

# Rubén Ballester

Topological Machine Learning PhD student

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Topological Machine Learning PhD student at *Universitat de Barcelona*. Rubén's main field of interest is theoretical computer science, focusing on (but not limited to) theoretical deep neural networks and algebraic topology. Other fields of interest are geometry, pure and applied logic theory, cognitive theory, statistics, data science and quantum computing.

## EDUCATION

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<b>Universitat de Barcelona</b> <i>PhD in Mathematics and Computer Science*</i>	Barcelona, Spain <i>Oct. 2022 – Present</i>
<b>Universitat Politècnica de Catalunya</b> <i>Master's Degree in Advanced Mathematics and Mathematical Engineering*</i>	Barcelona, Spain <i>Sept. 2021 – Sept. 2022</i>
<b>Universitat de Barcelona</b> <i>Bachelor's Degree in Computer Science, Minor in Mathematics*</i>	Barcelona, Spain <i>Sept. 2015 – Feb. 2021</i>
<b>Universitat de Barcelona</b> <i>Bachelor's Degree in Mathematics, Minor in Computer Science*</i>	Barcelona, Spain <i>Sept. 2015 – Feb. 2021</i>

\* Both majors were coursed simultaneously as a joint degree.

## EXPERIENCE

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<b>Predoctoral fellow funded by an FPU contract</b> <i>University of Barcelona - Ministerio de Universidades</i> <ul style="list-style-type: none"><li>Topological Machine Learning@UB group.</li></ul>	Jan. 2023 – Present <i>Barcelona, Spain</i>
<b>Associate professor</b> <i>University of Barcelona</i> <ul style="list-style-type: none"><li>Algorithmics I - Fall semester 2022/23 (first-year Computer Engineering course).</li><li>Advanced Algorithms - Fall semester 2022/23 (second-year Computer Engineering course).</li><li>Distributed Artificial Intelligence - Fall semester 2022/23 (fourth-year Computer Engineering course).</li><li>Operating Systems I - Spring semester 2021/22 (second-year Computer Engineering course).</li><li>Algorithmics I - Fall semester 2021/22 (first-year Computer Engineering course).</li><li>Numerical Methods II - Spring semester 2020/21 (third-year Mathematics course).</li><li>Operating Systems I - Spring semester 2020/21 (second-year Computer Engineering course).</li><li>Introduction to Integral Calculus 2020/21 - Spring semester 2020/21 (first-year Mathematics course).</li></ul>	Mar. 2021 – Nov. 2022 <i>Barcelona, Spain</i>
<b>Graduate Research Assistant</b> <i>University of Barcelona</i> <ul style="list-style-type: none"><li>Topological data analysis and deep learning research projects.</li></ul>	November. 2021 – June 2022 <i>Barcelona, Spain</i>
<b>Deep Learning Research Assistant</b> <i>HuPBA, Computer Vision Center</i> <ul style="list-style-type: none"><li>Topological data analysis over the deep neural network graph for predicting generalization gap.</li></ul>	Mar. 2021 – Aug. 2021 <i>Barcelona, Spain</i>
<b>Deep Learning Research Intern</b> <i>Computer Vision Center</i> <ul style="list-style-type: none"><li>Topological data analysis over the deep neural network graph for predicting generalization gap.</li></ul>	Nov 2020 – Feb 2021 <i>Barcelona, Spain</i>
<b>Associate Software Engineer</b> <i>Oracle</i> <ul style="list-style-type: none"><li>Full-stack software engineer in the Netsuite product with a focus on allowing customers to extend Netsuite's functionalities using JavaScript.</li><li>The main technologies that are being used are Java, Kotlin and SQL for the backend development. JavaScript, Oracle JET and other internal frontend frameworks are being used for the frontend development. Other tools used in the project include (but are not limited to) GitLab and Perforce (version-control systems).</li></ul>	Dec 2019 – Nov 2020 <i>Barcelona, Spain</i>

- Use of Agile (Scrum) within teams.

**Classroom assistant in the *Data Structures* course**

Jan 2019 – June 2019

*Universitat de Barcelona*

*Barcelona, Spain*

- Teaching assistance in the *Data Structures* course during the spring 2018-2019 semester. Creation of learning resources related to data structures and C++.
- Management and implementation of a coding tournament during the problem-solving sessions of the course with the aim of teaching the students to face difficult engineering problems related to the course topic.

**Assistant teacher internship in the *Algorithms* course**

Sept. 2018 – Jan. 2019

*Universitat de Barcelona*

*Barcelona, Spain*

- Teaching assistance in the *Algorithms* course during the autumn 2018-2019 semester.
- Creation of learning resources related to the course topic.
- Tutoring of students on the content taught by the lecturer.

**Undergraduate research assistant**

July 2017 – Oct. 2017

*Computer Vision Center*

*Barcelona, Spain*

- Development of AI (deep learning) methods using Python/Caffe/bash to research pain detection in patients in video sequences recorded in different modalities (such as thermal images, or RGB).

RELEVANT COURSES

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**Algebraic Topology: Methods, Computation and Science (ATMCS10)**

University of Oxford

*Conference assistant*

*May 2022 – May 2022*

**Graduate school on Geometric Group Theory and Low Dimensional Topology**

ICMAT

*Rigidity of hyperbolic manifolds and Cube complexes*

*May 2022 – May 2022*

**XIV MESIO UPC-UB Summer School**

FME - Facultat de Matemàtiques i Estadística - UPC

*Unsupervised machine learning based on distances*

*Jul. 2021 – Jul. 2021*

**XIV MESIO UPC-UB Summer School**

FME - Facultat de Matemàtiques i Estadística - UPC

*Introduction to Functional Data Analysis with R*

*Jul. 2021 – Jul. 2021*

**Coursera, Stanford University**

Online

*Machine Learning by Andrew Ng*

*Jan. 2015 – Apr. 2017*

PUBLICATIONS

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Rubén Ballester, Xavier Arnal Clemente, Carles Casacuberta, Meysam Madadi, Ciprian A. Corneanu, Sergio Escalera - 2022. *Towards explaining the generalization gap in neural networks using topological data analysis* - Preprint arXiv.

Mohammad A. Haque, Ruben Bautista, Fatemeh Noroozi, Kaustubh Kulkarni, Kamal Nasrollahi, Sergio Escalera, Christian B. Laursen, Ramin Irani, Ole K. Andersen, Erika G. Spaich, Thomas B. Moeslund, Marco Bellantonio, Golamreza Anbarjafari - 2018. *Deep Multimodal Pain Recognition: A Database and Comparison of Spatio-Temporal Visual Modalities* - FG2018

AWARDS AND HONORS

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**Càtedra Mir-Puig award to the highest GPA of the master's degree.** - 2022: *Master's Degree in Advanced Mathematics and Mathematical Engineering.*

**Second place in the ACIA Prize to the best BSC or MSC thesis** - 2021: *With the bachelor's thesis: "Topological Descriptors in Deep Learning and Their Connection with Model Generalization" Awarded by ACIA: The catalan association for artificial intelligence.*

**Hackathon HackUPC 2017** - 2017: *Finalist of the event with an application based on BlockChain that allows voting with a high degree of security, reliability and transparency.*

**Torneig de Tardor de la UB 2016** - 2016: *Mathematical problems tournament. Achieved the third position.*

**Hackathon HackUPC 2017** - 2017: *Finalist of the event with an application based on BlockChain that allows voting with a high degree of security, reliability and transparency.*