Ricardo Cruz, PhD

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Contents

Ricardo Cruz has worked on a wide range of machine learning topics, with particular emphasis on theoretical aspects of deep learning and computer vision – with 20+ publications and 100+ citations in such topics as: • adapting ranking models for class imbalance; • making convolutional neural networks invariant to background; • making them faster by adjusting the computational effort to each image; • losses for ordinal regression. He is a Post-doc Researcher on autonomous driving at the Faculty of Engineering, University of Porto, and he has been a researcher at INESC TEC since 2015, where his research earned him the computer science PhD in 2021. He has a BSc in computer science and a MSc in applied mathematics. He is frequently invited to teach at the Faculty of Engineering, University of Porto, where he earned a pedagogic award.

🎓 EDUCATION

2021 PhD   Computer Science (joint degree University of Porto, Minho and Aveiro)

2015 M.Sc.   Mathematical Engineering (Faculty of Sciences, University of Porto)

2012 B.Sc.   Computer Science (Faculty of Sciences, University of Porto)

💼 EMPLOYMENT

2021/09–present   **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
- 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 Auxiliary Professor**, University of Porto (FEUP)
Courses:
- OAT4001 🔗 & FACVC 🔗: Machine Learning

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

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

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)
- Some highlights: (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
- Contributed to workshops, Summer School on Computer Vision (VISUM), and other events
- 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. A little of everything: from differential equations to stochastic simulations to cellular automata.

👣 IMPACT AND CITATIONS

- Google Scholar h-index: **7** (2024-05-19)

- Crossref h-index: **5** with **112** total citations (2024-05-19)

- Best oral paper: 2021 RECPAD conference 🔗

Sources (last update: 2024-05-19): • Citation counts are from Crossref. • Impact Factor (IF) comes from each journal's webpage. • SJR rank quartiles are from Scimago and relate to the subject category closest to machine learning (not necessarily the best quartile). • CORE rank is from ICORE for whatever last year is available for that conference.

📰 JOURNAL PUBLICATIONS

Year	Paper	Citations	IF
2024	**[2ND ROUND]** Unimodal Distributions for Ordinal Regression J. Cardoso, **R. Cruz**, T. Albuquerque *IEEE Transactions on Artificial Intelligence, IEEE*		n/a
2024	**[2ND ROUND]** A Case Study on Phishing Detection with a Machine Learning Net A. Bezerra, I. Pereira, M. Ângelo, D. Coelho, D. Oliveira, J. Costa, **R. Cruz** *International Journal of Data Science and Analytics, Springer*		2.4
2024	**[SUBMITTED]** Learning Ordinality in Semantic Segmentation R. Cristino, **R. Cruz**, J.Cardoso *Pattern Recognition, Elsevier*		8

Year	Paper	Citations	IF
2024	Weather and Meteorological Optical Range Classification for Autonomous Driving 🔗 C. Pereira, **R. Cruz**, J. Fernandes, J. Pinto, J. Cardoso *IEEE Transactions on Intelligent Vehicles, Institute of Electrical and Electronics Engineers (IEEE)*	0	8.2
2023	Two-Stage Framework for Faster Semantic Segmentation 🔗 **R. Cruz**, D. Silva, T. Gonçalves, D. Carneiro, J. Cardoso *Sensors, MDPI AG*	1	3.9
2023	Rethinking low-cost microscopy workflow: Image enhancement using deep based Extended Depth of Field methods 🔗 T. Albuquerque, L. Rosado, **R. Cruz**, M. Vasconcelos, T. Oliveira, J. Cardoso *Intelligent Systems with Applications, Elsevier BV*	0	n/a
2022	Quasi-Unimodal Distributions for Ordinal Classification 🔗 T. Albuquerque, **R. Cruz**, J. Cardoso *Mathematics, MDPI AG*	2	2.4
2021	Ordinal losses for classification of cervical cancer risk 🔗 T. Albuquerque, **R. Cruz**, J. Cardoso *PeerJ Computer Science, PeerJ*	15	3.8
2019	Insulator visual non-conformity detection in overhead power distribution lines using deep learning 🔗 R. Prates, **R. Cruz**, A. Marotta, R. Ramos, E. Simas Filho, J. Cardoso *Computers & Electrical Engineering, Elsevier BV*	43	4.3
2018	Binary ranking for ordinal class imbalance 🔗 **R. Cruz**, K. Fernandes, J. Costa, M. Ortiz, J. Cardoso *Pattern Analysis and Applications, Springer Science and Business Media LLC*	2	3.9

Total 7 journal publications.

🗒 Conference Publications

Year	Paper	Citations	CORE Rank
2023	YOLOMM – You Only Look Once for Multi-modal Multi-tasking 🔗 F. Campos, F. Cerqueira, **R. Cruz**, J. Cardoso *Iberoamerican Congress on Pattern Recognition 2023 (CIARP), Springer Nature Switzerland*	0	C
2023	Condition Invariance for Autonomous Driving by Adversarial Learning 🔗 D. e Silva, **R. Cruz** *Iberoamerican Congress on Pattern Recognition 2023 (CIARP), Springer Nature Switzerland*	0	C
2023	Active Supervision: Human in the Loop 🔗 **R. Cruz**, A. Shihavuddin, M. Maruf, J. Cardoso *Iberoamerican Congress on Pattern Recognition 2023 (CIARP), Springer Nature Switzerland*	0	C
2023	Interpretability-Guided Human Feedback During Neural Network Training 🔗 P. Serrano e Silva, **R. Cruz**, A. Shihavuddin, T. Gonçalves *Iberian Conference on Pattern Recognition and Image Analysis 2023 (IbPRIA), Springer Nature Switzerland*	1	C

Year	Paper	Citations	CORE Rank
2023	Evaluating the Performance of Explanation Methods on Ordinal Regression CNN Models 🔗 J. Barbero-Gómez, **R. Cruz**, J. Cardoso, P. Gutiérrez, C. Hervás-Martínez *International Work-Conference on Artificial Neural Networks 2023 (IWANN), Springer Nature Switzerland*	0	National: Spain
2023	Two-stage semantic segmentation in neural networks 🔗 D. Teixeira e Silva, **R. Cruz**, T. Gonçalves, D. Carneiro *Fifteenth International Conference on Machine Vision (ICMV 2022), SPIE*	0	C
2021	Background Invariance by Adversarial Learning 🔗 **R. Cruz**, R. Prates, E. Simas Filho, J. Pinto Costa, J. Cardoso *2020 25th International Conference on Pattern Recognition (ICPR), IEEE*	1	B
2019	Averse Deep Semantic Segmentation 🔗 **R. Cruz**, J. Pinto Costa, J. Cardoso *2019 41st Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), IEEE*	1	C
2019	Automatic Augmentation by Hill Climbing 🔗 **R. Cruz**, J. Pinto Costa, J. Cardoso *International Conference on Artificial Neural Networks 2019 (ICANN), Springer International Publishing*	1	C
2018	Deep Image Segmentation by Quality Inference 🔗 K. Fernandes, **R. Cruz**, J. Cardoso *2018 International Joint Conference on Neural Networks (IJCNN), IEEE*	6	B
2018	A Class Imbalance Ordinal Method for Alzheimer's Disease Classification 🔗 **R. Cruz**, M. Silveira, J. Cardoso *2018 International Workshop on Pattern Recognition in Neuroimaging (PRNI), IEEE*	0	n/a
2017	Constraining Type II Error: Building Intentionally Biased Classifiers 🔗 **R. Cruz**, K. Fernandes, J. Pinto Costa, J. Cardoso *International Work-Conference on Artificial Neural Networks 2017 (IWANN), Springer International Publishing*	3	National: Spain
2017	Fine-to-Coarse Ranking in Ordinal and Imbalanced Domains: An Application to Liver Transplantation 🔗 M. Pérez-Ortiz, K. Fernandes, **R. Cruz**, J. Cardoso, J. Briceño, C. Hervás-Martínez *International Work-Conference on Artificial Neural Networks 2017 (IWANN), Springer International Publishing*	1	National: Spain
2017	Combining Ranking with Traditional Methods for Ordinal Class Imbalance 🔗 **R. Cruz**, K. Fernandes, J. Pinto Costa, M. Pérez Ortiz, J. Cardoso *International Work-Conference on Artificial Neural Networks 2017 (IWANN), Springer International Publishing*	7	National: Spain
2017	Ordinal Class Imbalance with Ranking 🔗 **R. Cruz**, K. Fernandes, J. Pinto Costa, M. Ortiz, J. Cardoso *Iberian Conference on Pattern Recognition and Image Analysis 2017 (IbPRIA), Springer International Publishing*	5	C
2016	Tackling class imbalance with ranking 🔗 **R. Cruz**, K. Fernandes, J. Cardoso, J. Pinto Costa *2016 International Joint Conference on Neural Networks (IJCNN), IEEE*	23	B

Total 16 conference publications. (Non-indexed conferences are omitted.)

MSc Supervisions

Year	Student	Dissertation	University
on-going	Diana Teixeira Silva	Quantifying How Deep 3D Representations Promote Label Efficiency	FEUP
on-going	Francisco Gonçalves Cerqueira	Comparative Study on Semi-Supervision and Self-Supervision Methods for Autonomous Driving	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 🔗 (Internship at Bosch Car Multimedia)	FEUP
2022	Pedro Silva	Human Feedback during Neural Networks Training 🔗	FEUP
2022	João Silva	Environment Detection for Railway Applications based on Automotive Technology 🔗 (Internship at Continental)	FEUP
2022	Ana Bezerra	Phishing Detection with a Machine Learning Net 🔗 (Internship at E-goi)	FCUP

BSc Supervisions

Year	Student	Project	University
on-going	João Monteiro	Cross-vehicle collaboration using RGB cameras	FCUP
on-going	Diogo Mendes	Automatic Recognition of Pig Activity in an Intensive Production System	FCUP
on-going	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

Jury Participation

2023/12 External Examiner @ U.Minho: MSc Dissertation "Prediction System for Municipal Waste Containers"

2023/07 Examiner @ INESC TEC: Evaluation of 6 summer interships (SCI 2023) on computer vision and machine learning

2022/10 External Examiner @ FEUP: MSc Dissertation "Neuroblastoma Cancer Radiogenomics"

2022/10	External Examiner @ FEUP: MSc Dissertation "AI-Based Models to Predict The Traumatic Brain Injury Outcome"
2022/07	Examiner @ INESC TEC: Evaluation of 2 summer interships (SCI 2022) on computer vision and machine learning
2022/07	Chairman @ FEUP: MSc Dissertation "Learning to write medical reports from EEG data"
2022/07	External Examiner @ U.Minho: MSc Dissertation "Detection and classification of small impacts on vehicles based on deep learning algorithms"
2021/12	External Examiner @ FCUP: MSc Dissertation "3D Lung Computed Tomography Synthesis using Generative Adversarial Networks"
2021/09	External Examiner @ U.Minho: MSc Dissertation "Feasibility of using autoencoders for learning car interior background models"
2021/07	Examiner @ INESC TEC: Evaluation of 4 summer interships (SCI 2021) on computer vision and machine learning

🎖 AWARDS

2022	Bosch for Mobility: 🔗 My students won Best New Participating Team in an autonomous driving competition
2021	INESC TEC Outstanding Recognition Award: 🔗 INESC TEC internal award, reason: maintenance of the HPC infrastructure
2021	Pedagogic award (voted by students): University of Porto (FEUP)
2021	Best paper and presentation: 🔗 RECPAD national conference
2018	INESC TEC Outstanding Recognition Award: 🔗 INESC TEC internal award, reason: help organizing workshops
2017	Kaggle Bronze Medal (competition) and Silver (engagement)