

Giancarlo Croce

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Research Interests

My research activity lies at the intersection of biology, machine learning, and statistical modeling. I develop data-driven algorithms to model T cells interactions with cancer cells, with the aim of expediting personalized cancer immunotherapies. Previously, I used statistical physics-inspired methods to model protein structures, evolution and interactions from their amino acid sequences.

Positions

JAN 2020 - CURRENT
LAUSANNE
(SWITZERLAND)

Postdoctoral Researcher

Marie Skłodowska-Curie Individual Fellow [MT-PoINT project](#)

University of Lausanne - Ludwig center for cancer research
Computational Cancer Biology Lab - [David Gfeller Lab](#)

OCT 2016 - OCT 2019,
PARIS (FRANCE)

Ph.D. Fellow

Sorbonne University, Computational and Quantitative Biology Lab ([LCQB](#))

Thesis: [Towards a genome-scale coevolutionary analysis](#)

Supervisor: Martin Weigt. Co-supervisor: Olivier Tenailon

Education

SEP 2014 - JUN 2016,
PARIS (FRANCE)

MSc in theoretical and statistical physics

École Normale Supérieure, Paris,

- M2 thesis: *Out of equilibrium dynamics of spin glass models*

Supervisor: Cristina Toninelli

- M1 thesis: *Adaptive Cluster expansion for Ising model*

Supervisors: Simona Cocco, Francesco Zamponi

SEP 2011 - JUL 2014,
PAVIA (ITALY)

BSc in physics

Thesis: Symmetries in quantum mechanics, Casimir Operators

Supervisor: Prof. Claudio Dappiaggi

Publications

Croce, G., Bobisse, S., Moreno, D. L., Schmidt, J., Guillaume, P., Harari, A., & Gfeller, D. (2023). Deep learning predictions of TCR-epitope interactions reveal epitope-specific chains in dual alpha T cells. *Nature Communications* 15.1 (2024): 3211.

Racle, J., Guillaume, P., Schmidt, J., Michaux, J., Larabi, A., Lau, K., ... & Gfeller, D. (2023). Machine learning predictions of MHC-II specificities reveal alternative binding mode of class II epitopes. *Immunity*, 56(6), 1359-1375.

Gfeller, D., Schmidt, J., **Croce, G.**, Guillaume, P., Bobisse, S., Genolet, R., ... & Harari, A. (2023). Improved predictions of antigen presentation and TCR recognition with MixMHCpred2. 2 and PRIME2. 0 reveal potent SARS-CoV-2 CD8+ T-cell epitopes. *Cell Systems*, 14(1), 72-83.

Camviel, N., Wolf, B., **Croce, G.**, Gfeller, D., Zoete, V., & Arber, C. (2022). Both APRIL and antibody-fragment-based CAR T cells for myeloma induce BCMA downmodulation by trogocytosis and internalization. *Journal for Immunotherapy of Cancer*, 10(11).

Vigué, L.*, **Croce, G.***, Petitjean, M., Ruppé, E., Tenaillon, O., & Weigt, M. (2022). Deciphering polymorphism in 61,157 *Escherichia coli* genomes via epistatic sequence landscapes. *Nature Communications*, 13(1), 4030.

Rodriguez-Rivas, J.*, **Croce, G.***, Muscat, M., & Weigt, M. (2022). Epistatic models predict mutable sites in SARS-CoV-2 proteins and epitopes. *Proceedings of the National Academy of Sciences*, 119(4), e2113118119.

Muscat, M., **Croce, G.**, Sarti, E., & Weigt, M. (2020). FilterDCA: interpretable supervised contact prediction using inter-domain coevolution. *PLoS computational biology*, 16(10), e1007621.

Croce, G., Gueudré, T., Ruiz Cuevas, M. V., Keidel, V., Figliuzzi, M., Szurmant, H., & Weigt, M. (2019). A multi-scale coevolutionary approach to predict interactions between protein domains. *PLoS computational biology*, 15(10), e1006891.

Cocco, S.*, **Croce, G.***, & Zamponi, F.* (2019). Adaptive cluster expansion for Ising spin models. *The European Physical Journal B*, 92, 1-17.

Grants and awards

Jul 2021 - Jul 2023 Marie Skłodowska-Curie Individual Fellowship 2020 for the [MT-PoINT](#) (Motif in T cells for the Prediction of INTERactions) project at the interface between data science and immunology

Apr 2020 - Jun 2021 Sorbonne University - SU-COVID19-FSI project: Data-driven models of SARS-CoV-2 sequences: Mutational effects, selective constraints, and potential drug targets

Jan 2019 - Mar 2019 Visiting researcher at University of L'Havana (Cuba) funded by the [INFERNET](#) project: new algorithms for inference and optimization from large-scale biological data

Oct 2016 - Nov 2019 Ph.D. grant funded by *Labex Calsimlab - Data, computing and simulation*. Calsimlab is a cluster of excellence for research (PIA2 laboratoires d'excellence)

Sep 2014 - Jun 2016 Two-years master scholarship funded by ICFP-ENS Labex. The ICFP-ENS master is specifically intended for international students wishing to obtain a first-class education in physics

Sep 2011 - Sep 2014 Student at Collegio Ghislieri - a 450-year-old Italian institution - that is committed to providing housing and financial support to students enrolled at the University of Pavia.

Recent talks

Set 2023 - Basel (Switzerland)

Basel Computational Biology Conference - Big data in biology promises and challenges

April 2023 - Antwerp (Belgium)

The Third Antwerp TCR meeting - international experts discuss T cells from the TCR perspective.

April 2023 - Lausanne (Switzerland)

Biological Evolution Across Scales: Mathematical modeling and statistical inference

Aug 2022 - Cargese (France)

Physics and Computation in Immunology

Jun 2022 - Paris (France)

QBIO-IARANA Innate and Adaptive Recognition of Antigens and Neoantigens

Students

Jan 2020 - Sep 2020 Richie Yat-Tasi Wan - M2 Master Project. Now PhD student at the Technical University of Denmark

Jan 2022 - Jan 2023 Daniel Hafez - M2 Master Project.

Jun 2023 - Sep 2023 Animesh Awasth - Undergraduate student (The School of Biology Summer Undergraduate Research Programme). Now PhD student at the Medical University of Vienna

Teaching

Sep-Nov 2023 - introduction to clinical bioinformatics

Sep-Nov 2022 - introduction to clinical bioinformatics

Dec 2021 - Introduction to Cancer Genomics - PhD class

Reviewing activities

Reviewer for Bioinformatics, Immunoinformatics, Plos ONE, Cell Genomics

Languages

- **Italian:** Native speaker
- **English:** Fluent
- **French:** Fluent