

Report STSM

Glasgow 22/05/2022 – 29/05/2022

During the STSM I have been working on the Agda mechanization of a type inference algorithm for the pi-calculus. Such algorithm is based on “FIRST-ORDER UNIFICATION BY STRUCTURAL RECURSION” (C. MCBRIDE).

There exists already a formalization of the results presented in the mentioned paper (see <https://github.com/wenkokke/FirstOrderUnificationInAgda> by W. Kokke). Unfortunately, for our sake we needed a proof of completeness that has not been mechanized yet (Notably, “correctness” has been used as a synonym of “soundness”). In this week we have been working on such proof trying to understand the main theoretical issues.

In particular, we had to prove that the substitution obtained through McBride’s algorithm is the most general one, that is, any other substitution that unifies two terms can be obtained by composing McBride’s one with another substitution. Hence, we proceeded as follows:

1. We studied the algorithm that outputs the most general substitution. The completeness proof should inspect the main cases analogously.
2. We studied how to build the substitution that must be composed with McBride’s one to obtain the that in input.

While, from the point of view of the mechanization, the algorithms deeply depend on the actual implementation of the datatypes, the main ingredients can be easily traced back to the notions introduced in both the paper and the mechanization mentioned before.

On the other hand, the formalization of the completeness proof requires many additional lemmas that, roughly speaking, connect the outputs of McBride’s algorithm to the inputs of our proof. We expect that this could be the most challenging point of the work. For this reasons, we think that the Agda mechanization of the completeness proof is a valuable contribution that can be used as the basis for next developments such as those proposed in the STSM proposal.

For what concerns the social aspects of the STSM, I have been kindly welcomed by all the collaborators in the School of Computing Science and in particular by the CoLab group in which I worked. As noted in the proposal, I am a third year PhD student and this has been the very first in person experience. I hope to have the chance to organize another visit very soon to continue the work that we started and to share ideas with the colleagues that I met for possible future collaborations as my PhD will conclude in October 2022.