Ricardo P. M. Cruz

PhD in Machine Learning and Computer Vision

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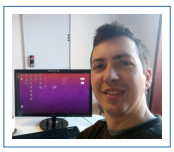

Ricardo P. M. Cruz is an Assistant Professor at the Faculty of Engineering of the University of Porto and a researcher at INESC TEC. His work focuses on machine learning, particularly deep learning, and computer vision. He received a B.Sc. degree in Computer Science (2012), an M.Sc. degree in Mathematical Engineering (2015), both from the University of Porto, and a Ph.D. degree in Computer Science (2021) jointly from the University of Porto, Aveiro and Minho. His topics cover transversal aspects of machine learning with applications to health and autonomous driving, detailed in over 20 publications with 100+ citations.

Skills

• PyTorch • TensorFlow • Python • R • Julia • MATLAB • Machine Learning • C/C++

Education

2021 **PhD in Computer Science**
Joint degree University of Porto, Minho and Aveiro

2015 **M.Sc. in Mathematical Engineering**
Faculty of Sciences, University of Porto

2012 **B.Sc. in Computer Science**
Faculty of Sciences, University of Porto

Work Experience

2024/02–(current) **Assistant Professor**, *University of Porto (FEUP)*

2023/07–2024/12 **Post-doctoral Researcher on Autonomous Driving**, *INESC TEC [in partnership with Bosch]*

2021/09–2023/06 **Post-doctoral Researcher on Autonomous Driving**, *University of Porto (FEUP) [in partnership with Bosch]*
Collaboration between the University of Porto and Bosch Car Multimedia to improve autonomous driving perception. I developed frameworks for object detection using camera and LiDAR (2D discretization and raw point-clouds), published new methods for efficient semantic segmentation and ordinal regression, supervised six master's theses, four bachelor's projects, and other team members, responsible for the HPC infrastructure (using Slurm).

2023/09–2024/02 **Invited Assistant Professor**, *University of Porto (FEUP)*
Courses on Machine Learning (theoretical lessons): - OAT4001, FACVC

2021/09–2022/08 **Invited Assistant Professor**, *University of Porto (FEUP)*
Courses: Programming Fundamentals (practical lessons in Python): - L.EIC003, Data Structures and Algorithms (practical lessons in C/C++): L.EEC009

2018/09–2021/08 **Invited Teacher Assistant**, *University of Porto (FEUP)*
Courses: Programming Fundamentals (practical lessons in Python): L.EIC003, Programming (practical lessons in C/C++): L.EIC009

2015/09–2021/08 **Research Assistant on Machine Learning and Computer Vision**, *INESC TEC*
Research focus: re-thinking fundamentals about image classification and semantic segmentation (8+ publications), in particular (1) a method for background invariance using adversarial training, (2) new losses that minimize absolute trade-offs between Type 1 and 2 errors instead of relative trade-offs, (3) using backpropagation also for inference to refine existing outputs, (4) deploying learning-to-rank methods for class imbalance. During the period, I contributed to workshops, the Summer School on Computer Vision (VISUM), and other events, and was twice awarded "outstanding recognition" for organizing workshops and helping with the HPC infrastructure.

2014/09–2014/12 **Research Grant on Mathematical Modelling Research**, *Mathematics Center of the University of Porto (CMUP)*
Epidemiological models for HIV: differential equations, stochastic simulations, cellular automata.

Publications

h-index

Google Scholar	Scopus	Web of Science
8	6	4

Sources for the following metrics: • Impact Factor (IF) as reported by the journal's webpage. • SJR rank quartiles are from Scimago and best quartile is chosen when multiple categories exist. • CORE rank is from ICORE for whatever last year is available for that conference. Last update: 2025-03-20

Journal Publications

[SUBMITTED] **R. Cruz**, "Spatial Early-Exit for Segmentation and Object Detection", *Elsevier Computer Vision and Image Understanding*, **IF=4.3, SJR=Q1**

2025 J. Cardoso, **R. Cruz**, T. Albuquerque, "Unimodal Distributions for Ordinal Regression", *IEEE Transactions on Artificial Intelligence*, **SJR=Q1**

2025 **R. Cruz**, R. Cristino, J. Cardoso, "Learning Ordinality in Semantic Segmentation", *IEEE Access*, **IF=3.4, SJR=Q1**

2025 J. Barbero-Gómez, **R. Cruz**, J. Cardoso, P. Gutiérrez, C. Hervás-Martínez, "CNN explanation methods for ordinal regression tasks", *Elsevier Neurocomputing*, **IF=5.5, SJR=Q1**

2024 A. Bezerra, I. Pereira, M. Rebelo, D. Coelho, D. Oliveira, J. Costa, **R. Cruz**, "A case study on phishing detection with a machine learning net", *Springer International Journal of Data Science and Analytics*, IF=3.4, SJR=Q2

2024 C. Pereira, **R. Cruz**, J. Fernandes, J. Pinto, J. Cardoso, "Weather and Meteorological Optical Range Classification for Autonomous Driving", *IEEE Transactions on Intelligent Vehicles*, **IF=14, SJR=Q1**

2023 **R. Cruz**, D. Silva, T. Gonçalves, D. Carneiro, J. Cardoso, "Two-Stage Framework for Faster Semantic Segmentation", *MDPI Sensors*, **IF=3.4, SJR=Q1**

2023 T. Albuquerque, L. Rosado, **R. Cruz**, M. Vasconcelos, T. Oliveira, J. Cardoso, "Rethinking low-cost microscopy workflow: Image enhancement using deep based Extended Depth of Field methods", *Elsevier Intelligent Systems with Applications*, **SJR=Q1**

2022 T. Albuquerque, **R. Cruz**, J. Cardoso, "Quasi-Unimodal Distributions for Ordinal Classification", *MDPI Mathematics*, IF=2.3, SJR=Q2

2021 T. Albuquerque, **R. Cruz**, J. Cardoso, "Ordinal losses for classification of cervical cancer risk", *PeerJ Computer Science*, **IF=3.8, SJR=Q1**

2019 R. Prates, **R. Cruz**, A. Marotta, R. Ramos, E. Simas Filho, J. Cardoso, "Insulator visual non-conformity detection in overhead power distribution lines using deep learning", *Elsevier Computers & Electrical Engineering*, **IF=4.0, SJR=Q1**

2018 **R. Cruz**, K. Fernandes, J. Costa, M. Ortiz, J. Cardoso, "Binary ranking for ordinal class imbalance", *Springer Pattern Analysis and Applications*, IF=3.7, SJR=Q2

2017 **R. Cruz**, K. Fernandes, J. Pinto Costa, J. Cardoso, "Constraining Type II Error: Building Intentionally Biased Classifiers", *Springer Pattern Analysis and Applications*, IF=3.7, SJR=Q2

International Conference Proceedings

2023 F. Campos, F. Cerqueira, **R. Cruz**, J. Cardoso, "YOLOMM – You Only Look Once for Multi-modal Multi-tasking", *Iberoamerican Congress on Pattern Recognition 2023 (CIARP)*, CORE=C

2023 D. e Silva, **R. Cruz**, "Condition Invariance for Autonomous Driving by Adversarial Learning", *Iberoamerican Congress on Pattern Recognition 2023 (CIARP)*, CORE=C

2023 **R. Cruz**, A. Shihavuddin, M. Maruf, J. Cardoso, "Active Supervision: Human in the Loop", *Iberoamerican Congress on Pattern Recognition 2023 (CIARP)*, CORE=C

2023 P. Serrano e Silva, **R. Cruz**, A. Shihavuddin, T. Gonçalves, "Interpretability-Guided Human Feedback During Neural Network Training", *Iberian Conference on Pattern Recognition and Image Analysis 2023 (IbPRIA)*, CORE=C

2023 J. Barbero-Gómez, **R. Cruz**, J. Cardoso, P. Gutiérrez, C. Hervás-Martínez, "Evaluating the Performance of Explanation Methods on Ordinal Regression CNN Models", *International Work-Conference on Artificial Neural Networks 2023 (IWANN)*

2023 D. Teixeira e Silva, **R. Cruz**, T. Gonçalves, D. Carneiro, "Two-stage semantic segmentation in neural networks", *Fifteenth International Conference on Machine Vision (ICMV 2022)*, CORE=C

2021 **R. Cruz**, R. Prates, E. Simas Filho, J. Pinto Costa, J. Cardoso, "Background Invariance by Adversarial Learning", *2020 25th International Conference on Pattern Recognition (ICPR)*, CORE=B

2019 **R. Cruz**, J. Pinto Costa, J. Cardoso, "Averse Deep Semantic Segmentation", *2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, CORE=C

2019 **R. Cruz**, J. Pinto Costa, J. Cardoso, "Automatic Augmentation by Hill Climbing", *International Conference on Artificial Neural Networks 2019 (ICANN)*, CORE=C

2018 K. Fernandes, **R. Cruz**, J. Cardoso, "Deep Image Segmentation by Quality Inference", *2018 International Joint Conference on Neural Networks (IJCNN)*, CORE=B

2018 **R. Cruz**, M. Silveira, J. Cardoso, "A Class Imbalance Ordinal Method for Alzheimer's Disease Classification", *2018 International Workshop on Pattern Recognition in Neuroimaging (PRNI)*

2017 M. Pérez-Ortiz, K. Fernandes, **R. Cruz**, J. Cardoso, J. Briceño, C. Hervás-Martínez, "Fine-to-Coarse Ranking in Ordinal and Imbalanced Domains: An Application to Liver Transplantation", *International Work-Conference on Artificial Neural Networks (IWANN)*

2017 **R. Cruz**, K. Fernandes, J. Pinto Costa, M. Pérez Ortiz, J. Cardoso, "Combining Ranking with Traditional Methods for Ordinal Class Imbalance", *International Work-Conference on Artificial Neural Networks (IWANN)*

2017 **R. Cruz**, K. Fernandes, J. Pinto Costa, M. Ortiz, J. Cardoso, "Ordinal Class Imbalance with Ranking", *Iberian Conference on Pattern Recognition and Image Analysis (IbPRIA)*, CORE=C

2016 **R. Cruz**, K. Fernandes, J. Cardoso, J. Pinto Costa, "Tackling class imbalance with ranking", *2016 International Joint Conference on Neural Networks (IJCNN)*, CORE=B

Supervisions

MSc Dissertations

active Rúben Lourinha Monteiro, "Intelligent 3D Interaction", *FEUP*

active Rúben Monteiro, "Intelligent 3D Interaction", *FEUP*

active João Ricardo Ramos Alves, "Self-supervised Occupancy Networks in Autonomous Driving", *FEUP* (internship @ Bosch Car Multimedia)

active Luís Paulo da Rocha Miranda, "Unsupervised Active Learning: Which Frames are Most Important in Autonomous Driving?", *FEUP* (internship @ Bosch Car Multimedia)

active Bruno Vieira Dias, "Trust or not to trust: When to trust the label prediction", *FEUP* (internship @ Bosch Car Multimedia)

active Alexandre Ferreira Nunes, "Semi-supervised Learning on 2D Projections for Autonomous Driving", *FEUP*

active Sofía Lucía, "Ordinal losses for range estimation in autonomous driving", *FEUP*

2024 Diana Teixeira Silva, "Quantifying How Deep 3D Representations Promote Label Efficiency", *FEUP*

2024 Francisco Gonçalves Cerqueira, "Exploring Label Efficiency with Semi-Supervision and Self-Supervision Methods", *FEUP*

2024 Airton Tiago, "Data Augmentation for Ordinal Data", *FEUP*

2023 Alankrita Asthana, "Iterative Inference for Point-Clouds", *TUM*

2023 Rafael Cristino, "Introducing Domain Knowledge to Scene Parsing in Autonomous Driving", *FEUP*

2023 José Guerra, "Uncertainty-Driven Out-of-Distribution Detection in 3D LiDAR Object Detection for Autonomous Driving", *FEUP* (internship @ Bosch Car Multimedia)

2022 Pedro Silva, "Human Feedback during Neural Networks Training", *FEUP*

2022 João Silva, "Environment Detection for Railway Applications based on Automotive Technology", *FEUP* (internship @ Continental)

2022 Ana Bezerra, "Phishing Detection with a Machine Learning Net (Internship at E-goi)", *FCUP*

BSc Projects

active Diogo Venade, "How Robust are Ordinal Regression Methods against Adversarial Attacks?", *FEUP*

active Bruno Ferreira, "Automatic Recognition of Pig Behavior", *FEUP*

active Isabel Sá, "Automatic Recognition of Pig Behavior", *FEUP*

2024 João Monteiro, "Cross-vehicle collaboration using RGB cameras", *FCUP*

2024 Diogo Mendes, "Automatic Recognition of Pig Activity in an Intensive Production System", *FCUP*

2024 Beatriz Sá, "Research on Deep Augmentation for Ordinal Regression", *FCUP*

2024 Eliandro Melo, "Resource Efficiency using Deep Q-Learning in Autonomous Driving", *FCUP*

2024 Ivo Duarte Simões, "Resource Efficiency using PPO in Autonomous Driving", *FCUP*

2023 Diana Teixeira Silva, "Condition Invariance for Autonomous Driving by Adversarial Learning", *FEUP*

2022 Diana Teixeira Silva, "Semantic Segmentation in Neural Networks using Iterative Visual Attention", *FEUP*

2022 Filipe Campos, Francisco Cerqueira, Vasco Alves, "Mobile App using Object Detection for Car Driving", *FEUP*

2022 Bruno Gomes, Rafael Camelo, “Internship at ANO”, *FEUP*

Internships

2024 July Isabel Gomes de Sá, “Making Sense of Ordinal Images Without Labels”, *INESC TEC*

PhD Advanced Projects

active André Almeida Catarino, “Data Marketplace for Driving Assistance Models”, *FEUP*

2023 Sept–2024 Feb Felipe Coelho, “Ensembles for Ordinal Classification”, *FEUP*