Strong normalisation via CPS translations for intuitionistic proof systems

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October 31, 2007

Abstract

CPS (continuation-passing style) translations have their origin as a compilation technique for functional programs, but are related to double-negation translations in logic. One application of CPS translations is the inference of strong normalisation of the source calculi from strong normalisation of the targets. In this talk we illustrate this idea to obtain strong normalisation of a system called LambdaJmse from the simply typed lambda-calculus.

The system LambdaJmse is the intuitioinistic fragment of the call-by-name version of Curien and Herbelin's classical system. LambdaJmse is equipped with two kinds of rules: a beta-like rule, that eliminates principal cuts, and permutative conversions, that help in generating principal cuts, execute a substitution, or eliminate certain trivial detours.

In order to infer strong normalisation for LambdaJmse and its subsystems, via an embedding, it is important that reduction steps are preserved. However, usual CPS translations fail in preserving permutative conversions, the best we get is their collapsing. We overcome this problem by using an idea introduced by Ikeda and Nakazawa, in the context of Parigot's lambda-mu-calculus, which consists of adding to CPS a "garbage" argument, to provide room for observing enough reductions in the target calculus. It turns out that, for the intuitionistic systems we consider, "units" of garbage suffice, as opposed to Ikeda and Nakazawa's translation where garbage consists of an extra copy of a continuation.

This is joint work with Ralph Matthes (CNRS and University of Toulouse III, France).