder being an easily visible error in spatial mapping. The multi-resolution atlases discussion emphasised that at each scale very different kinds of data may need to be captured and that not just spatial, but also time scales can vary greatly across levels. An integrated framework should accommodate all levels – some form of continuity should be achieved. Standard APIs at each level could support hierarchical use of models.

The second (half) day was dedicated to explore the atlas informatics research challenges to the computer science and informatics communities. Not only is the field multidisciplinary in the sense of bringing biomedical and computing research together, but even within computing are a wide range of core computer science areas that are relevant. This range was well reflected in the presentations that were given. The use of sufficiently formalised ontologies, in OWL, was demonstrated through advanced querying capabilities in the Virtual Fly Brain (Dr Osumi-Sutherland). An example of spatio-temporal modelling of biological processes using PEPA was demonstrated by Dr Galpin. It was generally recognised that there remains a lot of work to be done to improve the interoperability between such modelling programs and atlas systems. Although already a key component of atlas informatics, image processing still remains an area of current research, as illustrated by a presentation on how to deal with large deformations during atlas registration (Dr Hill). As in many other areas of computation, the "Big Data" challenge is equally present in the context of atlases, where ever increasing numbers of images with higher resolution need to be processed efficiently. The presentation by Dr Barker illustrated the use of scalable workflows to start addressing this problem. The final discussion of the second day (led by Dr Zaslavsky) raised again the importance and challenges of standards and infrastructure development to facilitate a maximum level of atlas systems interoperability.

Attendance:

The workshop was attended by just over 40 participants on each day. It brought together researchers from the computational sciences, e.g. St Andrews University, Heriot-Watt University and Edinburgh University, as well as the biomedical field. Representatives from industry as well as the NHS were present. Whilst the majority of participants came from Edinburgh and Scotland, due to its co-location with an INCF Atlas Program Task Force meeting, the workshop benefited from the participation of a number of international scientists, including from Ireland, Poland, Norway, Japan and the USA.

Acknowledgements:

We would like to thank all participants and presenters and who have attended and contributed to the workshop and made it a highly successful event. We also would like to thank the staff at the SHSC Conference and Training Centre and the UK Neuroinformatics Node, who have done an excellent job supporting the event. And, of course, we gratefully acknowledge the support of our sponsors: the MRC Human Genetics Unit, the UK Neuroinformatics Node, and the Scottish Informatics and Computer Science Alliance (SICSA).

Web Site:

A workshop web site (www.macs.hw.ac.uk/~ab/atlasinf2012/) has been created. Slides of the presentations (as far as they were made available), can be found on the Program page.