Report on the outcomes of a Short-Term Scientific Mission[1]

Action number: CA20111

Grantee name: Simon Guilloud

Details of the STSM

Title: Interoperability of Tableaux and Sequent Calculus Proof Systems

Start and end date: 25/03/2024 to 06/04/2024

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

During this stsm, in collaboration with Julie Cailler, we achieved subsential progress in the development of the SC-TPTP format, a proof exchange format for first order logic (in particular sequent calculus) based systems.

We implemented a library of tools and utilities to manipulate such proof: This includes parsing, printing and proof checking, but also a tool to re-export SC-TPTP proofs to Coq files, so that they can be rechecked independently.

One problem we encountered was that while most logical proof steps produced by Tableaux-based ATP maps straightforwardly to sequent calculus, it is typically not the case for equality. Goéland for example uses rigid e-unification to close branches, which translates to a "congruence" proof step. We defined "levels" of proof steps: Level 1 steps of SC-TPTP are small and very easy to verify steps, close to sequent calculus. Equality-reasoning is possible using a substitution step, given similarly to Leibniz' equality. Level 2 steps are more advanced steps, but which are possible to transform into Level-1 proof steps.

We implemented a proof transform procedure which eliminates such congruence proof steps. The procedure is based on E-graphs (themselves based on the Union-Find datastructure). Most time was dedicated to make the decision procedure proof-producing. This then allows to transform proofs using congruence, into Level 1 proofs, achieving transfer of proofs from e.g. the Goéland ATP to the Lisa ITP.

1 This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

Finally, we wrote a paper detailing the format and its potential. This is not finished and will continue past the STSM

We hoped to be able to link the Princess ATP to the SC-TPTP system, but the based on the availability of the princess developers during these two weeks, we privilegized the directions described above. This however is still planned for future work.

Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

(max. 500 words)

In this STSM, I and my collaborator at the host's laboratory achieved substential progress, arguably exceding their expectation of what was reasonably doable in two weeks. The library mentionned above is available publicly on github (https://github.com/SC-TPTP/sc-tptp) and is still being actively worked on.

We are preparing a submission for the PAAR workshop, whose deadline is in two weeks. Based on the feedback from the community, we plan to push this work further, extending it to other proof systems.