2016-01-28

Swedish Foundation for Strategic Research

SSF Call for Proposals:

Framework Grants for Research on

Big Data and Computational Science

The Swedish Foundation for Strategic Research announces SEK 200 million in a national call for proposals for problem- or application-driven research projects that meet the highest international scientific standards. The call aims to stimulate collaborative interdisciplinary research within the area of Big Data and Computational Science, of relevance to present or future Swedish-based industry and to society.

Selected projects will be supported by grants of SEK 4-7 million per year for a period of 5 years (incl. overheads) to be used for salaries (senior researchers, postdocs, PhD students, etc.), research tools, and running costs according to the needs of the project. Funding for the last two years will be contingent upon a successful midterm evaluation.

Background

The techniques of Big Data give grand opportunities in areas as different as materials design, system biology, and scientific visualization. They also underpin Science 2.0, which stands for challenges in the open-data era, and e-Science that connects research fields based on direct support from the development of hardware and computational tools.

The combination of statistical, mathematical, and computational methods has already led a revolution in telecommunication. It has resulted in dramatically improved simulations, e.g., for industrial development and manufacturing and, increasingly, in healthcare. It is also driving particular technological developments, like image-based search and automatic language translation, more virtual content in movies, etc.

In industrial settings intractably large data sets emerge in many ways, including searches on the internet or the maintenance of large technical systems, simulations of next-generation industrial product construction and manufacturing, and as collections of user data from market-leading apps. The need to simultaneously handle data from systems of different ancestry adds to the complexity. With the reduced barriers to the creation, storage, and handling of very large amounts of data there is potential to benefit and profit from the smart handling of such big data.

Sophisticated data analyses from large data sets may support adaptive, predictive, and robust behaviours in systems. They could also provide compensation for uncertainty or variability in contexts, e.g., self-healing or add possibilities to augment human capabilities in settings from decision making to surgery.

Outstanding research questions include:

- How to extract, transform, and load exponentially growing numbers of data?
- How to provide relevant infrastructure with über-computers and grids?
- What new concepts and algorithms will be required?
- How to draw empirically and verifiably conclusions from big data-related hypotheses?
- How to visualize large data sets in order to facilitate decision making based on big data?

Scope

The call addresses methods for dealing with enormous amounts of structured, semi-structured, and unstructured data that may move too fast, or not fit the structures of state-of-the-art database architectures, but have the potential to be mined for information. The project must include fundamental mathematical and computational research components, associated with big data.

Research areas included in this call that are considered strategic for Sweden, alone or in combination, are:

- **Visualisation**

  Improving representations of information from large data sets that support humans or – on their terms – robots

  Simulation and modelling to deal with scientific, industrial and societal challenges

- **Tools and algorithms for high-performance computing and computational science**

  Applying algorithmic research targeted at massive data sets for, e.g., databases, machine learning, data mining, high-performance computing, and visualization

  Creating algorithms needed for the analytics of massive, distributed, dynamic, uncertain, heterogeneously structured, and unstructured data, for accurate and reliable long-term, real-time or predictive techniques and sophisticated risk measures

  Providing techniques for data processing, management and inference that scale to the quantities speed of acquisition, dimensionality, and complexity of the relevant data and knowledge

- **Data Mining**

  Discovering patterns in large data sets. Handling constrained data, data variety, data velocity, and causality vs. correlation

- **Database Systems**
  Developing new database technology, e.g., supported by cloud computing and datacentres, to provide complex information environments with improved scaling properties, including methods for streaming data, rather than incremental support for contemporary industrial data handling

  Smart retrieval, processing, storing and cleaning of data with considerable practical importance

- **Applications to Large Information Systems**

  Permitting re-use, re-purposing, and integration of disparate data and information in ways that preserve provenance and appropriate protections

  Integrating data, hypothesis, predictive modeling and knowledge-based inference, experimentation, and simulation in decision making and discovery

  Handling uncertainty, including expressive representation of and reasoning about preferences, noise, inconsistency, or change of context, preferably with scalable techniques

  Analytics for massive, distributed, dynamic, uncertain, heterogeneously structured and unstructured data, for long-term, real-time or predictive techniques with accuracy, reliability, and risk control

- **Bioinformatics and Computational Biology**

  Empowering, for example, personalized medicine with smart and robust handling of data from large omics (genomics, transcriptomics, proteomics, epigenomic, metagenomics, metabolomics, nutriomics, etc.) aiming at more effective clinical decision-making.

Exclusions

Development of technical platforms for the needed computing and communications is not considered within the scope of this call. Projects merely focusing on use of Big Data are also not considered relevant.

Strategic relevance

This Call focuses on interdisciplinary projects that solve important application problems or, in other ways, are in direct contact with applications. This may be fulfilled in the way that the project ends up with a demonstrator which, for instance, could take the form of functioning software.

The criterion of strategic relevance, to be used when ranking the applications, is that the research shall demonstrate a clear vision of exploitation in Sweden during the course of the project and up to 10 years after the project is finished. Applications judged able to make a large contribution to Sweden's future competitiveness will receive higher priority than those judged to make a smaller contribution. This could be clarified by incorporation of a vision of exploitation in the project description, covering the following aspects:

- Description of the project's relation to state-of-the-art within the area
- Description of the societal needs that the project addresses
- Description of how the project will improve current practices
- Description of stake holders that need to be actively involved
- Description of how the results will be disseminated
- Description of how intellectual properties will be handled
- Description of any demonstrator that will be developed during the project

- Description of collaboration with industry, healthcare, and/or other parties seeking to employ Big Data, if applicable
- Description of the applicant's ongoing or planned related projects, including financing and scope.

Eligibility

All projects should be based on a credible collaboration between, typically, two to four applicants with different kinds of relevant complementary scientific expertise, from one or different research group(s) - not necessarily co-localised. All applicants should take active part in the project and their activities should be at least partly financed by the project budget.

The proposal must be submitted by a main applicant who is a prominent researcher prepared to assume responsibility for the project during the entire grant period. The applicant must be employed by a Swedish university, university college, university hospital, or by a public or private non-profit research institute. At least one of the applicants must be employed by a university or university college.

Project participation from industry, public authorities or other relevant organisations will be considered a merit. However, such participants must not be funded by the SSF grant but may participate on their own budget. The same goes for international scientists working outside Sweden unless the project plan itself includes, e.g., visits by foreign-based scientists to an applicant working in Sweden.

The proposal budget should be in the interval of SEK 4 to 7 million per year for five years. A maximum of 25% of the grant may be used for salary for the main applicant and/or the co-applicants, but only to cover up to a maximum of 25% of the salary of each applicant.

Please note:

- each applicant is allowed to be represented in one application as a main applicant.

- each applicant is allowed to be represented in one application as a co-applicant.

Applications not conforming to these conditions will not be considered. It is the responsibility of the main applicant to inform all the co-applicants and to check the proposal for compliance with the rules before submission.

Proposal and submission

A complete application must contain, among other data specified in the portal, a full description of the research plan and full details of the relevant expertise of the participating groups. It should contain a clear account of the strategic significance of the research, including a vision of utilisation/exploitation of the results in Sweden during the project's lifetime and/or up to 10 years after completion of the project.

Each proposal shall clearly describe the state of the art within the area(s) addressed. It is also important for the proposal to give a clear picture of the resources available and to demonstrate that the proposed constellation of research groups will be effective in view of its objectives.

A Letter of Intent from the Head of the main applicant's department is compulsory.

The proposal must be written in English and submitted via the SSF portal at: http://apply.stratresearch.se. Note that in order to get a complete view of all data required for submission it is necessary to consult the portal. Please log on to the portal well in advance of the deadline. Please also submit the application in due time before the deadline. When the application is submitted, the system will reject it if some data field is missing. As long as this is done before the application deadline it is possible to submit and re-submit as many times as necessary.

All applications must be submitted by **14:00 hours (2:00 pm CET) on DATE 2016**. No additional material will be considered after this deadline.

Evaluation

Applications will be assessed by an evaluation committee consisting of generalists and specialists from industry, academia and research institutes. In a first selection the applications will be judged primarily with regard to scope (as described above), relevance and impact. Furthermore, applications that are judged unable to compete in the final step of the evaluation, or that are considered too incomplete to be meaningfully assessed, will not pass this first step. The selected applications will be sent on international peer review. The results of this expert review will be taken into account by the evaluation committee in order to produce a recommendation on which SSF will base its decision.

The applications will be reviewed using the following criteria:

- Conformity to the scope and eligibility as outlined above
- Scientific quality; originality, strengths, weaknesses, degree of interdisciplinarity and feasibility of the research plan
- Strategic relevance and impact of the proposed research to Swedish industry and/or society. Precompetitive proposals with solutions that drive innovation are preferred over proprietary and competition-limiting ones.
- Qualifications of the applicants, previous scientific achievements, international experience, and networks, and leadership/management of research teams.

Timetable

- Last date for applications: 10 May 2016, 14:00 CET at the latest
- Decision by the SSF Board: December 2016
- Project start: 1 January 2017

No additional material submitted after deadline will be considered.

Please note that the Foundation is subject to the Principle of Public Access to Official Records (Offentlighetsprincipen). Thus, applicants should avoid submitting material that they do not wish to be made public, e.g. information that could prevent patenting.

Contact persons at SSF:

Dr. Olof Lindgren, Scientific Secretary, tel.: +46-8-505 81 669, e-mail: olof.lindgren@stratresearch.se

Dr. Joakim Amorim, Research Programmes Manager, tel.: +46-8-505 81 665, e-mail: joakim.amorim@stratresearch.se, tel. 08-505 81 665