Deutsche Forschungsgemeinschaft (German Research Foundation)
Information for Researchers

Call for Proposals

No. 53 **23 June 2023**

Priority Programme "Theoretical Foundations of Deep Learning" (SPP 2298)

In May 2020, the Senate of the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) established the Priority Programme "Theoretical Foundations of Deep Learning" (SPP 2298). The programme is designed to run for six years. The present call invites proposals for the second (and last) three-year funding period.

We currently witness the impressive success of deep learning in real-world applications, ranging from autonomous driving to game intelligence to the health care sector. At the same time, deep learning-based methods have a similarly strong impact on science, often replacing state-of-the-art classical model-based methods to solve mathematical problems such as inverse problems or partial differential equations. However, despite this outstanding success, most of the research on deep neural networks is empirically driven and mathematical foundations are largely missing. Moreover, in several special but important cases these techniques dramatically fail under small perturbations such as adversarial examples in image classification, which calls for improvements driven by a theoretical underpinning.

The key goal of this Priority Programme is the development of a comprehensive theoretical foundation of deep learning. The research within the programme will be structured along three complementary points of view, namely

(1) the statistical point of view regarding neural network training as a statistical learning problem and studying expressivity, learning, optimisation and generalisation,
(2) the applications point of view focusing on safety, robustness, interpretability and fairness, and
(3) the mathematical methodologies point of view relating to developing and theoretically analysing novel deep learning-based approaches to solve inverse problems and partial differential equations.

The research questions to be addressed within this Priority Programme are of a truly interdisciplinary nature and can only be solved by a joint effort of mathematics and computer science. Mathematical methods and models throughout mathematics are required, including algebraic geometry, analysis, applied probability, approximation theory, differential geometry, discrete mathematics, functional analysis, optimal control, optimisation and topology. A fundamental role is similarly played by statistics as well as theoretical computer science. In this sense, methods from mathematics, statistics and computer science are at the core of this Priority Programme.

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Successful proposals address a genuine contribution to the understanding and the theoretical foundations of deep learning along the above-mentioned three complementary points of view. Projects aiming "only" at the application of existing methods of deep learning or their further development without theoretical foundations may not be funded within the framework of the programme.
Proposals must be written in English and submitted to the DFG by **1 December 2023** (submission will open on 1 November 2023). Please note that proposals can only be submitted via elan, the DFG's electronic proposal processing system.

Applicants must be registered in elan prior to submitting a proposal to the DFG. If you have not yet registered, please note that you must do so by **17 November 2023** to submit a proposal under this call; registration requests received after this time cannot be considered. You will normally receive confirmation of your registration by the next working day. Note that you will be asked to select the appropriate Priority Programme call during both the registration and, later, the submission process.

If you would like to submit a proposal for a new project within the existing Priority Programme, please go to Proposal Submission – New Project – Priority Programmes and select "SPP 2298" from the list of current calls. Previous applicants can submit a proposal for the renewal of an existing project under Proposal Submission – Proposal Overview/Renewal Proposal.

In preparing your proposal, please review the programme guidelines (DFG form 50.05, section B) and follow the proposal preparation instructions (DFG form 54.01) in their currently valid version. These forms can either be downloaded from our website or accessed through the elan portal. Please note in particular the changes which were announced in "Information for Researchers No. 61" on 1 September 2022, notably with respect to the compulsory use of the DFG's template for CVs. As usual, the documents to be uploaded as pdf files can be prepared using LaTeX, provided the document's structure is retained.

A video review meeting by a confidential international review panel is planned to take place in spring 2024. Applicants are expected to submit additional posters for the suggested projects in due time before the virtual panel meeting that may also contain updated information, e.g. regarding the latest publications. Information about the poster format and submission date will be given to the applicants at a later date by the coordinator of the Priority Programme. The decision about the projects will presumably be reached in the summer of 2024.

An information event regarding the second funding period of SPP 2298 will be held in the format of a video conference meeting on 18 October 2023 from 2 pm to 4 pm CEST. An invitation to the planned virtual information session will be available in due time on the homepage of this Priority Programme.

Further Information

More information on the Priority Programme is available under:
www.foundationsofdl.de

The elan system can be accessed at:
https://elan.dfg.de/en

DFG forms 50.05 and 54.01 can be downloaded at:
www.dfg.de/formulare/50_05
www.dfg.de/formulare/54_01

For scientific enquiries please contact the Priority Programme coordinator:
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Questions on the DFG proposal process can be directed to:
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