Pedro Marco Achanccaray Diaz

Researcher and Lecturer at IGP/TU Braunschweig

Experienced researcher proficient in machine learning, deep learning, computer vision and remote sensing with expertise in applying these techniques to diverse fields such as agriculture mapping, oil and gas exploration/monitoring/extraction, and building heritage preservation. Exhibits competence in the supervision and orientation of master's and doctoral students during lectures and guiding them through the development of projects.

Contact Information

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Research Interests

Computer vision, Machine learning, Deep learning, Remote sensing

Education

Pontifical Catholic University of Rio de Janeiro (PUC-Rio)
Ph.D. in Electrical Engineering, 2019

Pontifical Catholic University of Rio de Janeiro (PUC-Rio)
M.Sc. in Electrical Engineering, 2014

National University of Engineering (UNI)
B.Sc. in Mechanical-Electrical Engineering, 2010

Professional/ Research Experience

Institute of Geodesy and Photogrammetry - IGP 2021-2027
Technische Universität Braunschweig – TUBS, Germany
Researcher and Lecturer
Research on projects using machine/deep learning methods and remote sensing data for different applications such as building heritage preservation, concrete damage detection, land use/land cover segmentation, and 3D concrete printing quality assessment. Lecturer on the Deep Learning course in the Master program, and supervision of master and doctoral students.

Applied Computational Intelligence Lab – ICA 2019-2021
Pontifical Catholic University of Rio de Janeiro – PUC-Rio, Brazil
Researcher and Developer
Research and development of projects using machine/ deep learning methods and data from different domains (sea surface satellite images, sea floor seismic data, and ROV pipeline inspection videos) in the exploration, extraction, and monitoring tasks in the Oil and Gas industry. Supervisor of master and doctoral students.

Computer Vision Lab - LVC 2015-2018
Pontifical Catholic University of Rio de Janeiro – PUC-Rio, Brazil
Researcher
Development of public benchmarks for agricultural applications. My activities involved the pre-processing of sequences of multitemporal Sentinel-1 (SAR) images for agricultural monitoring in two municipalities in Brazil: **Campo Verde** and Luis Eduardo Magalhães (**LEM**). These projects were in cooperation with the National Institute for Space Research – INPE. LEM received financial support from the ISPRS Scientific Initiatives.

Teaching Experience

- Deep learning (IGP/TUBS), *Lecturer – Master program* — 2022-2024
- Deep learning for social sciences and public administration (PUCP), *Lecturer – Specialization course* — 2022-2024
- Machine learning for social sciences (PUCP), *Lecturer – Specialization course* — Jan – Feb 2021

Achievements, Honors and Awards

- TU Braunschweig Lehrpreis 2024: Best international lecture, Deep Learning — 2024
- Scholarship *Science without Borders* from *CAPES,* for visiting researcher at *IPI, LUH (*Germany) — 2016
- Scholarship from *CNPq* for the Ph.D. program at *PUC-Rio* — 2014-2018
- Scholarship *Bolsa Nota 10* from *FAPERJ* — 2013
- Scholarship from *CAPES* for the M.Sc. program at *PUC-Rio* — 2012

Invited Talks

- *Interpretando el mundo a través de imágenes y deep learning*, XI Electronic Week International Conference, 2022.
- *Desafíos del aprendizaje profundo en la visión por computador: Introducción al aprendizaje profundo y aplicaciones en teledetección,* V International Conference on Systems Engineering, 2022.
- *Deep Learning*, Summer School – IBT TU Braunschweig, 2022.
- *Aplicaciones de Deep Learning en Procesamiento Digital de Imágenes: desde el fondo del océano hasta el espacio exterior*, Capitulo de Ingeniería Electrónica CIP Cusco, 2022.
- *Segmentación de tipos de cultivos agrícolas con herramientas de machine learning e imágenes de teledetección,* Pontificia Universidad Católica del Perú PUCP, 2021.
- *Reconocimiento de cultivos agrícolas en regiones tropicales usando secuencias de imágenes de teledetección de sensores activos y pasivos*, International Conference on Computer Systems and Sciences, 2020.

Key Skills and Experience

Programming:	Python, MATLAB, C++, C#, R, Bash Script
Frameworks:	TensorFlow, Keras, PyTorch
Version Control:	Git, GitLab, GitHub
Containerization Tools:	Docker, Singularity
Software:	QGIS, ESA SNAP, MS Office

Languages

Spanish (native), English (advanced), Portuguese (intermediate)

Students

Co-advisor, M.Sc., Eslam Nagah Sayed Mohamed Sharaawy (March 2025)
Co-advisor, M.Sc., Aditya Murti (February 2025)
Co-advisor, M.Sc., Reiko Lettmoden (December 2024)
Co-advisor, M.Sc., Jose Manuel Gutierrez Castellanos (December 2024)
Co-advisor, M.Sc., Friedrich Hellweg (September 2024)
Co-advisor, M.Sc., David Hunkemöller (March 2024)
Co-advisor, M.Sc., William Alberto Ramirez Ruiz (April 2021)

Publications

Harb, S., **Achanccaray, P.**, Maboudi, M., & Gerke, M. (2024). *Multi-temporal crack segmentation in concrete structure using deep learning approaches*. arXiv preprint arXiv:2411.04620.

Nyandwi, E., Gerke, M. & **Achanccaray, P**. *Local Evaluation of Large-scale Remote Sensing Machine Learning-generated Building and Road Dataset: The Case of Rwanda*. Journal of Photogrammetry, Remote Sensing and Geoinformation science – PFG (2024), DOI: 10.1007/s41064-024-00297-9

Heinrich, A., Mende, V., Wesche, L., & **Achanccaray, P**. (2024). *Database of recorded serial manufactured MLK-buildings (GDR) (Release 2) [Data set],* DOI:10.24355/dbbs.084-202403130624-0

A. Alamouri, J. Backhaus, V. De Arriba López, **P. M. Achanccaray Diaz**, M. Gerke. *High-Resolution Data Capture and Interpretation in Support of Port Infrastructure Maintenance*, DGPF-Jahrestagung, 2024.

M. Gerke, **P. M. Achanccaray Diaz**, S. Fekete, M. Figge, N. Fohrer, S. Giutronich, P. Keldenich, S. Lutz, M. Perk, A. Reinhardt, C. Richter, C. Rieck, B. Riedel, T. Riedemann, F. Saba, K. Schrader, A. Schröter, D.

Szafranski, A. Taghavi, P. Wagner. *Extremwettermanagement mit digitalen Multiskalen-Methoden: Das EXDIMUM-Projekt*, DGPF-Jahrestagung, 2024.

De Arriba López, V., Maboudi, M., **Achanccaray, P.**, Gerke, M. *Automatic non-destructive UAV-based structural health monitoring of steel container cranes*. Applied Geomatics (2023), DOI: 10.1007/s12518-023-00542-7

Achanccaray, P., Gerke, M., Wesche, L., Hoyer, S., Thiele, K., Knufinke, U., and Krafczyk, C.: *On the assessment of instance segmentation for the automatic detection of specific constructions from very high resolution airborne imagery*, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLVIII-1/W2-2023, 1303–1309, DOI: 10.5194/isprs-archives-XLVIII-1-W2-2023-1303-2023, 2023

Wesche, L., **Achanccaray Diaz, P. M.**, Hoyer, S., Knufinke, U., Gerke, M., Krafczyk, C., & Thiele, K. (2023). *Dataset of german steel system halls from the period of high modernism [Data set]*. DOI: 10.24355/dbbs.084-202305261242-0

Leonhard Wesche, Sebastian Hoyer, Ulrich Knufinke, **Pedro Achanccaray**, Christina Krafczyk, Markus Gerke and Klaus Thiele. *Technologien für die Baudenkmalpflege: Erfassung und Analyse von Systemhallen der Hochmoderne*, in: Berichte zur Denkmalpflege in Niedersachsen 43 (2023), 2, pp. 61-65

Wesche, L., **Achanccaray, P.,** Hoyer, S. (2023). *Serielle Gebäude und wie man sie findet - Eine Methodik der Künstlichen Intelligenz zur Gebäudeerfassung*. In Gisbertz, O., Escherich, M., Hoyer, S., Putz, A., Weber, C. & DFG-Netzwerk Bauforschung Jüngere Baubestände 1945+ (Ed.). Reallabor Nachkriegsmoderne: Zum Umgang mit jüngeren Denkmalen. JOVIS Verlag GmbH

Achanccaray, P., Gerke, M., Wesche, L., Hoyer, S., Thiele, K., Knufinke, U., Krafczyk, C. *Automatic Detection of Specific Constructions on a Large Scale Using Deep Learning in Very High Resolution Airborne Imagery*. Journal of Photogrammetry, Remote Sensing and Geoinformation science – PFG 91, pp. 189-209 (2023), DOI:10.1007/s41064-023-00237-z

Achanccaray, Pedro, Gerke, Markus, Hoyer, Sebastian, Knufinke, Ulrich, Krafczyk, Christina, Thiele, Klaus and Wesche, Leonhard. "*Deep Learning in der Denkmal-Inventarisation: Zur automatisierten luftbildbasierten Erfassung von Systembauwerken*" Die Denkmalpflege, 80, no. 2, 2022, pp. 162-16. DOI:10.1515/DKP-2022-2013

Heinrich, A., Mende, V., Wesche, L., & **Achanccaray, P.** (2022). *Database of recorded serial manufactured MLK-buildings (GDR) (Release 1) [Data set]*, DOI:10.24355/dbbs.084-202206080745-0

Ramirez, W., **Achanccaray, P.** & Pacheco, M.A. *A comparative study of Deep Learning architectures for Classification of Natural and Human-made Sea Events in SAR images*. Discov Artif Intell 2, 1 (2022). DOI:10.1007/s44163-022-00017-5

Bento, V., Kohler, M., **Diaz, P**. et al. *Improving deep learning performance by using Explainable Artificial Intelligence (XAI) approaches*. Discov Artif Intell 1, 9 (2021). DOI:10.1007/s44163-021-00008-y

Sanches, I. D., Feitosa, R. Q., Montibeller, B., **Achanccaray Diaz, P. M.**, Luiz, A. J. B., Soares, M. D., Prudente, V. H. R., Vieira, D. C., Maurano, L. E. P., Happ, P. N., Chamorro, J., and Oldoni, L. V.: *First results of the LEM benchmark database for agricultural applications*, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLIII-B5-2020, 251–256, DOI:10.5194/isprs-archives-XLIII-B5-2020-251-2020, 2020

Ramirez, W., **Achanccaray, P.**, Mendoza, L. F., and Pacheco, M. A. C.: *Deep convolutional neural networks for weed detection in agricultural crops using optical aerial images*, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLII-3/W12-2020, 551–555, DOI:10.5194/isprs-archives-XLII-3-W12-2020-551-2020, 2020

Soares, Marinalva Dias, Luciano Vieira Dutra, Gilson Alexandre Ostwald Pedro da Costa, Raul Queiroz Feitosa, Rogério Galante Negri, and **Pedro Diaz**. *A Meta-Methodology for Improving Land Cover and Land Use Classification with SAR Imagery*. Remote Sensing 12, no. 6 (2020): 961, DOI:10.3390/rs12060961

Sothe, Camile, Cláudia Maria De Almeida, Marcos Benedito Schimalski, Veraldo Liesenberg, and **Pedro Achanccaray Diaz**. *Automatic tuning of segmentation parameters for tree crown delineation with VHR imagery*. Geocarto International (2019): 1-19, DOI:10.1080/10106049.2019.1690056

Sanches, I. D., R. Q. Feitosa, **P. Achanccaray**, B. Montibeller, A. J. B. Luiz, M. D. Soares, V. H. R. Prudente, D. C. Vieira, and L. E. P. Maurano. *LEM benchmark database for tropical agricultural remote sensing application*. International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences 42, no. 1 (2018), DOI: 10.5194/isprs-archives-XLII-1-387-2018

Sanches, Ieda Del'Arco, Raul Queiroz Feitosa, **Pedro Marco Achanccaray Diaz**, Marinalva Dias Soares, Alfredo José Barreto Luiz, Bruno Schultz, and Luis Eduardo Pinheiro Maurano. *Campo verde database: Seeking to improve agricultural remote sensing of tropical areas*. IEEE Geoscience and Remote Sensing Letters 15, no. 3 (2018): 369-373, DOI: 10.1109/LGRS.2017.2789120

Cué, L. E.; Bermudez, J. D.; **Achanccaray, P.**; Sanches, I. D.; Happ, P. N.; Feitosa, R. Q. *A comparative analysis of deep learning techniques for crop type recognition in temperate and tropical regions from multitemporal SAR*

image sequences. Anais do XXVII Congresso Brasileiro de Cartografia e XXVI Exposicarta 6 a 9 de novembro de 2017, SBC, Rio de Janeiro – RJ, p. 730-734

Bermúdez, J. D.; **Achanccaray, P.**; Sanches, I. D.; Cue, L.; Happ, P.; Feitosa, R. Q. *Evaluation of recurrent neural networks for crop recognition from multitemporal remote sensing images*. Anais do XXVII Congresso Brasileiro de Cartografia e XXVI Exposicarta 6 a 9 de novembro de 2017, SBC, Rio de Janeiro – RJ, p. 800-804

Bermudez, J.; Feitosa, Raul Q.; Cue, L.; **Achanccaray, P.**; Sanches, I. D. *A comparative analysis of deep learning techniques for sub-tropical crop types recognition from multitemporal Optical/SAR image sequences*. In: 2017 30TH SIBGRAPI Conference on Graphics, Patterns and Images (SIBGRAPI), p. 382–389, Oct 2017, DOI: 10.1109/SIBGRAPI.2017.57

Achanccaray, P.; Feitosa, R. Q.; Rottensteiner, F.; Sanches, I. A.; Heipke, C. *Spatial-temporal conditional random field based model for crop recognition in tropical regions*. In: IEEE International Geoscience and Remote Sensing Symposium IGARSS, 2017, Fort Worth. IGARSS 2017 Proceedings, 2017. p. 3007-3010, DOI: 10.1109/IGARSS.2017.8127631

Achanccaray, P.; Feitosa, R. Q.; Rottensteiner, F.; Sanches, I. A.; Heipke, C. *Spatio-temporal Conditional Random Fields for recognition of sub-tropical crop types from multi-temporal images*. In: XVIII Simpósio Brasileiro de Sensoriamento Remoto SBSR, 2017, Santos. p. 2539-2546

Vega, Pedro J. Soto; Quirita, Victor A. Ayma; **Achanccaray, Pedro M.**; Tanscheit, Ricardo; Vellasco, Marley. *A fuzzy inference system for multispectral image classification*. In: 2016 IEEE ANDESCON, 2016, Arequipa. 2016 IEEE ANDESCON, 2016. p. 1-4, DOI:10.1109/ANDESCON.2016.7836268

Happ, P. N.; Ferreira, R. S.; Costa, G. A. O. P.; Feitosa, R. Q.; Bentes, C.; Farias, R.; **Achanccaray, P. M.** *InterSeg: A Distributed Image Segmentation Tool*. In: GEOBIA 2016: Solutions and Synergies, Enschede. Netherlands. University of Twente Faculty of Geo-Information and Earth Observation, 2016, DOI: 10.3990/2.450

Ayma Quirita, Victor Andres; **Achanccaray Diaz, Pedro**; Feitosa, Raul Q.; Happ, Patrick N.; Costa, Gilson A. O. P.; Klinger, Tobias; Heipke, Christian. *Metaheuristics for Supervised Parameter Tuning of Multiresolution Segmentation*. IEEE Geoscience and Remote Sensing Letters (Print), v. 13(9), p. 1364-1368, 2016, DOI:10.1109/LGRS.2016.2586499

Diaz, P. M. A., Feitosa, R. Q., Sanches, I. D., and Costa, G. A. O. P.: *A Method to estimate temporal interaction in a conditional random field based approach for crop recognition*, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLI-B7, 205-211, DOI:10.5194/isprs-archives-XLI-B7-205-2016, 2016

Jimenez, Luis Ignacio; Plaza, Antonio; Ayma, Victor Andres; **Achanccaray, Pedro**; Costa, Gilson A.O.P.; Queiroz Feitosa, Raul. *Segmentation as postprocessing for hyperspectral image classification*. In: IEEE EUROCON 2015 International Conference on Computer as a Tool (EUROCON), 2015, Salamanca, Spain. p. 1-4, DOI:10.1109/EUROCON.2015.7313746

Achanccaray, P.; Ayma, V. A.; Jimenez, L. I.; Garcia, S. B.; Happ, P. N.; Costa, G. A. O. P.; Feitosa, R. Q.; Plaza, A. *SPT 3.1: A free software for automatic tuning of segmentation parameters in Optical, Hyperspectral and SAR images*. In: International Geoscience and Remote Sensing Symposium 2015 (IGARSS 2015), Milan, Italy. p. 4332-4335, DOI:10.1109/IGARSS.2015.7326785

Jimenez, L. I.; Ayma, V. A.; **Achanccaray, P.**; Costa, G. A. O. P.; Feitosa, R. Q.; Plaza, A. *Segmentation as post processing for hyperspectral image classification*. In: International Geoscience and Remote Sensing Symposium 2015 (IGARSS 2015), Milan, Italy. p. 3723-3726; DOI:10.1109/IGARSS.2015.7326632

Achanccaray, P.; Ayma, V. A.; Jimenez, L. I.; Garcia, S. B.; Happ, P. N.; Feitosa, R. Q.; Plaza, A. *SPT 3.0: A free software for automatic segmentation parameters tuning*. In: Simposio Brasileiro De Sensoriamento Remoto, 17. (SBSR), 2015, João Pessoa, PB. Anais do 17mo Simpósio Brasileiro de Sensoriamento Remoto, João Pessoa, PB: INPE, 2015. p. 5578-5581

Achanccaray, P.; Ayma, V. A.; Jimenez, L.; Garcia, S.; Happ, P.; Feitosa, R. Q.; Plaza, A., *A free software tool for Automatic Tuning of Segmentation Parameters*. South-Eastern European Journal of Earth Observation and Geomatics, vol. 3, pp. 707-712, 2014

Service

Mentor, *SISAY mentoring program* (2017, 2022-2024).
General Secretary, *IEEE Geoscience and Remote Sensing Society Brazil's Chapter* (2015-2016).
Co-organizer, *IEEE GRSS Young Professionals and ISPRS Summer School 2015*.
Reviewer of Journals: *IJRS, PFG, TGRS, J-STARS, GRSL.*