Vittorio Cipriani - Curriculum Vitae

Università di Udine, Italy
Dipartimento di Scienze Matematiche, Informatiche e Fisiche
phone: (+39)3930018102
e-mail: vittorio.cipriani17@gmail.com

Personal Information

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

Current Position

Research fellow at the Institute of Discrete Mathematics and Geometry of Vienna University of Technology (TU Wien) where I am the project assistant of the project "Classifying structures via Learning" led by Prof. Ekaterina Fokina.

Education

- **May, 2023** - PhD in Computer Science, Mathematics and Physics, Università di Udine, Italy
  Thesis title:"Many problems, different frameworks: classification of problems from computable analysis to algorithmic learning theory"
  Supervisor: Alberto Marcone
  Co- Supervisor: Luca San Mauro

- **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 $\mathbf{\Pi}^1_1\text{-CA}_0$) 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 classically studied learning criteria, placing them in the novel hierarchy of learning provided by the notion of *learn reducibility*.

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 $\mathbf{\Pi}^1_1-\text{CA}_0$: 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), In: Della Vedova, G., Dundua, B., Lempp, S., Manea, F. (eds) Unity of Logic and Computation. CiE 2023. Lecture Notes in Computer Science, vol 13967. Springer, Cham. https://doi.org/10.1007/978-3-031-36978-0_15.

[6] Classical learning paradigms and algebraic structures (with Nikolay Bazhenov, Sanjay Jain, Luca San Mauro and Frank Stephan) *in preparation*;

[7] On the learning power of Friedman-Stanley jumps (with Alberto Marcone and Luca San Mauro) *in preparation*.

Talks

- **2024**
    - **July** - <u>Invited talk</u> at *UMI-AMS international joint meeting (Palermo)* on the results of [6,7];

- **July** - <u>Invited talk</u> at *Computability and Complexity in analysis* on the results of a joint work with David Belanger, Jun Le Goh, Sanjay Jain, Martin Richter, and Frank Stephan;
- **July** - Contributed talk at *Logic Colloquium* on the results of [6,7];
- **June** - Contributed talk at *Computability in Europe* on the results of [6,7];
- **June** - Talk at *Computational Logic seminar (TU Wien)* on the results of a joint work with David Belanger, Jun Le Goh and Frank Stephan;
- **May** - Talk at *NUS Logic seminar* on the results of [6,7];
- **March** - <u>Invited talk</u> at *UW Logic seminar* on the results of [6,7];

- **2023**

  - **December** - Talk at *Conference on Techniques from Logic in Mathematics* on the results of [3,5];
  - **September** - Talk at *Computational Logic seminar (TU Wien)* on the results of [6];
  - **July** - Contributed talk at *Computability in Europe* on the results of [5];
  - **July** - Contributed talk at *Computability, Complexity and Randomness* on the results of [4, 5];

- **2022**

  - **September** - Contributed talk at *XXVII incontro di logical (AILA)* on the results of [2];
  - **July** - Contributed talk at *Computability in Europe* on the results of [1];
  - **June**-**July** - Contributed talk at *Logic Colloquium* on the results of [2];
  - **May** - Contributed talk at *Computability and Compexity in Analysis* on the results of [4];

- **2021**

  - **November** - "Cantor-Bendixson theorem in the Weihrauch lattice", *Midwest Computability Seminars*, <u>Invited (online) talk</u>;
  - **September** - Contributed talk at *Continuity, Computability, Constructivity* on some preliminary results of [4];
  - **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];

- **2020**

  - **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];
  - **July** - Contributed talk at *Computability in Europe* on some preliminary results of [1];

Other research activities

- **May 2024** - Visiting Researcher at the National University of Singapore, under the supervision of Jun Le Goh.

- **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

- **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.

- **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.

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 the University of Camerino.

Memberships

- **2022**-**Current** - Member of Associazione Italiana di Logica e sue Applicazioni (AILA);

- **2021**-**Current** - Member of the association Computability in Europe (CiE);

- **2020**-**Current** - Member of American Mathematical Society (AMS);

Languages

- Italian (mother tongue);

- English (fluent spoken and written);

- German (basic).