

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA20111

Grantee name: Thiago Felicissimo

Details of the STSM

Title: Compiling dependent pattern matching to elimination principles in Dedukti

Start and end date: May 8, 2022 to May 21, 2022

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.

(max. 500 words)

This mission allowed for the beginning of the development of a prototype for translating definitions by pattern matching into elimination principles, in the specific case of the Agda2Dedukti translator. The mission was of particular importance in order for me to better understand the details of this translation, by discussing with Jesper Cockx, who proved it correct during his PhD thesis. Because Jesper is also part of the Agda development team, he provided me with precious knowledge about the Agda codebase which allowed me to start the project.

More precisely, during our discussions we realised that, in order to better structure our development and to have intermediate results, it would be better to start the implementation for the case of non-indexed inductive types. This would save us in this first step from having to modify Agda's unification algorithm in order to provide us with some extra information needed to perform the translation.

During the time of the mission, I could then partially implement this translation. More specifically, the implementation today (1) generates case principles for each non-indexed inductive type which is declared and (2) translates a definition by pattern matching into a single term made with such case principles and with recursive calls. This version is available at <https://github.com/thiagofelicissimo/Agda2Dedukti/tree/elimPattMatch>.

The next step is to finish the translation by also generating Bellow_D principles and using them to compile the recursive calls (see subsection 4.1.2 of Jesper's thesis for more details). We expect to finish this in the upcoming weeks, which would then allow us to start implementing the general translation that works also for indexed inductive types. Nevertheless, the part of the compilation which

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.

we implemented already allows to check that the translated functions and proofs made by pattern matching over non-indexed inductive types are complete, in the sense that such definitions cover all of the type constructors. This verification could not be done in the previous version of Agda2Dedukti, in which each clause of the definition was translated in a naive way as a rewrite rule.

The mission also allowed Jesper to help me by answering numerous questions about the Agda codebase, which helped me to improve the Agda2Dedukti translator.

We also used my time at Delft to have an in person meeting about our upcoming lecture in the 1st Dedukti school. Having such a discussion in person helped us to make a detailed plan of our lecture.

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)

This mission successfully allowed us to start implementing the discussed translation, which is very technical and whose development would have not started so smoothly without in person meetings. As predicted, such implementation is very time consuming, but the mission allowed us to understand much better the workload of the different tasks. Our approach was then to try to split the work in many steps, in order to have partial results. In this regard, even if there is a long way to go in order to implement the full translation, we were happy to be able to finish a working prototype which implemented a fragment of such translation. We envision of course to continue this implementation until the end, which should at some point lead to a publication. Overall, we think that this work contributes to the deliverable “Release of software for translating proofs coming from important proof systems based on type theory like Isabelle, Agda, PVS, Lean or Minlog, to Dedukti and back”.

This mission was also very useful to discuss with Jesper some of the features that could be added to Dedukti in order to support the translation of more features. In particular, it would be interesting to investigate at some point the addition of type-directed rules to Dedukti, which would allow for the encoding of eta-equality and definitional proof-irrelevance.

During the mission, I was also able to get to know other students and professors at the programming languages team of TU Delft. I had the opportunity to give to them a talk about Dedukti and my ongoing PhD work. I was also very happy to learn about their PhD projects and the problems they are trying to tackle. Overall, I think this contributed to the deliverables “Bring together members of the different communities working on proofs in Europe” and “Transfer knowledge in terms of expertise, scientific tools and human resources across the different disciplines and between academia and industry”.