Short-Term Scientific Mission Grant
- APPLICATION FORM[1] -

Action number: CA20111

Applicant name: Franziska Alber

Details of the STSM

Title: String Solving with Parametrized Automata

Start and end date: 25.05.2025 – 01.06.2025

Detail of the cost in EUROS:

- Transport (upload screen capture): 136.98
- Hotel/day (upload screen capture): 126
- Food/day: 50 (celiac disease)

TOTAL: 1368.98

Goals of the STSM

Purpose and summary of the STSM.

The goal of this STSM is to start a collaboration and exchange of knowledge between the University of Regensburg and TU Wien where we develop new approaches for solving string equations based on parametrized automata.

Parametrized automata are an extension of finite-state automata to infinite alphabets where the transitions are labeled with logical formulas that can, additionally, contain variables (=parameters). Therefore, parametrized automata can be defined for a wide range of different FOL theories, such as integers, reals or more complex data structures.

String solvers play an important role in software verification, typically employed to guarantee that a piece of software is invulnerable to string-related security exploits. The problem of solving word equations is decidable, however no general purpose SMT solver is complete for string equations. Existing, incomplete approaches rely, for example, on Nielsen transformations or conversion into suitable automata. SMT solvers provide even less support when considering sequence theories, i. e., strings over infinite alphabets.

We believe that parametrized automata lend themselves well to applications in SMT solving, especially sequence solving which is currently an active area of research. Concretely, our goal is to combine techniques for word equations (TU Wien) with techniques for automata over infinite alphabets (University of Regensburg), which will allow us to solve sequence constraints.

Working Plan

Description of the work to be carried out by the applicant.

1 This form is part of the application for a grant to visit a host organisation located in a different country than the country of affiliation. It is submitted to the COST Action MC via e-COST. The Grant Awarding Coordinator coordinates the evaluation on behalf of the Action MC and informs the Grant Holder of the result of the evaluation for issuing the Grant Letter.

The applicant Franziska Alber (Faculty of Informatics and Data Science, University of Regensburg) will visit Prof. Laura Kovács and Clemens Eisenhofer (Faculty of Informatics, TU Wien) for seven days. Clemens Eisenhofer and Franziska Alber have met previously at AVM 2024, where the former presented his research on string solving via compressing Nielsen graphs and the latter presented part of her master thesis on parametrized automata. So far, both have conducted their research independently. Therefore, initial discussions within this STSM stay will focus on knowledge exchange to form a common basis for further research. After mapping out the territory, we will identify the most promising applications of parametrized automata and automata theory for string and SMT solving. We cannot hope to exhaustively investigate all possible avenues of identified research, therefore we will likely only focus on one possible application where we hope to make significant progress.

Expected outputs and contribution to the Action MoU objectives and deliverables.

Main expected results and their contribution to the progress towards the Action objectives (https://europroofnet.github.io/objectives/) and deliverables (https://europroofnet.github.io/deliverables/).

Working groups to which this mission contributes:

We expect to lay the groundwork for fruitful and ongoing research into the relationship between (parametrized) automata theory and string solving.

The STSM will contribute to WG 2 (Automated theorem provers) and WG 3 (Program verification). In the long run, we aim to improve current techniques for string solving and extend the expressive power of SMT solvers (Research Coordination Objectives 2 and 3).

The STSM contributes heavily to the Action's Capacity Building Objectives, especially objectives 1, 3, 5, 6 and 7. As Franziska Alber is currently at the beginning of her scientific career, the STSM will provide her with guidance and mentorship and will influence the trajectory of her future research.