Willian Tessaro Lunardi

Lead Research Scientist at TII

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Summary

Lead Research Scientist with a Ph.D. in Computer Science from the University of Luxembourg. Specialized in machine learning, deep learning, combinatorial optimization, and out-of-distribution detection. Have a proven track record of developing advanced algorithms and models in both academic and industry settings.

Education

- **University of Luxembourg** — Luxembourg, Luxembourg
  Doctor of Philosophy in Computer Science — 2016 – 2020
- **PUC of Rio Grande do Sul** — RS, Brazil
  Master of Science in Computer Science — 2014 – 2016
- **University of Passo Fundo** — RS, Brazil
  Bachelor of Science in Computer Science — 2010 – 2014

Experience

- **Technology Innovation Institute**, *Lead Researcher* — Abu Dhabi, UAE, Jan 2023 – Present
- **Technology Innovation Institute**, *Senior Researcher* — Abu Dhabi, UAE, Jun 2021 – Jan 2023
  - Developed self-supervised (contrastive) methods for learning one-class representations for out-of-distribution detection.
  - Developed adversarial training regularization approach for enhancing autoencoder performance for network anomaly detection.
  - Developed voice recognition solutions using contrastive learning and spectrograms, improving accuracy on audio datasets.
- **University of Luxembourg**, *Research Associate* — Luxembourg, Luxembourg, Jun 2020 – Jun 2021
  - Developed neural combinatorial optimization strategies using graph networks and reinforcement learning.
  - Developed an out-of-distribution detection methods for predictive maintenance using autoencoders.
  - Developed metaheuristics for vehicle routing, optimizing routing and scheduling with coverage and energy constraints.
  - Deployed scheduling and routing algorithms in C++ for a European company, boosting operational efficiency.
- **University of Luxembourg**, *Doctoral Researcher* — Luxembourg, Luxembourg, Jun 2016 – Jun 2020
  - Developed MILP and CP models for industrial scheduling, addressing complex availability, overlapping, and setup constraints.
  - Developed novel hybrid neighborhood functions and global metaheuristics, achieving SOTA results in the FJSP problem.
  - Developed SOTA optimization algorithms, validated by publications in 10+ international conferences and journals.
  - Collaborated IBM Paris implementing models in real-world settings, enhancing production and revenue.

Skills

- **Programming Languages:** Python, C++, Javascript, C#, and Java.
- **Frameworks:** PyTorch, Scikit-learn, SciPy, Numpy, Pandas, among others.
- **Others:** OpenMP, Boost (C++), Unity 3D (C#), p5js (JS), processing (Java).

Additional Information

- **Dual Citizenship:** Brazil and Italy.
- **Languages:** Portuguese (native), English (fluent), Spanish (basic), and Italian (basic).

Research Interests

Machine Learning, Deep Learning, Out-of-Distribution Detection, Optimization, Operations Research, Representation Learning, Generative AI, Self-supervised Learning, Unsupervised Learning.

Highlighted Publications

[2023] **W. T. Lunardi**, M. A. Lopez, and J.-P. Giacalone, "ARCADE: Adversarially Regularized Convolutional Autoencoder for Network Anomaly Detection," *IEEE Transactions on Network and Service Management, Special Issue on Machine Learning and Artificial Intelligence*, vol. 20, no. 2, pp. 1305–1318, 2023, [URL].

[2021] **W. T. Lunardi**, E. G. Birgin, D. P. Ronconi, *et al.*, "Metaheuristics for the Online Printing Shop Scheduling Problem," *European Journal of Operational Research*, vol. 293, no. 2, pp. 419–441, 2021, [URL].

[2020] **W. T. Lunardi**, E. G. Birgin, P. Laborie, *et al.*, "Mixed Integer Linear Programming and Constraint Programming Models for the Online Printing Shop Scheduling Problem," *Computers & Operations Research*, vol. 123, p. 105 020, 2020, [URL].

Other Publications

[2022] A. R. B. Nabila, E. K. Viegas, and **W. T. Lunardi**, "A Generative Adversarial Network-based Attack for Audio-based Condition Monitoring Systems," in *Proceedings of the IEEE Consumer Communications & Networking Conference*, 2022, [URL].

[2022] A. S. Ali, **W. T. Lunardi**, L. Bariah, *et al.*, "Deep Reinforcement Learning Based Anti-Jamming Using Clear Channel Assessment Information in a Cognitive Radio Environment," in *Proceedings of the IEEE International Conference on Advanced Communication Technologies and Networking*, 2022, [URL].

[2022] A. S. Ali, M. Baddeley, L. Bariah, *et al.*, "JamRF: Performance Analysis, Evaluation, and Implementation of RF Jamming Over Wi-Fi," *IEEE Access*, vol. 10, pp. 133 370–133 384, 2022, [URL].

[2022] A. S. Ali, M. Baddeley, L. Bariah, *et al.*, "Performance Analysis and Evaluation of RF Jamming in IoT Networks," in *Proceedings of the IEEE Global Communications Conference*, 2022, [URL].

[2021] M. A. Lopez, M. Baddeley, **W. T. Lunardi**, *et al.*, "Towards Secure Wireless Mesh Networks for UAV Swarm Connectivity: Current Threats, Research, and Opportunities," in *Proceedings of the IEEE International Conference on Distributed Computing in Sensor Systems*, 2021, [URL].

[2019] **W. T. Lunardi**, H. Voos, and L. H. Cherri, "An Effective Hybrid Imperialist Competitive Algorithm and Tabu Search for an Extended Flexible Job Shop Scheduling Problem," in *Proceedings of the ACM Symposium on Applied Computing*, 2019, [URL].

[2019] H. de Faria Jr, **W. T. Lunardi**, and H. Voos, "A Parallel Multi-Population Biased Random-Key Genetic Algorithm for Electric Distribution Network Reconfiguration," in *Proceedings of the ACM Genetic and Evolutionary Computation Conference*, 2019, [URL].

[2018] **W. T. Lunardi** and H. Voos, "An Extended Flexible Job Shop Scheduling Problem with Parallel Operations," *ACM SIGAPP Applied Computing Review*, vol. 18, no. 2, pp. 46–56, 2018, [URL].

[2018] **W. T. Lunardi**, H. Voos, and L. H. Cherri, "An Imperialist Competitive Algorithm for a Real-World Flexible Job Shop Scheduling Problem," in *Proceedings of the IEEE International Conference on Emerging Technologies & Factory Automation*, 2018, [URL].

[2018] **W. T. Lunardi**, L. H. Cherri, and H. Voos, "A Mathematical Model and a Firefly Algorithm for an Extended Flexible Job Shop Problem with Availability Constraints," in *Proceedings of the Springer International Conference on Artificial Intelligence and Soft Computing*, 2018, [URL].

[2018] **W. T. Lunardi** and H. Voos, "Comparative Study of Genetic and Discrete Firefly Algorithm for Combinatorial Optimization," in *Proceedings of the ACM Annual Symposium on Applied Computing*, 2018, [URL].

[2016] **W. T. Lunardi**, L. Amaral, S. Marczak, *et al.*, "Automated Decision Support IoT Framework," in *Proceedings of the IEEE International Conference on Emerging Technologies & Factory Automation*, 2016, [URL].

[2016] L. A. Amaral, E. De Matos, R. T. Tiburski, *et al.*, "Middleware Technology for IoT Systems: Challenges and Perspectives Toward 5G," in *Internet of Things (IoT) in 5G Mobile Technologies*. Springer, 2016, pp. 333–367, [URL].

[2015] **W. T. Lunardi**, E. de Matos, R. Tiburski, *et al.*, "Context-Based Search Engine for Industrial IoT: Discovery, Search, Selection, and Usage of Devices," in *Proceedings of the IEEE Conference on Emerging Technologies & Factory Automation*, 2015, [URL].

[2015] E. de Matos, **W. Lunardi**, L. Amaral, *et al.*, "Context-Based Framework for the Discovery, Search, and Selection of Computing Devices in the Internet of Things," in *Proceedings of the SBC Integrated Software and Hardware Seminar*, 2015, [URL].

[2015] E. de Matos, L. A. Amaral, R. Tiburski, *et al.*, "Context-Aware System for Information Services Provision in the Internet of Things," in *Proceedings of the IEEE Conference on Emerging Technologies & Factory Automation*, 2015, [URL].

Work in Progress & Submitted Publications

[2023] **W. T. Lunardi**, S. Shrestha, and M. L. Andreoni, "Hierarchical Contrastive Learning of Time Series for Out-of-Distribution Detection with Outlier Exposure," 2023, Work in progress.

[2023] M. Gallacher, **W. T. Lunardi**, C. A. Boano, *et al.*, "Voice Authentication on Resource-Constrained Devices," 2023, Work in progress.

[2023] D. Herzalla, **W. T. Lunardi**, and M. A. Lopez, "TII-SSRC-23 Dataset: Typological Exploration of Diverse Traffic Patterns for Intrusion Detection," *IEEE Access*, 2023, Submitted for publication.

[2023] A. S. Ali, G. Singh, **W. T. Lunardi**, *et al.*, "RF Jamming Dataset: A Wireless Spectral Scan Approach for Malicious Interference Detection," *IEEE Communications Magazine*, 2023, Submitted for publication.