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

- Crossref h-index: **5** with **109** total citations (2024-02-29)
- Google Scholar h-index: **7** (2024-02)
- Best oral paper: 2021 RECPAD conference

The following citation counts come from Crossref (last update: 2024-02-29).

Journal Publications

Year	Paper	Citations	SJR Rank
2024	**[SUBMITTED]** Weather and Meteorological Optical Range Classification for Autonomous Driving C. Pereira, J. Fernandes, **R. Cruz**, J. Pinto, J. Cardoso *IEEE Transactions on Intelligent Vehicles*	0	Q1
2024	**[SUBMITTED]** 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** *Springer International Journal of Data Science and Analytics*	0	Q2
2024	**[SUBMITTED]** Spatial Resource-Efficiency using Partial Convolutions for Segmentation and Object Detection **R. Cruz** *Elsevier Pattern Recognition*	0	Q1
2024	**[SUBMITTED]** Learning Ordinality in Semantic Segmentation R. Cristino, **R. Cruz**, J.Cardoso *Elsevier Pattern Recognition*	0	Q1
2024	**[SUBMITTED]** Unimodal Distributions for Ordinal Regression J. Cardoso, **R. Cruz**, T. Albuquerque *IEEE Transactions on Artificial Intelligence*	0	Q1
2023	Two-Stage Framework for Faster Semantic Segmentation **R. Cruz**, D. Silva, T. Gonçalves, D. Carneiro, J. Cardoso *MDPI AG Sensors*	1	Q2
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 *Elsevier BV Intelligent Systems with Applications*	0	Q1
2022	Quasi-Unimodal Distributions for Ordinal Classification T. Albuquerque, **R. Cruz**, J. Cardoso *MDPI AG Mathematics*	2	Q2
2021	Ordinal losses for classification of cervical cancer risk T. Albuquerque, **R. Cruz**, J. Cardoso *PeerJ PeerJ Computer Science*	14	Q2
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 *Elsevier BV Computers & Electrical Engineering*	41	Q1

Year	Paper	Citations	SJR Rank
2018	Binary ranking for ordinal class imbalance **R. Cruz**, K. Fernandes, J. Costa, M. Ortiz, J. Cardoso *Springer Science and Business Media LLC Pattern Analysis and Applications*	2	Q2

Book Chapter Publications

Year	Paper	Citations	SJR Rank
2023	YOLOMM – You Only Look Once for Multi-modal Multi-tasking F. Campos, F. Cerqueira, **R. Cruz**, J. Cardoso *Springer Nature Switzerland Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications - Lecture Notes in Computer Science*	0	Q3
2023	Condition Invariance for Autonomous Driving by Adversarial Learning D. e Silva, **R. Cruz** *Springer Nature Switzerland Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications - Lecture Notes in Computer Science*	0	Q3
2023	Active Supervision: Human in the Loop **R. Cruz**, A. Shihavuddin, M. Maruf, J. Cardoso *Springer Nature Switzerland Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications - Lecture Notes in Computer Science*	0	Q3
2023	Interpretability-Guided Human Feedback During Neural Network Training P. Serrano e Silva, **R. Cruz**, A. Shihavuddin, T. Gonçalves *Springer Nature Switzerland Pattern Recognition and Image Analysis - Lecture Notes in Computer Science*	1	Q3
2023	Evaluating the Performance of Explanation Methods on Ordinal Regression CNN Models J. Barbero-Gómez, **R. Cruz**, J. Cardoso, P. Gutiérrez, C. Hervás-Martínez *Springer Nature Switzerland Advances in Computational Intelligence - Lecture Notes in Computer Science*	0	Q3
2019	Automatic Augmentation by Hill Climbing **R. Cruz**, J. Pinto Costa, J. Cardoso *Springer International Publishing Lecture Notes in Computer Science - Artificial Neural Networks and Machine Learning – ICANN 2019: Deep Learning*	1	Q3

Year	Paper	Citations	SJR Rank
2017	Constraining Type II Error: Building Intentionally Biased Classifiers **R. Cruz**, K. Fernandes, J. Pinto Costa, J. Cardoso *Springer International Publishing Advances in Computational Intelligence - Lecture Notes in Computer Science*	3	Q3
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 *Springer International Publishing Advances in Computational Intelligence - Lecture Notes in Computer Science*	1	Q3
2017	Combining Ranking with Traditional Methods for Ordinal Class Imbalance **R. Cruz**, K. Fernandes, J. Pinto Costa, M. Pérez Ortiz, J. Cardoso *Springer International Publishing Advances in Computational Intelligence - Lecture Notes in Computer Science*	7	Q3
2017	Ordinal Class Imbalance with Ranking **R. Cruz**, K. Fernandes, J. Pinto Costa, M. Ortiz, J. Cardoso *Springer International Publishing Pattern Recognition and Image Analysis - Lecture Notes in Computer Science*	5	Q3

Proceedings Publications

Year	Paper	Citations	CORE Rank
2023	Two-stage semantic segmentation in neural networks D. Teixeira e Silva, **R. Cruz**, T. Gonçalves, D. Carneiro *SPIE Fifteenth International Conference on Machine Vision (ICMV 2022)*	0	C
2021	Background Invariance by Adversarial Learning **R. Cruz**, R. Prates, E. Simas Filho, J. Pinto Costa, J. Cardoso *IEEE 2020 25th International Conference on Pattern Recognition (ICPR)*	1	B
2019	Averse Deep Semantic Segmentation **R. Cruz**, J. Pinto Costa, J. Cardoso *IEEE 2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*	1	C
2018	Deep Image Segmentation by Quality Inference K. Fernandes, **R. Cruz**, J. Cardoso *IEEE 2018 International Joint Conference on Neural Networks (IJCNN)*	6	B

Year	Paper	Citations	CORE Rank
2018	A Class Imbalance Ordinal Method for Alzheimer's Disease Classification **R. Cruz**, M. Silveira, J. Cardoso *IEEE 2018 International Workshop on Pattern Recognition in Neuroimaging (PRNI)*	0	
2016	Tackling class imbalance with ranking **R. Cruz**, K. Fernandes, J. Cardoso, J. Pinto Costa *IEEE 2016 International Joint Conference on Neural Networks (IJCNN)*	23	B

MSc Supervisions

Year	Student	Thesis
on-going	Diana Teixeira Silva	Quantifying How Deep Implicit Representations Promote Label Efficiency
on-going	Francisco Gonçalves Cerqueira	Comparative Study on Self-Supervision Methods for Autonomous Driving
2024	Airton Tiago	Data Augmentation for Ordinal Data
2023	Alankrita Asthana	Iterative Inference for Point-Clouds
2023	Rafael Cristino	Introducing Domain Knowledge to Scene Parsing in Autonomous Driving
2023	José Guerra	Uncertainty-Driven Out-of-Distribution Detection in 3D LiDAR Object Detection for Autonomous Driving (Internship at Bosch Car Multimedia)
2022	Pedro Silva	Human Feedback during Neural Networks Training
2022	João Silva	Environment Detection for Railway Applications based on Automotive Technology (Internship at Continental)
2022	Ana Bezerra	Phishing Detection with a Machine Learning Net (Internship at E-goi)

BSc Supervisions

Year	Student	Project
2024	Eliandro Melo	Resource Efficiency using Deep Q-Learning in Autonomous Driving
2024	Ivo Duarte Simões	Resource Efficiency using PPO in Autonomous Driving
2023	Diana Teixeira Silva	Condition Invariance for Autonomous Driving by Adversarial Learning
2022	Diana Teixeira Silva	Semantic Segmentation in Neural Networks using Iterative Visual Attention
2022	Filipe Campos, Francisco Cerqueira, Vasco Alves	Mobile App using Object Detection for Car Driving

Year	Student	Project
2022	Bruno Gomes, Rafael Camelo	Internship at ANO

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)