

# RICCARDO ROMANELLO

## PERSONAL INFORMATION

*Born in Treviso, 29 December 1996*

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## WORK EXPERIENCE

*Blue Reply SPA*

2018–2021              Software developer, BLUE REPLY SPA

Developed Java application for ensurance companies. Moreover, I worked as an internal project for the company, on a solution for Max-Cut problem using QAOA (In Python)

## EDUCATION

*PhD Student in  
Computer Science  
and Artificial  
Intelligence*

2021–Present           University of Udine

Research focus: mostly computational aspects of *Quantum Finite Automata*, focusing on developing the new formalism introduced in my master thesis. Moreover, a pretty big amount of time will be spent on *Quantum Machine Learning*, *Quantum Complexity Theory* and *Quantum Random Walks*.  
Advisor: Prof. Carla PIAZZA

*Master degree in  
Computer Science*

2018–2021              University of Udine

Degree cum laude  
Thesis: *Quantum Finite Automata*  
Description: This thesis explored the theoretical foundations of Quantum Automata, giving a full perspective of the state of the art in this subject. Moreover, an original work has been added, in which I formalized a new model of Quantum Automata called Quantum Heisenberg-Inspired Finite Automata  
Advisors: Prof. Carla PIAZZA

*Bachelor degree in  
Computer Science*

2015–2018              University of Udine

Degree cum laude · Awarded as best Computer Science student in 2019 edition of *Dies Academicus* from University of Udine  
Thesis: *Models for Quantum Computing*  
Description: This thesis focused in giving an introduction about Quantum Turing Machines;  
Advisors: Prof. Carla PIAZZA

## WORKS ACCEPTED IN CONFERENCES

*Italian Conference  
on Computation  
Logic*

July 2022                Heisenberg in Quantum Automata

In July 2022 I had my work about Quantum Finite Automata accepted at CILC2022. In particular, the proposal focused into proposing a series of new automata formalism in order to increase current state of the art Quantum Finite Automata (QFA) expressiveness. A first formalism was developed introducing the idea of Heisenberg picture (taken from Quantum Mechanics) into QFAs. We were able to prove the equivalence between this new model and QFAs. Since the expressive power of such class of automata remains limited to infinite languages, we then consider their extension with bounded (multi-letter QFAs) and unbounded memory.  
Authors: Carla PIAZZA, Riccardo ROMANELLO

## July 2022 Directed Graph Encoding in Quantum Computing supporting Edge-Failures

Reversible  
Computation

In July 2022 I presented my work about graphs encoding at RC22. The proposal focused into devising an encoding techniques for directed graphs. Given a graph as input, such procedure produces an unitary matrix that can be used in quantum circuits to perform Quantum Random Walks on the input graph. The novelty of our proposal is that if one or more edge-failures occur in the input graph, only a constant amount of time is needed in order to update the unitary matrix and adapt it to the new scenario.

Authors: Davide DELLA GIUSTINA, Carla PIAZZA, Brian RICCARDI, Riccardo ROMANELLO

## September 2022 Incremental NFA Minimization

Italian Conference  
on Theoretical  
Computer Science

Finite state automata are fundamental objects in Theoretical Computer Science and find their application in Text Processing, Compilers Design, Artificial Intelligence and many other areas. The problem of minimizing such objects can be traced back to the '50s and since then it has been the arena for developing new algorithmic ideas. In this work we correct a small mistake in the algorithm given by Almeida *et al.* in 2014 and we propose a simple, DFS-like and truly quadratic incremental algorithm for minimizing deterministic automata. Furthermore, we adapt the idea to the nondeterministic case obtaining an incremental algorithm which computes the maximum bisimulation relation in time  $\mathcal{O}(n^2 r |\Sigma|)$ , where  $n$  is the number of states,  $\Sigma$  is the alphabet and  $r$  is the degree of nondeterminism, improving by a factor of  $r$  the running time of the fastest known aggregation based algorithm for this problem.

Authors: Christian BIANCHINI, Alberto POLICRITI, Brian RICCARDI, Riccardo ROMANELLO

### LEADING POSITIONS

EQAI

2022 · I am one of the organizers of the [European Summer School on Quantum AI](#), hosted in Udine in September 2022.

Quantum  
Computing Lab,  
Udine

2023 · Together with some Professors from University of Udine, we aim at opening a Quantum Computing Laboratory in University of Udine. Its focus will be of spreading the knowledge about quantum computing to new brilliant students, and of course producing research papers.

### COMPUTER SKILLS

Basic

Bash, Javascript, Node JS, HTML, Quipper

Intermediate

Python, Qiskit,  $\LaTeX$ , Linux, Haskell, PHP, SQL

Advanced

Java, C++

### OTHER INFORMATION

Competitions

2021 · ICPC, member of one of the two teams enrolled by University of Udine

Badges

2020 · IBM Quantum Challenge, Advance badge. [Credentials](#)

Languages

ITALIAN · Mothertongue

ENGLISH · Advanced.

September 5, 2022