Carlos Cardonha

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Research Interests

Discrete optimization, mathematical programming, and theoretical computer science, with focus on the application of techniques in mixed integer linear programming, combinatorial optimization, and algorithms design to operations research and operations management problems.

Employment

- **University of Connecticut** — **Storrs, CT**
  Assistant Professor — *since August 2019*
  Assistant Professor at the Department of Operations and Information Management (OPIM).
- **IBM Research Brazil** — **São Paulo, Brazil**
  Research Staff Member — *January 2012–August 2019*
  Research Staff Member at the Natural Resources Optimization Group at IBM Research, with focus on the investigation of new methodologies and solution techniques based on data science, discrete optimization and algorithms design for problems in natural resources, transportation, agriculture, education, accessibility, etc.
- **Zuse Institute Berlin** — **Berlin, Germany**
  Visiting Researcher — *April 2007–October 2011*
  Investigation and implementation of advanced solution techniques based on mixed-integer linear programming for the Vehicle Positioning Problem.
- **University of São Paulo** — **São Paulo, Brazil**
  Coach for programming competitions — *2002–2007*
  Worked as coach in the Institute of Mathematics and Statistics for the Brazilian Olympiads in Informatics from 2002 until 2006 and for the ACM International Collegiate Programming Contest from 2006 until 2007.

Education

- **Technische Universität Berlin** — **Berlin, Germany**
  Ph.D. in Mathematics, "Applied Methods for the Vehicle Positioning Problem" — *2007–2011*
  Advisor: Prof. Dr. Martin Gröetschel
- **University of São Paulo** — **São Paulo, Brazil**
  M.Sc. in Computer Science — *2005–2006*
- **University of São Paulo** — **São Paulo, Brazil**
  Bachelor in Computer Science, graduated with Honors — *2001–2004*

Articles in Refereed Journals

[1] Carlos Cardonha, A. Raghunathan, C. Nohra, and D. Bergman. Recursive McCormick linearization of multilinear programs. *INFORMS Journal on Computing (Acceptance Date: November 27, 2024)*, 0(0), 2025.

[2] Carlos Cardonha, A. Cire, and L. Villa Real. Design and analysis of efficient sequencing policies for linear cold storage devices. *Production and Operations Management (Acceptance date: September 13, 2024)*, 0(0), 2025.

[3] K. Wang, L. Lozano, Carlos Cardonha, and D. Bergman. Optimizing over an ensemble of trained neural networks. *INFORMS Journal on Computing (Acceptance date: January 31, 2023)*, 35(3):652–674, 2023.

[4] D. Bergman, Carlos Cardonha, J. Imbrogno, and L. Lozano. Optimizing the expected maximum of two linear functions defined on a multivariate gaussian distribution. *INFORMS Journal on Computing (Acceptance date: October 30, 2022)*, 35(2):304–317, 2023.

[5] Carlos Cardonha, D. Bergman, and R. Day. Maximizing student opportunities for in-person classes under pandemic capacity reductions. *Decision Support Systems (Acceptance date: November 9, 2021)*, 154:113697, 2022.

[6] S. Mehrani, Carlos Cardonha, and D. Bergman. Models and algorithms for the bin packing problem with minimum color fragmentation. *INFORMS Journal on Computing (Acceptance date: July 8, 2021)*, 34(2):1070–1085, 2022.

[7] D. Bergman, M. Bodur, Carlos Cardonha, and A.A. Cire. Network models for multiobjective discrete optimization. *INFORMS Journal on Computing (Acceptance date: December 26, 2020)*, 34(2):990–1005, 2022.

[8] D. Bergman, Carlos Cardonha, A. A. Cire, and A. U Raghunathan. On the minimum chordal completion polytope. *Operations Research*, 67(2):532–547, 2019.

[9] F. Koch, M.D. Assunção, Carlos Cardonha, and M.A.S. Netto. Optimising resource costs of cloud computing for education. *Future Generation Computer Systems*, 55:473–479, 2016.

[10] M.D. Assunção, Carlos Cardonha, M.A.S. Netto, and R.L.F. Cunha. Impact of user patience on auto-scaling resource capacity for cloud services. *Future Generation Computer Systems*, 55:41–50, 2016.

[11] F.L. Koch, M.D. Assuncao, Carlos Cardonha, M.A.S. Netto, and T.T. Primo. An architecture and algorithm for context-aware resource allocation for digital teaching platforms. *IBM Journal of Research and Development*, 59(6):1–1, 2015.

[12] Carlos Cardonha, R.L. Guimaraes, A.B. Mattos, J. Nogima, P.B. Avegliano, D. Gallo, R. Hermann, and S. Borger. Toward a platform to support vocational training of people with disabilities. *IBM Journal of Research and Development*, 59(6):2–1, 2015.

[13] D. Gallo, Carlos Cardonha, P. Avegliano, and T. Carvalho. Taxonomy of citizen sensing for intelligent urban infrastructures. *IEEE Sensors Journal*, 4(12):4154–4164, 2014.

[14] Carlos Cardonha and R. Borndörfer. A set partitioning approach to shunting. *Discrete Applied Mathematics*, 160(18):2636 – 2644, 2012.

Submitted Journal Articles

[1] J. Sylvestre-Decary, D. Bergman, Carlos Cardonha, J. Imbrogno, and A. Lodi. Multi-entry betting strategies for single-elimination sports tournaments. *Major Revision at Production and Operations Management (Decision Date: February 6, 2025).*

[2] Carlos Cardonha and M. Bai. Cardinality constrained knapsack problem with concave piecewise-linear utilities. *INFORMS Journal on Computing (Submission date: February 11, 2025).*

[3] Carlos Cardonha, D. Bergman, A. Cire, L. Lozano, and T. Yunes. The sensitivity of the U.S. presidential election to coordinated voter relocation. *Minor Revision at INFORMS Journal on Computing (Decision date: May 1, 2025).*

Work in Progress

[1] Carlos Cardonha and A. Raghunathan. Coach reservation for group requests. *In Preparation.*

[2] M. Emadikhiav, Carlos Cardonha, D. Bergman, and M. Eftekhar. Workforce scheduling for efficient and equitable access to education. *In Preparation.*

[3] Carlos Cardonha and A. Gruber. Consistent assortment optimization under uncertainty. *In preparation.*

[4] Carlos Cardonha, A. Cire, and A. Diamant. Network-based approaches for two-stage stochastic discrete optimization problems. *In preparation.*

Articles in Refereed Conferences

[1] K. Wang, L. Lozano, D. Bergman, and Carlos Cardonha. A two-stage exact algorithm for optimization of neural network ensemble. In *International Conference on Integration of Constraint Programming, Artificial Intelligence, and Operations Research*, pages 106–114. Springer, 2021.

[2] D. Bergman, Carlos Cardonha, and S. Mehrani. Binary decision diagrams for bin packing with minimum color fragmentation. In *International Conference on AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems*, pages 57–66. Springer, 2019.

[3] M. Vasconcelos, Carlos Cardonha, and B. Gonçalves. Modeling epistemological principles for bias mitigation in AI systems: An illustration in hiring decisions. In *AAAI/ACM Conference on Artificial Intelligence, Ethics, and Society (AIES 2018)*, 2018. (arXiv preprint arXiv:1711.07111).

[4] Carlos Cardonha and L.C.V. Real. Online algorithms for the linear tape scheduling problem. In *Proceedings of the 26th International Conference on Automated Planning and Scheduling (ICAPS)*, pages 70–78, 2016.

[5] A.B. Mattos, R. Herrmann, Carlos Cardonha, D. Gallo, P.B. Avegliano, and S. Borger. Marker-assisted recognition of dynamic content in public spaces. In *Proceedings of the 11th Web for All Conference (W4A)*, page 30. ACM, 2014.

[6] R.L.F. Cunha, M.D. Assunçao, Carlos Cardonha, and M.A.S. Netto. Exploiting user patience for scaling resource capacity in cloud services. In *Cloud Computing (CLOUD), 2014 IEEE 7th International Conference on*, pages 448–455. IEEE, 2014.

[7] M.A.S. Netto, Carlos Cardonha, R.L.F. Cunha, and M.D. Assunçao. Evaluating auto-scaling strategies for cloud computing environments. In *Modelling, Analysis & Simulation of Computer and Telecommunication Systems (MASCOTS), 2014 IEEE 22nd International Symposium on*, pages 187–196. IEEE, 2014.

[8] P. Avegliano and Carlos Cardonha. Investigating the hidden losses caused by out-of-shelf events: a multi-agent-based simulation. In *Proceedings of the 2014 Winter Simulation Conference*, pages 242–251, 2014.

[9] Carlos Cardonha, D. Gallo, P. Avegliano, R. Herrmann, F. Koch, and S. Borger. A crowdsourcing platform for the construction of accessibility maps. In *Proceedings of the 10th international cross-disciplinary conference on web accessibility*, page 26. ACM, 2013.

[10] Carlos Cardonha, R. Herrmann, and P. Avegliano. Theoretical aspects of the integrated route planning problem. In *Proceedings of the 6th International Conference on Management and Control of Production and Logistics*, 2013.

[11] V.F. Cavalcante, Carlos Cardonha, and R.G. Herrmann. A resource constrained project scheduling problem with bounded multitasking. In *Proceedings of the 6th International Conference on Management and Control of Production and Logistics*, 2013.

[12] Carlos Cardonha, M.D. Assunção, M.A.S. Netto, R.L.F. Cunha, and C. Queiroz. Patience-aware scheduling for cloud services: Freeing users from the chains of boredom. In *Service-Oriented Computing*, pages 550–557. Springer, 2013.

[13] F. Koch, Carlos Cardonha, J.M. Gentil, and S. Borger. A platform for citizen sensing in sentient cities. In *Citizen in Sensor Networks*, pages 57–66. Springer Berlin Heidelberg, 2013.

[14] A.M.R. Serrano, J.P.C.L. Costa, Carlos Cardonha, A.A. Fernandes, and R.T. Sousa. Neural network predictor for fraud detection. In *Proceedings of the 7th International Conference on Forensic Computer Science*, 2012.

[15] Carlos Cardonha and R. Borndörfer. A set partitioning approach to shunting. *Electronic Notes in Discrete Mathematics*, 35:359–364, 2009.

[16] Carlos Cardonha, M.K.C. Silva, and C.G. Fernandes. Computacao quantica: Complexidade e algoritmos. In *Jornadas de Iniciação Científica do IMPA*, 2005.

Book Chapters

[1] R. Borndörfer and Carlos Cardonha. A binary quadratic programming approach to the vehicle positioning problem. In *Modeling, Simulation and Optimization of Complex Processes*, pages 41–51. Springer Berlin Heidelberg, 2012.

Extended Abstracts

[1] R. L. Guimarães, A. B. Mattos, and Carlos Cardonha. A comparative study of technology-mediated learning strategies for teaching people with intellectual disability. In *Proceedings of the XVI Simpósio Brasileiro sobre Fatores Humanos em Sistemas Computacionais (IHC 2017)*. ACM, 2017.

[2] Carlos Cardonha, A. B. Mattos, and R. L. Guimarães. A platform to support personalized training of people with disabilities. In *Proceedings of the 13th Web for All Conference*, pages 1–4. ACM, 2016.

[3] R.L. Guimarães, A.B. Mattos, and Carlos Cardonha. Investigating instructional pacing supports for teaching students with intellectual disability. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, pages 2171–2177. ACM, 2016.

[4] N. Sultanum, M. Motta, Carlos Cardonha, and R. Herrmann. Watchboard: curated microblogging for the enterprise. In *CHI'14 Extended Abstracts on Human Factors in Computing Systems*, pages 2107–2112. ACM, 2014.

[5] A.B. Mattos, Carlos Cardonha, D. Gallo, P. Avegliano, R. Herrmann, and S. Borger. Marker-based image recognition of dynamic content for the visually impaired. In *Proceedings of the 11th Web for All Conference*, page 34. ACM, 2014.

[6] M. Molinaro, S. Borger, Carlos Cardonha, D. Gallo, R. Herrmann, A. Ferreira, F. Koch, P. Avegliano, and K. Shigeno. Smarter board: a community-oriented communication tool. In *Proceedings of the 10th International Cross-Disciplinary Conference on Web Accessibility*, page 21. ACM, 2013.

[7] K. Shigeno, S. Borger, D. Gallo, R. Herrmann, M. Molinaro, Carlos Cardonha, F. Koch, and P. Avegliano. Citizen sensing for collaborative construction of accessibility maps. In *Proceedings of the 10th International Cross-Disciplinary Conference on Web Accessibility*, page 24. ACM, 2013.

Academic Awards and Accomplishments

- **Scholarship Facilitation Fund in 2024:** Awarded by the Office of the Vice President for Research (OVPR) at the University of Connecticut for the project "Assortment Optimization under Uncertainty".
- **Innovation in Teaching Award in 2022:** Awarded by the School of Business at the University of Connecticut for redesigning the courses OPIM 3803 (for undergraduates) and OPIM 5641 (for graduates) with Prof. Stephen Fitzgerald and Prof. David Wanik.
- **Excellent in Teaching in 2020:** Rated "excellent in teaching" by students in the Fall semester of 2020.
- **Scholarship Facilitation Fund in 2020:** Awarded by the Office of the Vice President for Research (OVPR) at the University of Connecticut for the project "Online Scheduling for Queuing Systems".
- **IBM Research Outstanding Technical Achievement Award in 2019:** Awarded by the IBM Research Division for scientific contributions to Education and Accessibility.

- **IBM Research Accomplishment in Science in 2018:** Awarded by the IBM Research Division for scientific contributions to Education and Accessibility.
- **IBM Research Technical Achievement Award in Science in 2018:** Awarded by the IBM Research Division for scientific contributions to initiatives in resource management for big data and analytics in cloud computing platforms.
- **IBM Research Accomplishment in Science in 2017:** Contributed to the IBM Research initiative in resource management for big data and analytics in cloud platforms.
- **Honorable Mention for Short Paper:** Award for the article "A comparative study of technology-mediated learning strategies for teaching people with intellectual disability" at the XVI Simpósio Brasileiro sobre Fatores Humanos em Sistemas Computacionais (IHC 2017).
- **IBM Research Outstanding Technical Achievement Award in 2015:** Awarded by the IBM Research Division for technical and innovative contributions to engineering and science.
- **Delegates Prize in the Paciello Group Web Accessibility Challenge:** Best demo prize awarded in 2014 at the 11^{th} Web for All Conference (W4A) for the work "*Marker-based image recognition of dynamic content for the visually impaired*".
- **John Slatin Award for Best Communication Paper:** Best short paper prize awarded in 2013 at the 10^{th} Web for All Conference (W4A) for the work "*A crowdsourcing platform for the construction of accessibility maps*".

Visiting Positions

- **LIP - Inria, ENS de Lyon**, Lyon (France), June 2019.
  Project: *Algorithms for Elasticity of Data Stream Processing Services on Edge Computing Environments*

Research Consulting

- **Mitsubishi Electric Research Laboratories**, External Consultant, March 2023.
  Project: *Develop algorithms for simultaneous seat assignment and pricing in trains.*
- **Mitsubishi Electric Research Laboratories**, External Consultant, February 2024.
  Project: *Develop algorithms for solving general mixed integer programs and applications, including simultaneous seat assignment and pricing in trains.*

Academic Services

- **Associated Editor:** INFORMS Journal on Computing (April 2025 - Present)
- **Services at the University of Connecticut:**
  - OPIM Doctoral student recruiting committee (August 2019 – Present)
  - OPIM Doctoral student qualifying paper committee (August 2020 – July 2022)
  - MSBAPM Committee (August 2023 - July 2024)
  - OPIM Research Seminar Coordinator (with Miao Bai) (August 2024 - Present)

- **Mentorship:**
  - Keliang Wang (Co-Major Advisor) - University of Connecticut (2019 – 2024)
  - Chenbo Shi (Associate Advisor) - University of Connecticut (2019 – 2024)
  - Saharnaz Mehrani (Associate Advisor) - University of Connecticut (2017 – 2021)
  - Teng Huang (Associate Advisor) - University of Connecticut (2014 – 2020)
- **Program Committee Member:** SBIE (2018), CARE (2013-2017), IEEE BigData Congress (2018), SocialEdu (2015-2016), IBERAMIA (2014), SMARTLIFE (2014), AAMAS (2016, 2020), IAAI (2021, 2022), CPAIOR (2022,2023, 2024), AAAI (2023, 2024).
- **Reviewer:** Constraints, European Journal of Operational Research, INFORMS Journal on Computing, Engineering Applications of Artificial Intelligence, Computational and Applied Mathematics, Computers and Operations Research, ACM Transactions on Storage, Service Science, Journal of Computer Languages, SBPO, AAMAS, LAGOS, IJCAI, CPAIOR, LION 10, AAAI, ICMLA.
- **Organization:**
  - Session *Optimization Meets Machine Learning* at the 2023 INFORMS Annual Meeting, Phoenix, AZ, 2023.
  - Mini-symposium *New Algorithmic Techniques for Global Optimization* at the 2023 SIAM Conference on Optimization (OP23), Seattle, WA, 2023.

Teaching Experience

- **OPIM 5641 - Business Decision Modeling:** University of Connecticut
  Graduate course for Master and MBA students (Fall 2019, Spring 2020, Fall 2020, Fall 2021, Spring 2022, Fall 2022, Spring 2023, Fall 2023, Spring 2024, Fall 2024)
- **OPIM 3803 - Spreadsheet Modeling for Business Analysis:** University of Connecticut
  Undergraduate course (Spring 2020, Fall 2020)
- **OPIM 3511 - Business Data Analytics II:** University of Connecticut
  Undergraduate course (Spring 2025)

Selected Talks

- INFORMS Annual Meeting 2024. *Consistent assortment optimization under uncertainty*. Seattle, WA, October 2024.
- International Symposium in Mathematical Programming (ISMP 2024). *Consistent assortment optimization under uncertainty*. Montreal (Canada), July 2024.
- Production and Operations Management (POMS International 2024). *Consistent assortment optimization under uncertainty*. Istanbul (Turkey), June 2024.
- INFORMS Annual Meeting 2023. *Consistent assortment optimization under uncertainty*. Phoenix, AZ, October 2023.
- Production and Operations Management (POMS International 2023). *Cardinality-constrained continuous knapsack problem with concave piecewise-linear utilities*. Paris (France), July 2023.
- INFORMS Revenue Management and Pricing (RMP 2023). *Consistent assortment optimization under uncertainty*. London (England), July 2023.

- INFORMS Manufacturing & Service Operations Management (MSOM 2023). *Cardinality-constrained continuous knapsack problem with concave piecewise-linear utilities*. Montreal (Canada), June 2023.
- SIAM Conference on Optimization (OP23). *Recursive McCormick Linearization of Multilinear Programs*. Seattle, WA, June 2023.
- INFORMS Annual Meeting 2022. *Minimum Recursive Mccormick Linearization of Multilinear Programs*. Indianapolis, IN, October 2022.
- INFORMS Computing Society Conference 2022. *Network Models for Multiobjective Discrete Optimization*. Tampa, FL, January 2022.
- ACP Winter School on Decision Diagrams for Optimization, Invited Speaker. *Network Models for Multiobjective Discrete Optimization*. Online, December 2021.
- INFORMS Annual Meeting 2021. *Appointment Scheduling with Customer Preferences and Service Constraints*. Online Conference, October 2021.
- INFORMS Annual Meeting 2020. *Optimization for Maximizing the Expected Value of Order Statistics*. Online Conference, November 2020.
- University of Massachusetts Amherst, Invited Speaker (Discrete Math Seminar). *Optimization for Maximizing the Expected Value of Order Statistics*. Amherst, MA, December 2019.
- INFORMS Annual Meeting 2019. *Stochastic Task Scheduling with Heterogeneous Agents*. Seattle, WA, October 2019.
- LIP - Inria, ENS de Lyon, Invited Speaker. *Online scheduling in magnetic tapes*. Lyon (France), June 2019.
- Ninth International Workshop on Accelerating Analytics and Data Management Systems Using Modern Processor and Storage Architectures, Keynote Speaker. *Quantum Computing and IBM Q: An Introduction*. Rio de Janeiro (Brazil), August 2018.
- International Symposium on Mathematical Programming (ISMP 2018). *Network models for multiobjective discrete optimization*, Bordeaux (France), June 2018.
- LIP - Inria, ENS de Lyon, Invited Speaker. *Network Models for Multiobjective Discrete Optimization*. Lyon (France), June 2018.
- First Workshop Think Tank Brasil em Informática na Educação, Invited Speaker. *IBM Watson e a Informática na Educação*. Recife (Brazil), October 2017.
- IFORS 2017. *Online Algorithms for the Linear Tape Scheduling Problem*. Quebec City (Canada), July 2017.
- ICAPS 2016. *Online Algorithms for the Linear Tape Scheduling Problem*. London (England), 2016.
- International Symposium on Mathematical Programming (ISMP 2015). *The Online Resource Constrained Project Scheduling Problem with Bounded Multitasking*, Pittsburgh, PA, July 2015.
- IFORS 2014. *The Online Resource Constrained Project Scheduling Problem with Bounded Multitasking*. Barcelona (Spain), July 2014.
- Tenth International Cross-Disciplinary Conference on Web Accessibility. *A Crowdsourcing Platform for the Construction of Accessibility Maps*. Rio de Janeiro (Brazil), May 2013.
- International Symposium on Mathematical Programming (ISMP 2012). *A fast solution method applied to the vehicle positioning problem and its multi-periodic, online, and robust extension*, Berlin (Germany), August 2012.
- International Symposium on Mathematical Programming (ISMP 2009). *A Nonlinear Approach to the Vehicle Positioning Problem*, Chicago, IL, August 2009.
- Fourth International Conference on High Performance Scientific Computing. *A Binary Quadratic*

Programming Approach to the Vehicle Positioning Problem. Hanoi (Vietnam), March 2009.

Other Awards and Accomplishments

- **IBM Technical Leadership Council Member:** Joined in 2018 the group responsible for providing technical leadership to initiatives conducted at IBM Brazil.
- **IBM Quantum Ambassador:** Nomination in 2018 for role restricted to a selected group of individuals authorized to speak on behalf of IBM about quantum computing.
- **IBM Master Inventor:** Valid for 3 years, this title is granted by IBM to strong contributors to its portfolio of patents (64 filed as of September 2020, with 29 granted). The first appointment started in January 2016 and a new one started in January 2019.
- **IBM Client Value Outstanding Technical Achievement Award in 2014:** Recognition given by the IBM Corporation for technical and innovative contributions in client-facing engagements.
- **Silver Medal for Undergraduate-level work:** Silver medal awarded in 2004 at the first Jornadas de Iniciação Científica, organized by the Instituto Nacional de Matemática Pura e Aplicada, with the work "*Computação Quântica: Complexidade e Algoritmos*".
- **Gold medal in the ACM ICPC South America Regional 2006:** Coach of the team who won a gold medal in the regional competition and got the 26^{th} position in the ACM-ICPC World Finals 2007.
- **Champion of the Java Challenge in the ACM ICPC World Finals 2002:** First place in a competition involving all teams participating in the ACM ICPC World Finals 2002.
- **Medals at the ICPC South America Regional 2002-2005:** One bronze medal, two silver medals, and one gold medal in the competition.
- **Champion of the ICPC South America Regional 2001:** First place in a competition involving 129 teams representing 74 universities.
- **Gold medal in the Brazilian Olympiad in Informatics 2001:** Competition with 350+ participants.

Patents

[1] A.P. Appel, H.C.S.P Candello, Carlos Cardonha, and M.A. Vasconcelos. Delivering personalized advertising, 2017. US Patent App. 15/399036.

[2] A.Y. Aravkin, Carlos Cardonha, S.P. Caskey, D. Kanevsky, and T.N. Sainath. System and method for generating content corresponding to an event, 2016. US Patent 10,180,974.

[3] P.B. Avegliano, S.C.S. Bianchi, Carlos Cardonha, and V.F. Santana. Detecting fraudulent mobile payments, 2015. US Patent 10,282,728.

[4] P.B. Avegliano, A.P.D. Binotto, Carlos Cardonha, R.L. Guimaraes, and L.C.V. Real. Dynamically generating and delivering sequences of personalized multimedia content, 2017. US Patent App. 15/460,566, 15/818,831.

[5] P.B. Avegliano, A.P.D. Binotto, Carlos Cardonha, L.C.V. Real, and R.L. Guimaraes. Cognitive system and method for dynamically generating flash sales based on the assessment of queue size and customer emotional state, 2018. US Patent App. 15/909024.

[6] P.B. Avegliano, S. Borger, Carlos Cardonha, D.S. Gallo, R.G. Herrmann, C. Kawabata, and D.A. Mattos, A.B.and Da Silva. Mobile device based inventory management and sales trends analysis in a retail environment, 2023. US Patent 11,593,821.

[7] P.B. Avegliano, Carlos Cardonha, D.S. Gallo, and R.G. Herrmann. Determining vehicle occupancy using sensors, 2018. US Patent 9,928,667.

[8] P.B. Avegliano, Carlos Cardonha, D.S. Gallo, and J. Nogima. Mobile device to device communications for privacy-preserved retrieval of contextualized mobile device data, 2017. US Patent 9,578,512.

[9] P.B. Avegliano, Carlos Cardonha, R.L. Guimaraes, A.B.M. Lima, and J. Nogima. System and method for automatic identification of review material, 2015. US Patent App. 20,170,180,508 A1.

[10] P.B. Avegliano, Carlos Cardonha, R.G. Herrmann, and D.S. Gallo. Determining vehicle occupancy using sensors, 2015. US Patent 10,719,996.

[11] P.B. Avegliano, Carlos Cardonha, R.G. Herrmann, and D.S. Gallo. Reducing waiting time for activities at a venue, 2015. US Patent App. 20,170,178,084 A1.

[12] P.B. Avegliano, Carlos Cardonha, F.L. Koch, and T. Imamichi. Recommendation engine based on a representation of the local environment augmented by citizen sensor reports, 2015. US Patent App. 20,150,348,407.

[13] P.B. Avegliano, Carlos Cardonha, A.B.M. Lima, and D.S. Gallo. Restocking shelves based on image data, 2015. US Patent App. 20,170,193,430 A1.

[14] P.B. Avegliano, Carlos Cardonha, A.B.M. Lima, and D.A.B Oliveira. Online utility-driven spatially-referenced data collector for classification, 2022. US Patent 11,267,128.

[15] P.B. Avegliano, Carlos Cardonha, A.B.M. Lima, L.C.V. Real, and V.F. Santana. Image-based encoding, 2021. US Patent 11,172,700.

[16] P.B. Avegliano, Carlos Cardonha, S. Mazon, and J. Nogima. Multimodal speech recognition for real-time video audio-based display indicia application, 2018. US Patent 9,959,872.

[17] P.B. Avegliano, Carlos Cardonha, M.A.S. Netto, L.C.V. Real, and V.F. Santana. Crowdsourcing big data transfer, 2021. US Patent 10,958,708.

[18] P.B. Avegliano, Carlos Cardonha, and J. Nogima. Disease prediction and prevention using crowdsourced reports of environmental conditions, 2019. US Patent 10,318,875 and 10,958,708.

[19] P.B. Avegliano, Carlos Cardonha, L.C.V. Real, and V.F. Santana. Using computer vision to support manufacturing processes and origin validation, 2018. US Patent App. 16/244196.

[20] P.B. Avegliano, Carlos Cardonha, L.C.V. Real, and V.F. Santana. Dynamic assignment of tasks to internet connected devices, 2023. US Patent 11,694,139.

[21] P.B. Avegliano, Carlos Cardonha, L.C.V. Real, and J.M.B. Santos. Optimal calendar organization for groups, 2018. US Patent App. 15/988520.

[22] P.B. Avegliano, Carlos Cardonha, M.P. Viana, and L.C.V. Real. Wearable device for automated construction of training plans and method of using the same, 2020. US Patent 10,600,509.

[23] M.P.M.A. Bayser, S.C.S. Bianchi, Carlos Cardonha, P.R. Cavalin, M.G. Bayser, L.G. Moyano, V.G. Santana, M.N. Santos, V.C.V.B. Segura, and B. Zadrozny. Managing item life-cycle at home with internet of things, 2015. US Patent App. 14/953,838.

[24] A. Beloglazov, Carlos Cardonha, C. Guttmann, F.L. Koch, J. Richter, and K. Steer. Contextualized fair ranking of citizen sensor reports, 2015. US Patent App. 20,150,324,871.

[25] Alecio Binotto, Carlos Cardonha, Jose Spagnuolo, and Samir Palma. Cognitive evaluation of sensor environments and resource allocation, 2023. US Patent 11,645,598.

[26] S. Borger, Carlos Cardonha, and F.L. Koch. Mobile device message enabled on-line community bulletin board, 2013. US Patent 9,571,443 B2.

[27] S. Borger, Carlos Cardonha, and F.L. Koch. Intermediated data entry in a shared message board through a mobile computing device, 2016. US Patent 9,485,637.

[28] S. Borger, Carlos Cardonha, F.L. Koch, and J.M.P. Ientile. Assigning priority levels to citizen sensor reports, 2015. US Patent App. 20,150,302,425.

[29] S. Borger, Carlos Cardonha, F.L. Koch, and A.F. Silva. Prioritizing video surveillance media, 2016. US Patent App. 20,160,196,268 A1.

[30] S. Borger, Carlos Cardonha, A.F. Silva, and F.L. Koch. Self-rousing surveillance system, method and computer program product, 2015. US Patent App. 20,150,312,535.

[31] Carlos Cardonha, R.L.F. Cunha, V.H.L Mesquita, and E.R. Rodriguez. Automated generation of scheduling algorithms based on task relevance assessment, 2017. US Patent 10,620,993.

[32] Carlos Cardonha, M.D. De Assuncao, R.L. Cunha, and M.A.S. Netto. Auto-scaling thresholds in elastic computing environments, 2016. US Patent 9,513,935.

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