Internship proposal:
Factorizing probabilistic intersection types

Advisers. Flavien Breuvart and Damiano Mazza

Keywords. intersection types, category theory, probabilistic lambda-calculus, linear logic, functional programming

Potential collaborations. Luc Pellissier

Prerequisite. A strong taste for category theory and/or denotational semantics is required. Additional notion of Linear Logic, advanced type systems, functional programming and/or measure theory are also welcomed.

Localisation. LIPN, University Paris 13

Mazza, Pellissier and Vial [2] showed, two years ago, that most intersection types systems in the literature could be factorized into the choice of an encoding of the calculus into linear logic proof net and the choice of a polyadic interpretation of those proof-net (a decomposition similar to Taylor expansion). This factorization arises in the highly abstract categorical framework of Cat-operads (Cat-enriched colored operads) in which they apply Grothendieck construction to transport the two into composable morphisms. The strength of this construction is that it assures the soundness and completeness of the intersection type system for the considered calculus.

The same year, Breuvart and Dal Lago [1] wrote an intersection type system that is sound and complete for the probabilistic λ-calculus. In spite of the strong logical intuitions behind this system, no denotational semantics could be found. In addition, the probabilistic behaviour cannot be encoded correctly in the linear logic, leading to the failure of Mazza et al.'s factorization.

In this internship, we intend to revisit Mazza, Pellissier and Vial's result and generalize it to extensions of the linear logic in order to factorize Breuvart and Dal Lago's type system.

References

[1] Flavien Breuvart and Ugo Dal Lago. Intersection Type Systems for Probabilistic λ-Calculi. In *PPDP*, 2018.

[2] Damiano Mazza, Luc Pellissier, and Pierre Vial. Polyadic Approximations, Fibrations and Intersection Types. In *POPL*, 2018.