CAPOD Funding Report

Please complete this report and submit by email to your authorising signature from your School/Unit and capod@st-andrews.ac.uk

<table>
<thead>
<tr>
<th>Name</th>
<th>Philip Cammack</th>
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<tr>
<td>School/Unit</td>
<td>School of Psychology and Neuroscience</td>
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<tr>
<td>E-mail</td>
<td><a href="mailto:ppkf@st-andrews.ac.uk">ppkf@st-andrews.ac.uk</a></td>
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<tr>
<td>Funding</td>
<td>£150</td>
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<tr>
<td>Your authorising staff member</td>
<td>Prof. Julie Harris</td>
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<tr>
<td>Event/Course Title</td>
<td>Autumn academy for high performance computing</td>
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<tr>
<td>Date of event</td>
<td>14th – 25th September</td>
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1. Brief description of Event (50-100 words):

The event was a training event in high performance and parallel computing – a growing necessity in the increasingly computationally intensive environment of research. It was constructed to teach the relevant scientific computing skills to PhD students to enable them to fully exploit the available computational resources. The event consisted of two weeks of practical and lectures sessions taken by leaders in the field along with several networking opportunities.

2. What were the benefits of attending and what did you gain from the experience in terms of transferable skills and knowledge.

In summary the key transferable skills and knowledge lie within my increased knowledge and understanding of how to not only program, but program code that runs fast and efficiently both on single computers and supercomputers enabling much better exploration of data and computational models when applied to any subject. To give some numbers, piece of realistic demonstration code we were given ran in 40s pre-optimisation; the techniques taught in this course enabled us to speed the code up to take less than 0.01s with no decrease in accuracy in the answer on a normal desktop computer. In detail, I now have:

- An increased understanding of computer hardware, and how the hardware of the computer can restrict or enhance software performance. This will not only enable me to create faster models and code, but be in an excellent position to make informed decisions on hardware purchases.
- Being able to code in a new language (C), the use of which is widespread. Additionally, this language is at a lower level than any I had previous experience with so I have a much better understanding of key computational concepts such as pointers.
- Greatly increased coding ability in serial in any language, with an increase in understanding of how to code well and how to tune the code for best performance both in terms of the runtime and the accuracy of the result.
- Knowledge of how to code in parallel, both on a normal computer and on a supercomputer. This is invaluable with a large amount of scientific computation, where the size of the data set
or computational model would often require excessive runtimes that are prohibitive to research without the use of parallelisation.

- Good programming techniques to increase transferability of code between both people and disciplines, ensuring that the written code will be useful for both lab members and adaptation to future problems.

3. What actions will you be taking as a result of attending or by making new networking contacts.

I will be changing my approach and techniques when I am creating code for software and scientific computing, which I expect to make significant improvements to both computer runtime and the time spent in developing the code. I have a variety of interdisciplinary contacts who I can contact to discuss the methods and best applications of the coding techniques I have learnt thus enabling me to continue to broaden by knowledge.

4. Can you share any additional resources produced in connection with the event (e.g. feedback from participants, training resources, website links, and additional materials.

Last year’s course notes are publicly available online, and in some cases (for example MPI or computer hardware) are extremely useful stand-alone notes: http://congo.dl.ac.uk:8080/portal

Additionally, the supercomputer ARCHER will give 80k core hours for free to any user that completes their “driving test”. This is a significant amount of computation time, and may enable some research that is too slow to be done on a desktop computer to be completed for free on a supercomputer.

6. Tips/experience learned from the event

Outside of extensive coding experience, I have found that summer schools can teach far more than expected even. They are also excellent networking opportunities due to the amount of peer to peer interaction (particularly in the group project).

7. Any additional comments or information regarding the event

Excellent course, well taught and both informative and enjoyable and I highly recommend it. This course would be useful to anyone who needs to do scientific computing, even if they are not using a supercomputer as 10 of 12 days teach techniques that can be used on a conventional multi-cored desktop (although the course material is easiest to use if coding using a lower level language such as C or Fortran).

8. I give permission for my report to be uploaded to the CAPOD Funding Website:

Yes ☒  No ☐

Report submitted by: Philip Cammack
Date: 28/09/2015