TITLE: Type-based quantitative model-checking for higher order programming languages

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DESCRIPTION:
Higher order functional languages, like Ocaml or Haskell, provide powerful abstraction mechanisms helpful to structure programs in a modular way. However, these same abstraction mechanisms make the analysis and the verification of functional programs more difficult.

A promising recent approach to functional programs verification is the use of type-based model checking algorithms [1,2,3]. These algorithms permit to efficiently verify the correctness of functional programs with many respects. The type-based algorithm proposed in [2] is based on the use of intersection types. This approach is particularly attractive since it establish some strong connections with methods studied in the semantics of functional programming.

This algorithm can be used to verify several properties of functional programs. However, one aspect in which this algorithm is still limited is the verification of quantitative properties like for instance counting. Quantitative properties requires the use of more refined model checking techniques like the ones studied in [4].

The goal of this internship is to study variants of the algorithm in [2] that are useful for the verification of quantitative properties. The starting point will be to consider a variant using non-idempotent intersection type systems. A further step will be to study variants of the algorithm in [2] based on uniform description of non-idempotent intersection types similar to the one that can be found in bounded type systems for complexity analysis [5].

REFERENCES:

PREREQUISITS:
Basic understanding of verification and programming language semantics.

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