1st Swiss-Italian Workshop on Proof and Computation

Verona, 18-19 January 2018
University of Verona, Ca' Vignal 3 - Piramide, Sala Verde

Programme

18 January 2018

10.00 - 10.50 Gerhard Jäger, *Theories around Γ_0 – again*

10.50 - 11.20 Coffee

11.20 - 12.10 Michael Bärtschi, *Uniform fixpoint variants in second order arithmetic*

12.10 - 13.00 Takako Nemoto, *Baire category theorem and nowhere differentiable continuous functions*

13.00 - 15.00 Lunch

15.00 - 15.50 Silvia Steila, *SCT through the reverse mathematical looking glasses*

15.50 - 16.40 Samuele Maschio, *Consistency of the intensional level of the Minimalist Foundation with Church's Thesis and Axiom of Choice*

16.40 - 17.10 Coffee

17.10 - 18.00 Beatrice Donati, *Detecting Domain-Specific Ambiguities: An NLP Approach Based on Wikipedia Crawling and Word Embeddings*

19 January 2018

10.00 - 10.50 Hajime Ishihara, *Coequalisers in the category of basic pairs*

10.50 - 11.20 Coffee

11.20 - 12.10 Riccardo Bruni, *Computations Over Revision Graphs*

12.10 - 13.00 Franziskus Wiesnet, *Limit Values in the Signed Digit Representation*

Abstracts

Beatrice Donati

Ambiguity is at the same time a strength and a weakness when it comes to natural language processing. How can we keep intact the expressive power of our language and, at the same time, prevent misunderstandings related to ambiguous terms? We want to present a novel approach based on wikipedia crawling and word-embeddings designed to identify domain-specific ambiguities. This method (and the related software) is aimed primarily at those who deal with sensitive contexts, such as software requirements specifications, legal notes, medical documents. We implemented a first version of our tool and our preliminary experiments show promising results.

Hajime Ishihara

Ishihara and Kawai constructed coequalisers in the category BP of basic pairs in an extension of the constructive Zermelo-Fraenkel set theory (CZF), founded by Aczel, using the notion of a set-generated class and its characterisation by a generalised geometric theory introduced in Aczel et al. In this talk, we propose a kind of the non-deterministic inductive definition principle (NID) introduced by van den Berg, and show that it is in between NID for elementary rules and that for nullary rules introduced by Ishihara and Nemoto, and that it is equivalent to the existence of coequalisers in BP over a subsystem of CZF.

Samuele Maschio Joint work with Hajime Ishihara, Maria Emilia Maietti and Thomas Streicher.

Consistency with the formal Church thesis (CT) and the axiom of choice (AC) was one of the requirements asked to the intensional level of a two-level foundation for constructive mathematics as proposed by M.E. Maietti and G. Sambin in 2005. Here we show that this is the case for the intensional level of the two-level Minimalist Foundation (MF) completed in 2009 by M.E. Maietti. The intensional level of MF consists of an intensional type theory à la Martin-Löf, called mTT. The consistency of mTT with CT and AC is obtained by showing the consistency with the formal Church thesis of a fragment of intensional Martin-Löf's type theory, called MLtt_1, where mTT can be easily interpreted. Then, in order to show the consistency of MLtt_1 with CT, we interpret it within Feferman's predicative theory of non-iterative fixpoints $\widehat{ID_1}$ by extending the well known Kleene's realizability semantics of intuitionistic arithmetics.

Takako Nemoto

In constructive mathematics, Baire Category Theorem has at least following two forms:

A. Let $\{U_n\}$ be a sequence of dense open sets in a complete metric space X. Then the intersection $U = \bigcap_{n \in N} U_n$ is also dense in X.

B. Let $\{V_n\}$ be a sequence of nowhere dense closed sets in a complete metric space X. Then the union $V = \bigcup_{n \in N} V_n$ is also nowhere dense in X.

In [1], a constructive proof of A is given. In this talk, we will show that there exist nowhere differentiable continuous functions densely in $C[0, 1]$, using the above A.

[1] E. Bishop, Foundations of Constructive Analysis, Academic Press (1967).

Silvia Steila Joint work with Emanuele Frittaion, Florian Pelupessy and Keita Yokoyama.

In 2001 Lee, Jones and Ben-Amram introduced the notion of size-change termination (we call MSCT) for first order functional programs, a sufficient condition for termination. They proved the SCT criterion: a program is size-change terminating (i.e. MSCT) if and only if it satisfies a certain property (we call ISCT) which can be statically verified from the recursive definition of the program.

From Lee, Jones and Ben-Amram's paper we can outline the following three-steps argument to prove the termination of a first order functional program P: 1. Verify that P is ISCT; 2. Apply the SCT criterion to prove that P is MSCT; 3. Derive the termination of P from the fact that "every MSCT program terminates"

Since the Ackermann function is ISCT provably in RCA_0, a natural question arises: in which theory can we carry out the above argument? Specifically, in which theory can we prove the SCT criterion? Similarly, in which theory can we prove that every MSCT program terminates? In this talk we focus on the reverse mathematical analysis of such statements.