Computational Science

Academy of Finland Research Programme Lastu 2010–2015

Lastu

Academy of Finland
Research funding and expertise

Computational Science Research Programme (Lastu) 2010–2015

Lastu in brief

With the rapid development of computational devices and methods over the last few years, a completely new scientific discipline has emerged: computational science. It can be applied to all those research questions that require large amounts of data or high-performance computing. Through modelling and simulation complex experiments, a computational approach can lead to significant savings compared with practical experiments, which may not even be feasible. The main goals of the Computational Science Research Programme (LASTU) are to support increasingly complex computational studies in different fields of science, increase the methodological capabilities and promote good practices in data and software management.

Computational science – a new way of doing science

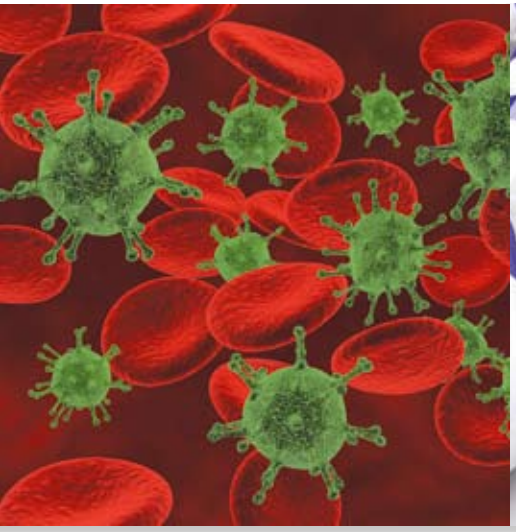
The revolutionary development of information technology has dramatically changed the way research is done today. The calculation and data processing capacities of computers have reached the level where real systems can be described by computational models. Previously, only parts of real phenomena could be modelled, for example in climate modelling, where small-scale models for chemical reactions and large-scale air-flow models have been treated separately. Now these can be combined, which will improve our understanding of the behaviour of complicated systems where the interaction of small- and large-scale phenomena is crucial. Computational science has become the third leg next to theoretical and experimental science.

Great challenges

Computational science can help many scientific disciplines to solve problems hitherto inaccessible with traditional methods. This is the case in brain research, for example, where the amount of data is huge, or in pulp manufacturing processes, where simulation requires high-performance computation in fluid analysis. A key topic of the LASTU research programme consists of such "grand challenges" where computationally challenging and scientifically significant questions are studied. Topical examples, in addition to climate change, are questions related to health and welfare, the security of global data networks, and controlling the global economy. Models describing these systems contain many interlinking elements. To solve, verify, and interpret these is both important to society and scientifically challenging.

National and international development

The breakthrough of computational science is part of the coinciding change of the science paradigm. This new principle is called eScience. Research is moving into virtual environments. We need only look at the

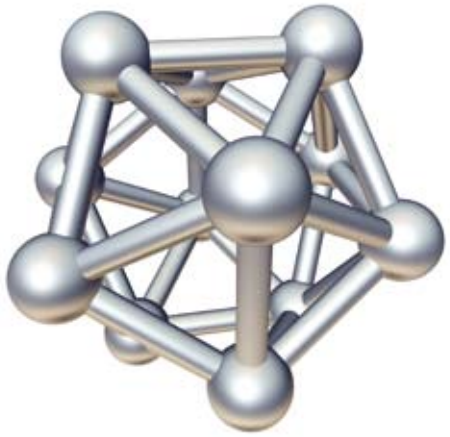


dramatic changes in human interaction and the utilisation of library services, for instance. The idea of eScience has also reached the political level, as a number of eScience strategies have been written in the EU and at the national level. Finland, too, drafted a national eScience strategy in 2007. One of the key suggestions in the strategy was to launch a national research programme in computational science. In addition, eScience has also received a notable position at the Nordic level, being one of the future focus areas of Nordic science policy.

Goals

One of the main objectives of the Computational Science Research Programme is to promote the use of computational methods throughout society. In view of this objective, the programme will be working to develop computational methods and the necessary statistical, mathematical and computer science solutions; to promote the efficient and appropriate use of infrastructures; to support computational science research; and to develop computational applications for different disciplines and for interdisciplinary research on various scientific and social problems and phenomena.

To improve methodological skills and competencies, the research programme also aims to raise the level of mathematical and computer science knowledge in the scientific community. It will promote interaction between mathematics, computer science, information technology and research applying computational



methods. To increase interdisciplinary interaction, the research programme aims to encourage transdisciplinary collaboration between application fields and algorithm and method development, and to act as a catalyst to refine ideas to concrete research co-operation.

The programme aims to promote good practices in the storage and recording of data used and produced in research. Data are often part of international joint projects implying that the same commonly accepted practices must be followed everywhere. In terms of eScience, this is still a considerable challenge.

After programme launch

The research programme can act as a link between scientists, not only within the LASTU projects, but in a broader context as well. There are a number of graduate schools in Finland and the other Nordic countries in the field of computational science. A particular goal is to bring these young scientists together under the common interest of computational science. LASTU can also be a national contact point for the planned Nordic research programme in eScience.

In the first call of LASTU in 2009, funding was granted to seven Finnish research consortia as well as Finnish partners in three international projects in ERA-SysBio, the ERA-NET for systems biology. In 2011, LASTU plans to open another call, whose focus and timetable will be decided in 2010.

Photos: futureimagebank.com, rodeo.fi

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Lastu research programme

Projects funded in the Lastu call

BrIAn: Computational analysis of complex brain imaging data
Aapo Hyvärinen, University of Helsinki
Riitta Hari, Aalto University, TKK

ComQuaCC: Computational research chain from quantum chemistry to climate change
Hanna Vehkamäki, University of Helsinki
Lauri Halonen, University of Helsinki
Kari Lehtinen, Finnish Meteorological Institute

CSI Speech: Computerized inversion for spoken language - An interdisciplinary consortium on inverse problems in the production and perception of speech
Samuli Siltanen, University of Helsinki
Paavo Alku, Aalto University, TKK
Risto Ilmoniemi, Aalto University, TKK
Anne-Maria Laukkanen, University of Tampere

eVLBI+GEO: From ultrarapid data transfer into science - near realtime VLBI application
Markku Poutanen, Finnish Geodetic Institute
Merja Tornikoski, Aalto University, TKK

MUMO: Multiscale modelling of chemical processes
Tapio Salmi, Åbo Akademi University
Matti Alatalo, Lappeenranta University of Technology
Pertti Koukkari, VTT Technical Research Centre of Finland
Ilkka Turunen, Lappeenranta University of Technology

Novac: Novel advanced mathematical and statistical methods for understanding climate
Heikki Haario, Lappeenranta University of Technology
Heikki Järvinen, Finnish Meteorological Institute
Erkki Oja, Aalto University, TKK
Johanna Tamminen, Finnish Meteorological Institute

SimITER: Turning Teraflops into Megawatts
Taina Kurki-Suonio, Aalto University, TKK
Markus Arila, VTT Technical Research Centre of Finland
Jukka Heikkinen, Aalto University, TKK
Kai Nordlund, University of Helsinki
Jura Tarus, CSC — IT Center for Science
Jan Westerholm, Åbo Akademi University

Projects funded in the ERA-SysBio+ call

SYNERGY:
Systems approach to gene regulation biology through nuclear receptors
Finnish partners
Sampsa Hautaniemi, University of Helsinki (coordinator)
Olli A Jänne, University of Helsinki
Antti Honkela, Aalto University, TKK

Tcellnet:
Signalling pathways and gene regulator networks responsible for Th17 cell differentiation
Finnish partners
Riitta Lahesmaa, University of Turku (coordinator)
Harri Lähdesmäki, Tampere University of Technology

iSAM:
Integrative Systems Analysis of the Shoot Apical Meristem
Finnish partner
Yrjö Helariutta, University of Helsinki

Further information

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