Vittorio Cipriani - Curriculum Vitae

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Personal Information

Born: February 3, 1995 - Macerata (MC), Italy
Nationality: Italian

Current Position

Doctoral Student at Dipartimento di Scienze Matematiche, Informatiche e Fisiche, Università di Udine, Italy
Thesis title:"Many problems, different frameworks: classification of problems from computable analysis to algorithmic learning theory" (under review)
Supervisor: Alberto Marcone
Co- Supervisor: Luca San Mauro
Thesis status: under review
Expected graduation date: May 2023

Education

- **2019** - MSc in Computer Science, Università di Camerino, Italy (last year at TU Wien, Vienna, Austria)
  Thesis title: "Algorithmic Learning of Computable Structures"
  Supervisor(s): Ekaterina Fokina, Luca San Mauro, Carlo Toffalori
  Grade: 110 with honour out of 110
- **2017** - BSc in Computer Science, Università di Camerino, Italy
  Thesis title: "Towards a Workbench for Topological Data Analysis"
  Supervisor(s): Emanuela Merelli
  Grade: 110 with honour out of 110

Research Interests

Keywords: Computable analysis, Weihrauch reducibility, computability theory, algorithmic learning theory, computable structure theory.

My research so far focused on Weihrauch reducibilty and algorithmic learning of algebraic structures. Some of the results obtained in Weihrauch reducibility can be placed in the research area that tries to connect reverse mathematics and computable analysis. In particular, I have worked on the classification of

problems related to the Cantor-Bendixson theorem (that in reverse mathematics is equivalent to $\mathbf{\Pi}^1_1$-CA$_0$) w.r.t. to well-known problems in the Weihrauch lattice. In the same research area, I have also studied the classification of problems related to the (induced) subgraph problem for countably infinite graphs in the Weihrauch lattice obtaining new results.

For what concerns algorithmic learning of algebraic structures, I have worked on the new concept of E-learnability that, using tools coming from descriptive set theory, helps in calibrating the learning complexity of nonlearnable families of structures. This provided a nice connection between apparently distant research areas like algorithmic learning theory and descriptive set theory. I have worked also on the learning criterion in which we bound the number of possible mind-changes, providing different characterizations of this based on topological and structural properties of the target family of structures to be learned.

Complete list of publications

[1] Calculating the Mind Change Complexity of Learning Algebraic Structures (with Nikolay Bazhenov and Luca San Mauro). In: Berger, U., Franklin, J.N.Y., Manea, F., Pauly, A. (eds) Revolutions and Revelations in Computability. CiE 2022. Lecture Notes in Computer Science, vol 13359. Springer, Cham. https://doi.org/10.1007/978-3-031-08740-0_1;

[2] Learning algebraic structures with the help of Borel equivalence relations (with Nikolay Bazhenov and Luca San Mauro). In Theoretical Computer Science, 951:113762, 2023.
Available at https://arxiv.org/abs/2110.14512;

[3] The Weihrauch lattice at the level of $\mathbf{\Pi}^1_1-$CA$_0$: the Cantor-Bendixson theorem (with Alberto Marcone and Manlio Valenti), submitted to *Journal of symbolic logic*.
Available at https://arxiv.org/abs/2210.15556;

[4] The uniform computational content of the (induced) subgraph problem (with Arno Pauly), submitted.

[5] The complexity of finding supergraphs (with Arno Pauly), accepted for publication in CiE 2023 proceedings.

Talks

- **2020**
  - **July** - Contributed talk at *Computability in Europe* on some preliminary results of [1];
  - **September** - Contributed talk at *Computability and complexity in analysis* on some preliminary results of [3];
  - **September** - Contributed talk at *Continuity, Computability, Constructivity* on some preliminary results of [3];
- **2021**
  - **July** - Contributed talk at *Computability in Europe* on the results of [2];
  - **July**- Contributed talk at *Logic Colloquium* on the results of [3];

  - **July** - Contributed talk at *Computability and complexity in analysis* on the results of [2];
  - **September** - Contributed talk at *Continuity, Computability, Constructivity* on some preliminary results of [4];
  - **November** - "Cantor-Bendixson theorem in the Weihrauch lattice", *Midwest Computability Seminars*, Invited seminar talk;
- **2022**
  - **July** - Contributed talk at *Computability, Complexity and Randomness* on the results of [3];

Other research activities

- **Fall 2022** - Visiting Ph.D. Student at the University of Swansea, under the supervision of Arno Pauly.
- **2021** - Member of the organizing committee of the conference "Equivalences, Numberings, Reducibilities", a satellite event of the 8th european congress of mathematics, website: *https://equinumred-8ecm.uniud.it/*;
- **2016-2018** - Collaborator at the Bioshape & Data Science Lab of University of Camerino under the supervision of Emanuela Merelli. Partecipated at the software development of a Java library for efficient matrix multiplication and a visualization tool for RNA molecules.

Teaching Experience

- **2021-2022** - Teaching assistant for the course of Linear Algebra, Bachelor degree in Internet of Things, Big Data, Machine Learning, Uniud held by D'Agostino.
- **2023** - staff member of the logic lab for high schools organized by "Associazione italiana di logica e sue applicazioni" at the University of Udine in occasion of the UNESCO World Logic Day.

Awards and Grants

- **July 2022** - Springer student travel grant for the conference Computability in Europe 2022;
- **June 2022** - ASL student travel grant for the conference Logic Colloquium 2022;
- **April 2018** - Merit Prize from the association "Pozzo di Miele" for students enrolled at the MSc in Computer Science of University of Camerino.

Memberships

- **2020-Current** - Member of American Mathematical Society (AMS);
- **2021-Current** - Member of the association Computability in Europe (CiE);

Languages

- Italian (mother tongue);
- English (fluent spoken and written);
- German (basic).