



## Alejandro Agostini

### PI Austrian Science Fund (FWF) project

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### Short Biography

- Since 2019. Principal Investigator. Austrian Science Fund (FWF) projects. University of Innsbruck, Austria.
- 2019-2021. Group Leader. Department of Electrical and Computer Engineering, Technical University of Munich, Germany.
- 2011-2018. Group Leader. Bernstein Center for Computational Neuroscience, University of Göttingen, Germany.
- 2011. PhD in Artificial Intelligence. Polytechnic University of Catalonia, Spain.
- 2005-2011. Graduate Research Position. Spanish Research Council.
- 2008. Eng. Degree in Electronic Engineering. Polytechnic University of Catalonia, Spain.
- 2003-2005. Graduate Research Grant. Spanish Research Council.
- 2004. Dipl. in Informatics. Polytechnic University of Catalonia, Spain.
- 2002-2003. Graduate Research Grant. Polytechnic University of Catalonia, Spain.
- 2001-2002. Head of Department and Deputy Director. Health Care Ministry of Salta, Argentina.
- 2000-2001. Private Consultant to the Health Minister. Health Care Ministry of Salta, Argentina.
- 1999. Eng. Degree in Bioengineering. National University of Entre Rios, Argentina.

### Research Interests

My current field of research covers machine learning in robotics, combined task and motion planning, reinforcement learning, and cognitive systems for life science applications.

## Projects

- **ABSTRACTRON** (EUREGIO Project). Conceptual Abstraction in Humans and Robots. 2024 - 2027.
- **PURSUIT** (Principal Investigator FWF Project). Purposeful Signal-symbol Relations for Manipulation Planning. 2023 - 2026.
- **SEAROCO** (Lise Meitner FWF Project). Seamless Levels of Abstraction for Robot Cognition. 2019 - 2023.
- **ALAIVE** (Innovation Project - SNIC). Automatic Control of Living Systems using Artificial Intelligence and Advanced Sensing. 2018 - 2019.
- **RECONCELL** (FoF EU Project). A Reconfigurable Robot Work-cell for Fast Set-up of Automated Assembly Processes in SMEs. 2015 - 2019.
- **XPERIENCE** (IP EU Project). Robots Bootstrapped through Learning from Experience. 2011 - 2016.
- **INTELLACT** (STREP EU Project). Intelligent Observation and Execution of Actions and Manipulations. 2011 - 2014.
- **GARNICS** (STREP EU Project). Gardening with a Cognitive System. 2010 - 2013.
- **PACO-PLUS** (IP EU Project). Perception, Action, and Cognition through learning Object-Action Complexes. 2006 - 2010.
- **SIRVENT** (CSIC). Reconfigurable System for Vision Based Navigation of Legged and Wheeled Robots in Natural Environments. 2003 - 2006.
- **CARREL** (UPC, Puigvert Foundation and Hospital Santa Creu i Sant Pau). Development of multi-agent architecture for intelligent management of organs and tissues for transplantation. 2002 - 2003.

## Teaching

- [Machine Learning](#). University of Innsbruck. SoSe 2022.
- Machine Learning in Robotics. Technical University of Munich. SoSe 2020-2021.
- Reinforcement Learning for Robotics. Technical University of Munich. WS 2019-2020.
- Advanced Seminar Autonomous System. Technical University of Munich. WS 2019-2020. SoSe 2020.
- Project Laboratory Human-centered Robotics. Technical University of Munich. WS 2019-2020.
- Mathematics II. National University of Entre Ríos, Argentina. SoSe and WS 1997.

## Publications

### Journal Articles

1. Paulius\*, D., Agostini\*, A., Lee, D. (2023). [Long-Horizon Task and Motion Planning with Functional Object-Oriented Networks](#). (\*) Co-first author. IEEE Robotics and Automation Letters, 8(8), 4513-4520. DOI: 10.1109/LRA.2023.3285510.
2. Agostini, A., Saveriano, M., Lee, D., Piater, J. (2020). [Manipulation Planning Using Object-Centered Predicates and Hierarchical Decomposition of Contextual Actions](#). IEEE Robotics and Automation Letters, 5(4), 5629-5636. DOI: 10.1109/LRA.2020.3009063.
3. Lüddecke, T., Agostini, A., Fauth, M., Tamosiunaite, M., Wörgötter, F. (2019). [Distributional Semantics of Objects in Visual Scenes in Comparison to Text](#). Artificial Intelligence, 274, 44-65. DOI:10.1016/j.artint.2018.12.009. Elsevier.
4. Freudenberg, M., Nölke, N., Agostini, A., Urban, K., Wörgötter, F., Kleinn, C. (2019). [Large Scale](#)

- [Palm Tree Detection in High Resolution Satellite Images using U-Net](#). Remote Sensing, 11(3), 312. DOI: 10.3390/rs11030312. MDPI.
5. Agostini, A., Torras, C., Wörgötter, F. (2017). [Efficient Interactive Decision-making Framework for Robotic Applications](#). Artificial Intelligence, 247:187–212. DOI: 10.1016/j.artint.2015.04.004. Elsevier.
  6. Agostini, A., Celaya, E. (2017). [Online Reinforcement Learning Using a Probability Density Estimation](#). Neural Computation, 220-246, 29, 1. DOI: 10.1162/NECO\_a\_00906. MIT Press.
  7. Agostini, A., Alenya, G., Fischbach, A., Scharr, H., Wörgötter, F., and Torras, C. (2017). [A Cognitive Architecture for Automatic Gardening](#). Computers and Electronics in Agriculture, 69–79, 138. DOI: 10.1016/j.compag.2017.04.015. Elsevier.
  8. Celaya, E., Agostini, A. (2015). [Online EM with Weight-Based Forgetting](#). Neural Computation, 1142 - 1157, 27, 5. DOI: 10.1162/NECO\_a\_00723. MIT Press.
  9. Agostini, A., Torras, C., Wörgötter, F. (2014). [Learning Weakly Correlated Cause-effects for Gardening with a Cognitive System](#). Engineering Applications of Artificial Intelligence, 178-194, 36. DOI: 10.1016/j.engappai.2014.07.017. Elsevier.
  10. Krüger, N., Piater, J., Geib, C., Petrick, R., Steedman, M., Wörgötter, F., Ude, A., Asfour, T., Kraft, D., Omrcen, O., Agostini, A., and Dillmann, R. (2011). [Object-Action Complexes: Grounded Abstractions of Sensorimotor Processes](#). Robotics and Autonomous Systems, 740 - 757, 59, 10. DOI: 10.1016/j.robot.2011.05.009. Elsevier.
  11. Wörgötter, F., Agostini, A., Krüger, N., Shylo, N., Porr, B. (2009). [Cognitive Agents - A Procedural Perspective relying on the Predictability of Object-Action-Complexes](#). Robotics and Autonomous Systems. Volume 57, Issue 4. pp. 420-432. DOI: 10.1016/j.robot.2008.06.011. Elsevier.

## Refereed Conference Papers

1. Paulius, D., Agostini, A., and Konidaris, G (2024). [From Language to Action with Object-level Planning](#). In 2nd CoRL Workshop on Learning Effective Abstractions for Planning.
2. Orbik, J., Agostini, A., and Lee, D (2021). [Inverse Reinforcement Learning for Dexterous Hand Manipulation](#). In: IEEE International Conference on Development and Learning (ICDL). pp. 1-7. DOI: 10.1109/ICDL49984.2021.9515637. IEEE.
3. Urbaniak, D., Agostini, A., and Lee, D (2021). [Combining Task and Motion Planning using Policy Improvement with Path Integrals](#). In: IEEE International Conference on Humanoid Robots (HUMANOIDS). pp. 149-155. DOI: 10.1109/HUMANOIDS47582.2021.9555684. IEEE.
4. Paulius, D., Agostini, A., Sun, Y., and Lee, D. (2021). [A Road-map to Robot Task Execution with the Functional Object-Oriented Network](#). International Conference on Ubiquitous Robots (UR). WIP.
5. Agostini, A., Wörgötter, F. (2019). [Automatic Control of the Growth of Plants using Artificial Intelligence and Internet Technology](#). In: Poster Proceedings of the 12th European Conference on Precision Agriculture (ECPA). pp. 12-13. SupAgro Montpellier. ISBN 978-2-900792-49-0.
6. Mustafa, W., Waechter, M., Szedmak, S., Agostini, A., Kraft, D., Asfour, T., Piater, J., Wörgötter, F., and Krüger, N. (2016). [Affordance Estimation for Vision-Based Object Replacement on a Humanoid Robot](#). Proceedings of 47st Int. Symposium on Robotics (ISR), pp. 164-172.
7. Agostini, A., Aein, M.J., Szedmak, S., Aksoy, E.E., Piater, J., Wörgötter, F. (2015). [Using Structural Bootstrapping for Object Substitution in Robotic Executions of Human-like Manipulation Tasks](#). IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS), 6479-6486. DOI: 10.1109/IROS.2015.7354303. IEEE.
8. Quack, B., Wörgötter, F., Agostini, A. (2015). [Simultaneously Learning at Different Levels of Abstraction](#). IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 4600-4607. DOI: 10.1109/IROS.2015.7354032. IEEE.
9. Agostini, A., Torras, C., Wörgötter, F. (2011). [Integrating Task Planning and Interactive Learning for Robots to Work in Human Environments](#). International Joint Conference on Artificial

- Intelligence (IJCAI), pp. 2386-2391. AAAI Press.
10. Agostini, A. and Celaya, E. (2011). [A Competitive Strategy for Function Approximation in Reinforcement Learning](#). International Joint Conference on Artificial Intelligence (IJCAI), pp. 1146-1151. AAAI Press.
  11. Agostini, A. and Celaya, E. (2010). [Reinforcement Learning for Robot Control Using Probability Density Estimations](#). Proc. of the 7th International Conference on Informatics in Control, Automation and Robotics (ICINCO), pp. 160-168.
  12. Agostini, A. and Celaya, E. (2010). [Reinforcement Learning with a Gaussian Mixture Model](#). International Joint Conference on Neural Networks (IJCNN), pp. 3485-3492. DOI: 10.1109/IJCNN.2010.5596306. IEEE.
  13. Agostini, A. and Celaya, E. (2009). [Exploiting Domain Symmetries in Reinforcement Learning with Continuous State and Action Spaces](#). Int. Conf. on Machine Learning and Applications (ICMLA), pp. 331-336. IEEE.
  14. Agostini, A. and Celaya, E. and Torras, C. and Wörgötter, F. (2008). [Action Rule Induction from Cause-Effect Pairs Learned through Robot-Teacher Interaction](#). International Conference on Cognitive Systems (COGSYS), pp. 213-218.
  15. Agostini, A. and Celaya, E. (2005). [Feasible Control of Complex Systems using Automatic Learning](#). Proc. of the 2nd International Conference on Informatics in Control, Automation and Robotics (ICINCO), pp. 284-287.
  16. Agostini, A. and Celaya, E. (2004). [Learning Model-Free Motor Control](#). Proc. of the 16th European Conference on Artificial intelligence (ECAI), pp. 947-948.
  17. Agostini, A. and Celaya, E. (2004). [Trajectory Tracking Control of a Rotational Joint using Feature-Based Categorization Learning](#). IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS), pp. 3489-3494. IEEE.
  18. Agostini, A. and Celaya, E. (2004). [Learning in Complex Environments with Feature-Based Categorization](#). In Proc. of the 8th Conference on Intelligent Autonomous Systems (IAS), pp. 446-455.
  19. Agostini, A. and Celaya, E. (2004). [Applying Categorization to Improve Learning in Complex Environments](#). 1a Jornada de Recerca en Automàtica, Visió i Robòtica: 263-268.
  20. Rollón, E., Isern D., Agostini, A., and Cortes, U. (2003). [Towards the distributed management of emergencies: forest fires case study](#). Workshop on Environmental Decision Support Systems. International Joint Conference on Artificial Intelligence (IJCAI), pp. 77-82. AAAI press.
  21. Agostini, A. (2002). [Multiagent System for an Intelligent Domiciliary Monitoring of Patients with Cardiovascular Pathologies](#) (in Spanish). Open Discussion Track. Proceedings of the VIII Iberoamerican Conference on Artificial Intelligence (IBERAMIA), pp. 205-210.
  22. Agostini, A. and Barreiro, J. (2001). New Hospital El Milagro: Model for the Private Management in the Public Health. In proceedings of the VII Jornadas Internacionales de Ingeniería y Mantenimiento Hospitalario. FIUNER.
  23. Agostini, A., Gamero, L., and Rumi, P. (2000). [Clinical Application of the Matlab Toolbox VFCLab for the Analysis of the Heart Rate Variability](#) (in Spanish). In Proc. of the XVII Brazilian Conference in Biomedical Engineering (CBEB).
  24. Agostini, A., Gamero, L., and Rumi, P. (1999). [VFCLab: Matlab Toolbox for the Analysis of the Heart Rate Variability](#) (in Spanish). In Proc. of the XII Argentinean Conference of Bioengineering (SABI).

## Other Publications

1. Agostini, A., & Lee, D. (2020). [Efficient state abstraction using object-centered predicates for manipulation planning](#). arXiv preprint arXiv:2007.08251.
2. Agostini, A. PLANTAR: Automatic control of the growth of plants using artificial intelligence and Internet Technology (2018). URL: <https://alaive.github.io/agriculture.html>. Accessed:

- 2022-11-01. Technology transference prototype. ALAIVE, Südniedersachsen Innovations Campus (SNIC).
3. Agostini, A. HRV2: Internet Platform for the Intelligent Monitoring of Cardiovascular Patients using Wearable Technology (2015). URL: <https://alaive.github.io/healthcare.html>. Accessed: 2022-11-01. Technology transference prototype. ALAIVE, Südniedersachsen Innovations Campus (SNIC).
  4. Agostini, A. and Celaya, E. (2014). [Competitive function approximation for reinforcement learning](#). Technical report, IRI-TR-14-05. Institut de Robòtica i Informàtica Industrial. UPC-CSIC. (Barcelona, Spain).
  5. Agostini, A., Wörgötter, F., Celaya, E., and Torras, C. (2008). [On-line learning of macro planning operators using probabilistic estimations of cause-effects](#). Technical report, IRI-TR 05/2008. Institut de Robòtica i Informàtica Industrial. UPC-CSIC. (Barcelona, Spain).

## Theses

1. Agostini, A. (2011). [Q-Learning with a Degenerate Function Approximation](#). Polytechnic University of Catalonia (UPC), Spain. PhD Thesis.
2. Agostini, A. (1999). [Mathematical Analysis of the Heart Rate Variability and Its Clinical Implications](#) (in Spanish). National University of Entre Ríos. Eng. Degree Thesis.

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