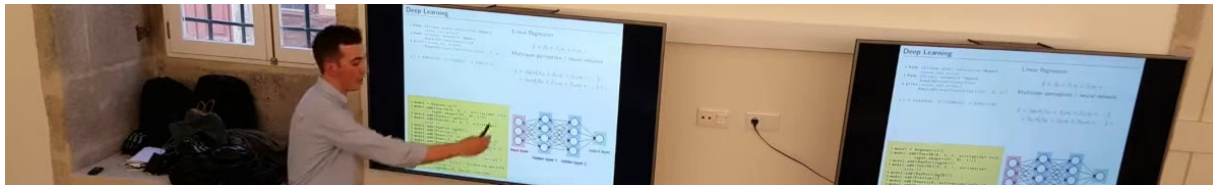


# Ricardo Cruz, PhD

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I enjoy a good challenge. From mathematics to computer science, from research to engineering, from health applications to autonomous driving, I have been applying, proposing and teaching data science and artificial intelligence.

SKILLS: Python · C · C++ · Java · R · MATLAB · PyTorch · TensorFlow · OpenCV · SQL · Git



## EDUCATION

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|-----------|---|
| 2016–2021 | <b>Ph.D. in Computer Science</b><br>Joint Degree: University of Porto, Minho and Aveiro |
| 2013–2015 | <b>MSc in Mathematical Engineering</b><br>University of Porto (FCUP)                    |
| 2009–2012 | <b>BSc in Computer Science</b><br>University of Porto (FCUP)                            |



## EMPLOYMENT

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|-----------------------------|--|
| 2021–ongoing                | <b>Autonomous Driving Post-Doc Researcher</b><br>University of Porto (FEUP) [in partnership with Bosch] <ul style="list-style-type: none"><li>• Collaboration between the University of Porto and Bosch Car Multimedia to improve autonomous driving perception</li><li>• Developed frameworks for object detection using camera and LiDAR (2D discretization and raw point-clouds)</li><li>• Published new methods for efficient semantic segmentation and ordinal regression</li><li>• Supervised six master's theses, four bachelor's projects, and other team members</li><li>• Responsible for the HPC infrastructure (using Slurm)</li></ul>   |
| 2015–2021<br><i>6 years</i> | <b>Machine Learning and Computer Vision Researcher</b><br>INESC TEC <ul style="list-style-type: none"><li>• Research focus: re-thinking fundamentals about image classification and semantic segmentation (8+ publications)</li><li>• 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</li><li>• Contributed to workshops, Summer School on Computer Vision (VISUM), and other events</li><li>• Twice awarded "outstanding recognition" for organizing workshops and helping with the HPC infrastructure</li></ul> |
| 2014<br><i>6 months</i>     | <b>Mathematical Modelling Research</b><br>Mathematics Center of the University of Porto (CMUP) <ul style="list-style-type: none"><li>• Epidemiological models for HIV. A little of everything: from differential equations to stochastic simulations to cellular automata.</li></ul>   |



## TEACHING

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2021–2022 **Invited Auxiliary Professor (~3h/week)**  
*1 year* University of Porto (FEUP)

- Programming Fundamentals (Python) [L.EIC]
- Programming (C/C++) [L.EIC]
- Data Structures and Algorithms (C/C++) [L.EEC]

2018–2021 **Invited Teacher Assistant (~3h/week)**  
*3 years* University of Porto (FEUP)

- Programming Fundamentals (Python) [L.EIC]
- Programming (C/C++) [L.EIC]



## PUBLICATIONS

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- 2023 **Two-Stage Framework for Faster Semantic Segmentation** [↗](#)  
 R. Cruz, D. Silva, T. Gonçalves, D. Carneiro, J. Cardoso. MDPI Sensors.
- 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 Intelligent Systems with Applications.
- 2022 **Two-stage Semantic Segmentation in Neural Networks** [↗](#)  
 R. Cruz, D. Silva, T. Gonçalves, D. Carneiro. Proceedings of the Fifteenth International Conference on Machine Vision (ICMV 2022).
- 2022 **Quasi-Unimodal Distributions for Ordinal Classification** [↗](#)  
 T. Albuquerque, R. Cruz, J. Cardoso. MDPI Mathematics.
- 2021 **Ordinal Losses for Classification of Cervical Cancer Risk** [↗](#)  
 T. Albuquerque, R. Cruz, J. Cardoso. PeerJ Computer Science.
- 2021 **Background Invariance by Adversarial Learning** [↗](#)  
 R. Cruz, R. Prates, E. Filho, J. Costa, J. Cardoso. IEEE 25th International Conference on Pattern Recognition (ICPR).
- 2019 **Automatic Augmentation by Hill Climbing** [↗](#)  
 R. Cruz, J. Costa, J. Cardoso. Springer 28th International Conference on Artificial Neural Networks (ICANN).
- 2019 **Averse Deep Semantic Segmentation** [↗](#)  
 R. Cruz, J. Costa, J. Cardoso. IEEE 41st Engineering in Medicine and Biology Conference (EMBC).
- 2019 **Insulator visual non-conformity detection in overhead power distribution lines using deep learning** [↗](#)  
 R. Prates, R. Cruz, A. Marotta, R. Ramos, E. Filho, J. Cardoso. Springer Journal Computers & Electrical Engineering.
- 2018 **A Class Imbalance Ordinal Method for Alzheimer's Disease Classification** [↗](#)  
 R. Cruz, M. Silveira, J. Cardoso. IEEE International Workshop on Pattern Recognition in Neuroimaging (PRNI)
- 2018 **Binary ranking for ordinal class imbalance** [↗](#)  
 R. Cruz, K. Fernandes, J. Costa, M. Pérez Ortiz, J. Cardoso. Springer Journal Pattern Analysis and Applications.

- 2018 **Deep image segmentation by quality inference** [↗](#)  
K. Fernandes, R. Cruz, J. Cardoso. IEEE International Joint Conference on Neural Networks (IJCNN)
- 2017 **Constraining type II error: building intentionally biased classifiers** [↗](#)  
R. Cruz, K. Fernandes, J. Costa, J. Cardoso. Springer International Work-conference on Artificial Neural Networks (IWANN)
- 2017 **Fine-to-coarse ranking in ordinal and imbalanced domains: an application to liver transplantation** [↗](#)  
M. Pérez-Ortiz, K. Fernandes, R. Cruz, J. Cardoso. Springer International Work-conference on Artificial Neural Networks (IWANN).
- 2017 **Combining ranking with traditional methods for ordinal class imbalance** [↗](#)  
R. Cruz, K. Fernandes, J. Costa, M. Pérez-Ortiz, J. Cardoso. Springer International Work-conference on Artificial Neural Networks (IWANN)
- 2017 **Ordinal class imbalance with ranking** [↗](#)  
R. Cruz, K. Fernandes, J. Costa, M. Pérez-Ortiz, J. Cardoso. Springer Iberian conference on pattern recognition and image analysis (Ibpria).
- 2016 **Tackling class imbalance with ranking** [↗](#)  
R. Cruz, K. Fernandes, J. Costa, J. Cardoso. IEEE International Joint Conference on Neural Networks (IJCNN).

My favorite publications are in **highlight**. See my Google Scholar for more information: [scholar.google.com/citations?user=pSFY\\_gQAAAAJ](https://scholar.google.com/citations?user=pSFY_gQAAAAJ)



## PROJECTS

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### Uber Pixor implementation [↗](#)

Implementation of a popular bird's eye view LiDAR object detection model.

### objdetect package [↗](#)

Light-weight and versatile one-stage object detection framework

### Apoo (virtual machine) GTK+ interface [↗](#)

I helped with the development of the GTK+ interface for Apoo (together with Profs Rogério Reis and Nelma Moreira), a virtual machine that is currently being used to teach Assembly. Apoo is written in Python and GTK+.

### EatFeed [↗](#)

RSS/Atom reader written in C++ and GTK+

### Google Summer of Code

I was awarded twice a Google grant to work on open-source projects. LibreOffice dynamic layouts (2007) and YaST port from GTK+ to Qt (2006).

### SuperTux, co-author [↗](#)

While in high-school, I was part of the initial team developing this game. It is written in C++, SDL, and OpenGL.

See my github for more projects: [github.com/rpmcruz](https://github.com/rpmcruz)



## SUPERVISIONS

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- on-going      **Introducing Domain Knowledge to Autonomous Driving**  
Rafael Valente Cristino
- Iterative Inference for Point-Clouds**  
Alankrita Asthana (University of Munich)
- Academic Internship in Out of Distribution Detection – Autonomous Driving (Internship at Bosch Car Multimedia)**  
José António Barbosa da Fonseca Guerra (co-supervisor: Prof Luís Teixeira)
- 2022            **Human Feedback during Neural Networks Training** [↗](#)  
Pedro João Cruz Serrano e Silva (co-supervisor: Tiago Filipe Sousa Gonçalves)
- Environment Detection for Railway Applications based on Automotive Technology (Internship at Continental)** [↗](#)  
João Malheiro Baptista Marcos da Silva
- Phishing Detection with a Machine Learning Net (Internship at E-goi)** [↗](#)  
Ana Luís Carvalho Matos Bezerra (co-supervisor: Prof Joaquim Pinto da Costa)



## AWARDS

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- 2022            **Bosch for Mobility** [↗](#)  
My students won Best New Participating Team in an autonomous driving competition
- 2021            **INESC TEC Outstanding Recognition Award** [↗](#)  
Monthly award for INESC TEC collaborators, for maintenance of the HPC infrastructure
- 2021            **Pedagogic award (voted by students)**  
University of Porto (FEUP)
- 2021            **Best paper and presentation** [↗](#)  
RECPAD conference
- 2018            **INESC TEC Outstanding Recognition Award** [↗](#)  
Monthly award for INESC TEC collaborators, for organizing workshops
- 2017            **Kaggle Bronze Medal (competition) and Silver (engagement)**