

*Last updated on December 11, 2021*

## Activities

- [2022- ] **Principal Research Scientist**, at MERL Mitsubishi Electric Research Labs, Cambridge;  
[2019-2022] **Assistant Research Professor** (*Inv. Aux.*), at “Instituto Superior Técnico, Lisboa”;  
[2018-2019] **Post-Doctoral Associate**, at KTH Royal Institute of Technology, Stockholm;  
[2014-2018] **Post-Doctoral Researcher**, at “Instituto Superior Técnico, Lisboa”;

## Education

- [2009-2013] **PhD degree** at the University of Coimbra (ECE);  
[2007-2008] **MSc degree** at the University of Coimbra (ECE);  
[2003-2007] **BSc degree** at the University of Coimbra (ECE);

## Awards

- [2018] **Outstanding Reviewer Award**, Computer Vision and Image Understanding (CVIU);  
[2003-2008] **Academic merit** (four times – years **2004/2005, 2005/2006, 2006/2007, and 2007/2008**), Name of the award: “Prémio 3% dos Melhores Estudantes, Universidade de Coimbra”;

## Research Grants

- [2016-2022] **Individual Post-Doctoral grant** (~**106K EUR**): Awarded by the Portuguese Foundation for Science and Technology (FCT), Reference: SFRH/BPD/111495/2015;  
[2009-2013] **PhD grant** (~**57K EUR**): Awarded by the Portuguese Foundation for Science and Technology (FCT), Reference: SFRH/BD/49054/2008;

## Publications

### CVPR, ECCV, ICCV, ICRA, IROS, and Journal papers

- [1] João R. Cardoso and **Pedro Miraldo**, *Solving the discrete Euler–Arnold equations for the generalized rigid body motion*, Journal of Computational and Applied Mathematics (CAM), **402**:1 [[arXiv:2109.00505](#), [doi](#)];
- [2] André Mateus, Omar Tahri, A. Pedro Aguiar, Pedro U. Lima, and **Pedro Miraldo**, *On Incremental Structure-from-Motion using Lines*, IEEE Trans. Robotics (T-RO), pp. [[arXiv:2105.11196](#), [doi](#)];
- [3] Siddhant Ranade, Yu Xin, Shantnu Kakkar, **Pedro Miraldo**, and Srikumar Ramalingam (2020), *Mapping of Sparse 3D Data using Alternating Projection*, Asian Conf. Computer Vision (ACCV), pp. 295-313 [[arXiv:2010.02516](#), [doi](#)] Oral presentation;
- [4] Pedro Roque, Elisa Bin, **Pedro Miraldo**, and Dimos V. Dimarogonas (2020), *Fast Model Predictive Image-Based Visual Servoing for Quadrotors*, IEEE/RSJ Int’l Conf. Intelligent Robots and Systems (IROS), pp. 7566-7572 [[doi](#)];

- [5] **Pedro Miraldo** and João R. Cardoso (2020), *On the Generalized Essential Matrix Correction: An efficient solution to the problem and its applications*, J Math Imaging Vis (JMIV), **62**:1107-1120 [[arXiv:1709.06328](#), [doi](#)];
- [6] André Mateus, Srikumar Ramalingam, and **Pedro Miraldo** (2020), *Minimal Solvers for 3D Scan Alignment with Pairs of Intersecting Lines*, IEEE/CVF Conf. Computer Vision and Pattern Recognition (CVPR), pp. 7232-7242 [[doi](#)];
- [7] G. Dias Pais, Srikumar Ramalingam, Venu Madhav Govindu, Jacinto C. Nascimento, Rama Chellappa, and **Pedro Miraldo** (2020), *3DRegNet: A Deep Neural Network for 3D Point Registration*, IEEE/CVF Conf. Computer Vision and Pattern Recognition (CVPR), pp. 7191-7201 [[arXiv:1904.01701](#), [doi](#)];
- [8] R. T. Rodrigues, **P. Miraldo**, D. V. Dimarogonas, and A. P. Aguiar (2020), *Active Depth Estimation: Stability Analysis and its Applications*, IEEE Int'l Conf. Robotics and Automation (ICRA), pp. 2002-2008 [[arXiv:2003.07137](#), [doi](#)];
- [9] P. U. Lima, C. Azevedo, E. Brzozowska, J. Cartucho, T. J. Dias, J. Gonçalves, M. Kinarullathil, G. Lawless, O. Lima, R. Luz, **P. Miraldo**, E. Piazza, M. Silva, T. Veiga, and R. Ventura (2019), *SocRob@Home Integrating AI Components in a Domestic Robot System*, Künstliche Intelligenz (KI), **33**(4):343-356 [[doi](#)];
- [10] R. Rodrigues, **P. Miraldo**, D. V. Dimarogonas, and A. P. Aguiar (2019). *A Framework for Depth Estimation and Relative Localization of Ground Robots using Computer Vision*, IEEE/RSJ Int'l Conf. Intelligent Robots and Systems (IROS), pp: [[arXiv:1908.00309](#), [doi](#)];
- [11] **P. Miraldo**, S. Saha, and S. Ramalingam (2019). *Minimal Solvers for Mini-Loop Closures in 3D Multi-Scan Alignment*, IEEE/CVF Conf. Computer Vision and Pattern Recognition (CVPR), pp. 9691-9700 [[arXiv:1904.03941](#), [doi](#)];
- [12] G. Pais, J. C. Nascimento, and **P. Miraldo** (2019). *OmniDRL: Robust Pedestrian Detection using Deep Reinforcement Learning on Omnidirectional Cameras*, IEEE Int'l Conf. Robotics and Automation (ICRA), pp. 4782-4789 [[arXiv:1903.00676](#), [doi](#)];
- [13] J. Campos, J. R. Rodrigues, and **P. Miraldo** (2019). *POSEAMM: A Unified Framework for Solving Pose Problems using an Alternating Minimization Method*, IEEE Int'l Conf. Robotics and Automation (ICRA), pp. 3493-3499 [[arXiv:1904.04858](#), [doi](#)];
- [14] A. Mateus, D. Ribeiro, **P. Miraldo**, and J. C. Nascimento (2018). *Efficient and Robust Pedestrian Detection using Deep Learning for Human-Aware Navigation*, Robotics and Autonomous Systems (RAS), **113**:23-37 [[arXiv:1607.04441](#), [doi](#)];
- [15] **P. Miraldo**, T. Dias, and S. Ramalingam (2018). *A Minimal Closed-Form Solution for Multi-Perspective Pose Estimation using Points and Lines*, European Conf. Computer Vision (ECCV), pp. 490-507 [[arXiv:1807.09970](#), [doi](#)];
- [16] A. Mateus, O. Tahri, and **P. Miraldo** (2018). *Active Structure-from-Motion for 3D Straight Lines*, IEEE/RSJ Int'l Conf. Intelligent Robots and Systems (IROS), pp: 5819-5825 [[arXiv:1807.00753](#), [doi](#)];
- [17] **P. Miraldo**, F. Eiras, and S. Ramalingam (2018). *Analytical Modeling of Vanishing Points and Curves in Catadioptric Cameras*, IEEE/CVF Conf. Computer Vision and Pattern Recognition (CVPR), pp: 2012-2021 [[arXiv:1804.09460](#), [doi](#)];
- [18] R. Rodrigues, M. Basiri, A. P. Aguiar, and **P. Miraldo** (2018). *Low-level Active Visual Navigation: Increasing robustness of vision-based localization using potential fields*, IEEE Robotics and Automation Letters (RA-L) and IEEE Int'l Conf. Robotics and Automation (ICRA), double submission for RA-L and ICRA, **3**(3):2079-2086 [[arXiv:1801.07249](#), [doi](#)];
- [19] X. Liu, Z. Li, K. Zhong, Y. Chao, **P. Miraldo**, and Y. Shi (2018). *Generic distortion model for metrology under optical microscopes*, Optics and Lasers in Engineering (OLEN), **103**:119-126 [[doi](#)];
- [20] J. Iglésias, **P. Miraldo**, and R. Ventura (2016). *Towards an Omnidirectional Catadioptric RGB-D Camera*, IEEE/RSJ Int'l Conf. Intelligent Robots and Systems (IROS), pp: 2506-2513 [[doi](#)];

- [21] T. Veiga, **P. Miraldo**, R. Ventura, and P. Lima (2016). *Efficient Object Search for Mobile Robots in Dynamic Environments: Semantic Map as an Input for the Decision Maker*, IEEE/RSJ Int'l Conf. Intelligent Robots and Systems (IROS), pp: 2745-2750 [doi];
- [22] X. Liu, Z. Li, **P. Miraldo**, K. Zhong, and Y. Shi (2016). *A framework to calibrate the scanning electron microscope under any magnifications*, IEEE Photonics Technology Letters (PT-L), **28**(16):1715-1718 [doi];
- [23] T. Dias, **P. Miraldo**, and N. Gonçalves (2016). *A Framework for Augmented Reality using Non-Central Catadioptric Cameras*, Springer J. Intelligent & Robotic Systems (JINT), **83**(3):359-373 [doi];
- [24] F. Amigoni, J. Berghofer, A. Bonarini, G. Fontana, N. Hochgeschwender, L. Iocchi, G. K. Kraetzschmar, P. Lima, M. Matteucci, **P. Miraldo**, D. Nardi, and V. Schiaonati (2015). *Competitions for Benchmarking: Task and Functionality Scoring Complete Performance Assessment*, IEEE Robotics & Automation Magazine (RAM), **22**(3):53-61 [doi];
- [25] T. Dias, **P. Miraldo**, N. Gonçalves, and P. Lima (2015). *Augmented Reality on Robot Navigation using Non-Central Catadioptric Cameras*, IEEE/RSJ Int'l Conf. Intelligent Robots and Systems (IROS), pp: 4999-5004 [doi];
- [26] **P. Miraldo** and H. Araujo (2015). *Pose Estimation for Non-Central Cameras Using Planes*, Springer J. Intelligent & Robotic Systems (JINT), **80**(3):595-608 [doi];
- [27] **P. Miraldo** and H. Araujo (2015). *Generalized Essential Matrix: Properties of the Singular Value Decomposition*, Elsevier Image and Vision Computing (IMAVIS), **34**:45-50 [doi];
- [28] **P. Miraldo**, H. Araujo, and N. Gonçalves (2015). *Pose Estimation for General Cameras Using Lines*, IEEE Trans. Cybernetics (T-CYB), **45**(10):2156-2164 [doi];
- [29] **P. Miraldo** and H. Araujo (2015). *Direct Solution to the Minimal Generalized Pose*, IEEE Trans. Cybernetics (T-CYB), **45**(3):404-415 [doi];
- [30] **P. Miraldo** and H. Araujo (2014). *Planar Pose Estimation for General Cameras using Known 3D Lines*, IEEE/RSJ Int'l Conf. Intelligent Robots and Systems (IROS), pp: 4234-4240 [doi];
- [31] **P. Miraldo** and H. Araujo (2014). *A Simple and Robust Solution to the Minimal General Pose Estimation*, IEEE Int'l Conf. Robotics and Automation (ICRA), pp: 2119-2125 [doi];
- [32] **P. Miraldo** and H. Araujo (2013). *Calibration of Smooth Camera Models*, IEEE Trans. Pattern Analysis and Machine Intelligence (T-PAMI), **35**(9):2091-2103 [doi];
- [33] **P. Miraldo**, H. Araujo, and J. Queiró (2011). *Point-based Calibration Using a Parametric Representation of General Imaging Models*, IEEE Int'l Conf. Computer Vision (ICCV), pp: 2304-2311 [doi];

## Book Chapters

- [34] L. Iocchi, G. Kraetzschmar, D. Nardi, P. U. Lima, **P. Miraldo**, and E. Bastianelli (2017). *RoCKIn@Home: Domestic Robots Challenge* (boot title *RoCKIn - Benchmarking Through Robot Competition*), InTechOnline Chapter, pp: 25-46 [doi];

## Research Impact

### Invited Talks

- [04/2021]: Mitsubishi Electric Research Laboratories (MERL), Cambridge, MA;  
Title: **Localization and Mapping: 3D Registration, Omnidirectional cameras, and Active SfM**;
- [06/2019]: Microsoft Research, HoloLens team, Zurich;  
Title: **Robust Pose Estimation: Multi-perspective absolute pose and 3D Scan Alignment**;

[01/2019]: Ericsson Research, Kista, Stockholm;

Title: **Non-Conventional Imaging Devices and their Applications in Robotics**;

[03/2018]: KTH Royal Institute of Technology, Stockholm, Department of Automatic Control;

Title: **Non-Conventional Imaging Devices and their Applications in Robotics**;

## Principal Investigator (PI) in Research Projects

[2020-2023] **STORESLAM**: Accurate Agent Localization and Mapping Methods for Structured Indoor Retail Store Environments [[link](#)];

## Participation in Research Projects

[2016-2018] **RockEU2**: Robotics coordination action for Europe two [[link](#)];

[2014-2015] **RoCKIn**: Robot competitions kick innovation in cognitive systems and robotics [[link](#)];

[2018-2019] **COIN**: Co-adaptive human-robot interactive systems [[link](#)];

[2016-2019] **HaRoDE**: Human-aware service robots for domestic environments [[link](#)];

[2014-2016] **SocRob**: Soccer Robots and Society of Robots [[link](#)];

[2013-2014] “Novas Tecnologias para apoio à Saúde e Qualidade de Vida: Projecto A-Cirurgia e Diagnóstico Assistido por Computador Usando Imagem”;

[2012-2015] Calibration and 3D Reconstruction in Omnidirectional Catadioptric Systems [[link](#)];

[2011-2012] Automatic heart scan with ultrasound using visual servoing techniques;

[2010-2013] **UniProjection**: Unified Projection Model of Non SVP Systems – Application to Endoscopy and Graphics [[link](#)];

## Teaching

[2021-2022] **Artificial Intelligence and Decision Systems** (ECE,DCE,AerE);

[2020-2021] **Artificial Intelligence and Decision Systems** (ECE,DCE,AerE);

[2017-2018] **Computer Graphics** (CS&E);

[2016-2017] **Algorithms & Data Structures** (ECE);

[2015-2016] **Automatic Control** (ECE);

[2014] **Computer Vision; and Mobile Robotics** (ECE);

## Students

### Completed PhD

#1: **André Mateus** (2017-2021): *Robot Control using Computer Vision*.

### Ongoing PhD

#2: **G. Dias Pais** (2020-): *All SLAM leads to Rome: Localize and Map Dynamic Environments with 3D Sensors*

*and Semantic Information.*

## **Interns**

**#1: Arihant Gaur** (2021- );

## **Other Research Grants (Graduate and Undergraduate)**

**#2: Luis Lopes** (2020-2021);

**#3: Valter Piedade** (2020-2021);

**#4: G. Dias Pais** (2018-2019);

**#5: João Campos** (2017-2018);

**#6: Tiago Dias** (2015-2019);

**#7: Francisco Eiras** (2017-2018);

**#8: Rômulo Rodrigues** (2016-2017);

**#9: José Iglesias** (2015-2017);