

Jamal Toutouh, PhD

Associate Professor (Tenured) of Computer Science, University of Málaga (Spain)
Research Collaborator, MIT Computer Science and Artificial Intelligence Laboratory (CSAIL)

jamal@uma.es
www.jamal.es

ORCID: 0000-0003-1152-0346
Scopus Author ID: 35362760300

Research Profile

Artificial Intelligence and Machine Learning researcher developing evolutionary and co-adaptive methods for learning systems composed of interacting models, populations, or agents. My research investigates how such systems can learn robustly, efficiently, and at scale when their components adapt jointly rather than in isolation. This programme spans generative AI, semi-supervised learning, federated and privacy-aware learning, adversarial robustness, and multi-model neural systems, with evolutionary computation and cooperative coevolution providing a distinctive methodological foundation. I connect these advances to sustainable mobility, urban systems, and environmental intelligence, combining foundational research with open-source software, technology transfer, and interdisciplinary deployment. I am a tenured Associate Professor at the University of Málaga and a Research Collaborator at MIT CSAIL, where long-running collaborations have produced joint publications, software, and international teaching activities.

Research areas: Artificial Intelligence · Machine Learning · Generative AI · Co-Adaptive and Multi-Model Learning · Evolutionary Computation · Cooperative Coevolution · Semi-Supervised Learning · Federated and Privacy-Preserving Learning · Trustworthy AI · AI for Sustainable and Urban Systems

Research at a Glance

- **24 ISI-JCR-indexed journal articles** (10 Q1, 9 Q2, 4 Q3, and 1 Q4) and more than 60 peer-reviewed conference publications. Recent machine-learning work spans generative, semi-supervised, federated/privacy-preserving, adversarial, and multi-model learning, with outputs in *Applied Soft Computing*, *ACM Transactions on Evolutionary Learning and Optimization*, *GECCO*, *PPSN*, and *FOGA*.
- Google Scholar: h-index 26 and +2,500 citations; Scopus: h-index 21 and 1,453 citations (September 2026).
- **Marie Skłodowska-Curie Global Fellow; Principal Investigator** and Coordinator of the national AGENT-SAM project on agentic generative-evolutionary AI for safe and active mobility.
- Research long-time Collaborator at MIT CSAIL since 2021, following a two-year MSCA-funded research stay at MIT, with sustained joint publications, software, and international teaching.
- **Five current PhD researchers**, including two as unique supervisor; 13 Master's theses and more than 25 undergraduate dissertations supervised or co-supervised.
- Innovation and research translation: co-founder and scientific advisor of **AIDOS**, an AI startup selected among the **TOP101 Spain Up Nation** companies and awarded **€274,857.70 in CDTI NEOTEC 2025 funding**; Principal Investigator of a related €30,000 university–industry R&D contract.
- **Seven national/international research and doctoral distinctions**, together with extensive invited tutorials and graduate teaching in generative and evolutionary AI.

Five Significant Research Contributions

1. Coevolutionary and Distributed Learning for Generative AI

Developed a sustained research line on population-based and spatially distributed training of generative adversarial systems, studying diversity, local interactions, ensemble construction, failure resilience, and alternatives to purely end-to-end optimization. This work, developed in close collaboration with MIT CSAIL, produced the open-source *Lipizzaner* framework and a sequence of peer-reviewed contributions spanning *GECCO*, *PPSN*, and *ACM Transactions on Evolutionary Learning and Optimization*. It established the basis for my broader programme on learning in interacting AI systems.

2. Co-Adaptive Learning for Multi-Model AI Systems

Advanced the view of machine learning as a process in which multiple interacting models, modules, or populations adapt jointly rather than being optimized as a single monolithic system. Recent work studies self-adaptation, spatial topologies, evolutionary autoencoder training, and the theoretical behaviour of coevolutionary algorithms, including publications at *GECCO* and *FOGA*. This line now provides the unifying methodological framework for my research on scalable, modular, and robust AI.

3. Data-Efficient, Semi-Supervised, and Privacy-Aware Learning

Extended evolutionary and coevolutionary learning to settings in which labels, data, or centralized access are limited. Contributions include coevolutionary semi-supervised GANs, controlled comparisons between cooperative and monolithic semi-supervised search, and coevolutionary federated learning with differential privacy. Representative outputs include *Applied Soft Computing*, *GECCO* 2023/2026, and *PPSN* 2026, connecting population-based learning with data efficiency and privacy.

4. Robust and Trustworthy AI through Evolutionary Search

Investigated how evolutionary search can expose, analyse, and mitigate failure modes in learning systems. This includes

resilient distributed GAN training, adversarial attacks against image classifiers, security-oriented genetic programming, and robustness assessment in applied AI. The work links evolutionary search with adversarial learning and trustworthy-AI questions, and has supported invited tutorials at GECCO, PPSN, and IEEE CEC as well as participation in the European TAILOR network on trustworthy AI.

5. AI and Optimization for Sustainable Urban and Environmental Systems

Translated machine learning and multi-objective optimization into decision-support methods for complex real-world systems, including sustainable mobility, electric-vehicle charging, bicycle and e-scooter infrastructure, urban waste, vehicular communications, air quality, energy planning, and environmental monitoring. This programme combines methodological research with realistic data, uncertainty, public-sector collaboration, and technology transfer, and now underpins the nationally funded AGENT-SAM research agenda on AI-enabled safe and active mobility.

Academic Appointments

Associate Professor (Tenured; Profesor Titular de Universidad) <i>Department of Computer Languages and Computer Science, University of Málaga, Spain</i> Tenured full-time faculty appointment in Computer Science, with responsibilities in research, teaching, doctoral supervision, funded-project leadership, and academic service.	Mar 2025–Present
Research Collaborator <i>MIT Computer Science and Artificial Intelligence Laboratory (CSAIL), Massachusetts Institute of Technology, USA</i> Research focused on generative AI, evolutionary computation, coevolution, deep learning, and distributed learning.	Sep 2021–Present
Associate Professor <i>University of Málaga, Spain</i> Faculty rank immediately preceding appointment to the current tenured position.	Jan 2024–Mar 2025
Assistant Professor <i>University of Málaga, Spain</i> Full-time faculty appointment combining teaching, research, supervision, and service.	Sep 2021–Jan 2024
Marie Skłodowska-Curie Global Fellow <i>University of Málaga / Massachusetts Institute of Technology</i> Postdoctoral appointment associated with the H2020 Marie Skłodowska-Curie project <i>NeCOL: An Innovative Methodology for Building Better Deep Learning Tools for Real World Applications</i> .	Sep 2018–Sep 2021
Postdoctoral Fellow, University of Málaga Research Plan <i>University of Málaga, Spain</i>	Dec 2017–Sep 2018
Researcher on Competitive Research Project <i>University of Málaga, Spain</i>	Jan 2016–Dec 2017
FPU Predoctoral Fellow / Contract Researcher <i>University of Málaga, Spain</i>	Jan 2012–Jan 2016
Researcher on Competitive Research Project <i>University of Málaga, Spain</i>	Dec 2009–Jan 2012
Research Technician <i>University of Málaga, Spain</i>	Oct 2007–Sep 2008

Education

European PhD in Computer Engineering <i>University of Málaga, Spain</i> Dissertation: <i>Natural Computing for Vehicular Networks</i> . Supervisor: Prof. Enrique Alba Torres. Grade: <i>Cum Laude Honors</i> . European Doctorate distinction. Extraordinary Doctorate Award.	2016
MSc in Software Engineering and Artificial Intelligence <i>University of Málaga, Spain</i> Final grade: 8.73/10.	2010
Master in Information and Computer Sciences — Intelligent and Adaptive Systems <i>University of Luxembourg, Luxembourg</i> Final grade: 8.05/10.	2010
Computer Engineering Degree / Ingeniero en Informática <i>University of Málaga, Spain</i>	2009

Competitive Research Funding

Funding as Principal Investigator or Competitive Fellowship Holder

AGENT-SAM: Agentic Generative Evolutionary Networks for Safe and Active Mobility 2026–2029
Principal Investigator and Project Coordinator — Spanish Knowledge Generation Projects 2025, PID2025-174277OA-I00

National competitive research project establishing an independent programme at the intersection of generative-evolutionary AI, agentic systems, federated learning, and sustainable mobility. Team: 12 researchers. Total funding: EUR 131,250.

NeCOL: An Innovative Methodology for Building Better Deep Learning Tools for Real World Applications 2018–2021

Marie Skłodowska-Curie Global Fellow — European Union, Horizon 2020, Grant 799078

Competitive individual Global Fellowship supporting research at MIT CSAIL and the University of Málaga. The project established the long-term MIT–Málaga research line on evolutionary and coevolutionary deep learning. Total EU contribution: EUR 239,191.20.

Resolución de problemas de mecánica de fluidos computacional usando physically-informed neural networks y computación evolutiva 2023–2025

Principal Investigator — University of Málaga

Competitive university research project combining physics-informed neural networks and evolutionary computation. Team: 6 researchers. Total funding: EUR 4,000.

Selected Participation in Competitive Research Projects

Friendship Networks of Immigrant and Ethnic Minority Women that Are Conducive to Social Integration (FriendsMatter) 2023–2026

Researcher — University of Málaga

PI: Emilia Aiello. Team: 12 researchers.

RECOVER: InterpREtación automática multilingüe para casos COVID-19 en los sERvicios de urgencias 2022–2025

Researcher — Junta de Andalucía, PAIDI 2020 Excellence Projects

Team: 18 researchers. Total funding: EUR 79,994.

HUMOVE: Human Centered Smart Mobility 2021–2024

Researcher — Spanish Ministry of Economy and Competitiveness

PIs: Gabriel Luque Polo and Enrique Alba Torres. Total funding: EUR 138,182.

TAILOR: Foundations of Trustworthy AI 2020–2023

Researcher — European Union, H2020-ICT-2019-3

European network on the scientific foundations of trustworthy artificial intelligence. Coordinator/PI: Holger Hoos.

6city: Inteligencia cruzada para ciudades inteligentes 2018–2020

Research Team Member — Spanish Ministry of Economy and Competitiveness, TIN2017-88213-R

PIs: Enrique Alba Torres and José Francisco Chicano García. Team: 11 researchers. Total funding: EUR 76,956.

Accesibilidad territorial, universal y sostenible: caracterización del sistema de transporte intermodal de Montevideo 2020–2021

Researcher — Agencia Nacional de Investigación e Innovación, Uruguay, FSDA_1_2018_1_154502

Team: 17 researchers. Total funding: EUR 53,350.

Estudio de movilidad por transporte público en la zona metropolitana de Maldonado y de la accesibilidad a servicios públicos 2019–2020

Researcher — Oficina de Planeamiento y Presupuesto, Uruguay

Team: 8 researchers. Total funding: EUR 10,500.

moveON: Metaheurísticas, Inteligencia Holística y Movilidad Inteligente 2015–2017

Researcher — MINECO, TIN2014-57341-R

PI: Enrique Alba Torres. Team: 8 researchers. Total funding: EUR 133,705.

CellCar: Advanced Cellular Technologies for Connected Cars 2013

Researcher — Qatar National Research Fund, NPRP 5-1080-1-186

Host: Qatar Mobility Innovations Center (QMIC), Doha, Qatar. PI: Fethi Filali.

RoadME: Fundamentos para la aplicación de metaheurísticas a problemas reales: el caso de las redes vehiculares 2012–2015

Researcher — Spanish Ministry of Science and Innovation, TIN2011-28194

PI: Enrique Alba Torres. Team: 11 researchers. Total funding: EUR 101,640.

TABS: Teoría, Algoritmos Bioinspirados y Software <i>Research Team Member — University of Málaga</i> Team: 6 researchers. Total funding: EUR 10,000.	2015
DIRICOM: Diseño Inteligente de Redes Inalámbricas de Comunicación <i>Researcher — Regional Research Project, P07-TIC-03044</i> PI: Enrique Alba Torres. Team: 12 researchers. Total funding: EUR 462,000.	2007–2010
CARLINK: Plataforma Inalámbrica de Servicio de Tráfico para conectar vehículos <i>Researcher — EUREKA-CELTIC, FIT-330210-2006-49</i> European project. Total funding: EUR 55,600.	2006–2009

Technology Transfer, Industry Collaboration & Societal Impact

Startup Innovation and Research Translation

Co-Founder & Scientific Advisor — Artificial Intelligence <i>AIDOS — Desarrollo de Inteligencia Artificial y Psicología S.L., Melilla, Spain</i> Co-founded a deep-tech startup developing proprietary artificial-intelligence technologies based on neural networks and computer vision for behavioral analysis. Responsible for the development of AI algorithms and scientific/technical advisory, supporting the translation of research methods into deployable technology. AIDOS was selected among the TOP101 Spain Up Nation companies in 2024 and recognized as one of the 19 territorial ambassadors of the programme. The company was awarded €274,857.70 through CDTI NEOTEC 2025 for the project <i>Prevención y detección de comportamiento extremista mediante inteligencia artificial</i> (total project budget: €323,362).	2022–Present
---	---------------------

University–Industry and Public-Sector R&D Contracts

AI Validation and Robustness for AIDOS NEOTEC Technology <i>Principal Investigator / Project Coordinator — AIDOS — Desarrollo de Inteligencia Artificial y Psicología S.L., University–Industry R&D Contract 8.06/6.18.7677</i> Technical validation, benchmarking, robustness assessment, and methodological support for the CDTI NEOTEC-funded AI project <i>Prevención y detección de comportamiento extremista mediante inteligencia artificial</i> . University–industry contract value: €30,000.	2026–2028
AI applied to urban mobility: technical advisory and research collaboration <i>Principal Investigator — Moven Consulting 2020, S.L., contract 8.06/6.18.6573</i> Total contract value: EUR 20,000.	2023–2026
Melilla transparente <i>Principal Investigator / Project Coordinator — Ciudad Autónoma de Melilla</i> Total contract value: EUR 13,570.	2022–2024
UrbanMoov: Algoritmos de Inteligencia de Enjambre aplicados a Movilidad Urbana <i>Researcher — SECMOTIC, contract 8.06/5.47.5578</i> PI: Enrique Alba Torres. Total contract value: EUR 39,022.	2020–2022
UrbanMoov: Calidad y Evaluación de Resultados <i>Researcher — EMERGYA Ingeniería, S.L., contract 8.06/5.47.5579</i> PI: Enrique Alba Torres. Total contract value: EUR 64,500.	2020–2022
BubbleWall: Inteligencia Ubicua para la Seguridad por Diseño Mejorado del Software IoT <i>Researcher — EMERGYA Ingeniería, S.L., contract 8.06/5.47.5461</i> PI: Enrique Alba Torres. Total contract value: EUR 82,284.	2019–2021
FIQARE — Generic Enablers in FIWARE <i>Researcher — SECMOTIC Innovation, S.L., contract 8.06/5.47.4996</i> PI: Enrique Alba Torres. Total contract value: EUR 45,000.	2017–2020
FIQARE — Quality and FIWARE <i>Researcher — EMERGYA Ingeniería, S.L., contract 8.06/5.47.4997</i> PI: Enrique Alba Torres.	2017–2020
Energy Sequence <i>Researcher — Vatia Energía, S.L., contract 8.06/47.4792</i> PI: Enrique Alba Torres. Total contract value: EUR 26,000.	2017
Movilidad Inteligente, WiFi, Rutas y Contaminación <i>Researcher — Innovation and New Technologies Area, Málaga City Council, contract 8.07/5.47.4425</i> PI: Enrique Alba Torres.	2015–
MaxCT: Movilidad Inteligente: Wi-Fi, Rutas y Contaminación <i>Researcher — Agencia de Obra Pública, Junta de Andalucía, contract 8.06/5.47.4356</i> PI: Enrique Alba Torres. Total contract value: EUR 84,150.	2015–

International Development Cooperation

Since 2016, external consultant in international development-cooperation initiatives financed by multilateral and public organizations including the **World Bank**, the **Inter-American Development Bank (IDB)**, and Spanish **AECID**. Work has included technical and leadership responsibilities in initiatives such as *SIASAR* and *SANIHUB*, developing information systems, data-analysis models, and technological tools for indicator generation, service monitoring, and planning support.

Publications

Peer-Reviewed Journal and Serial Articles

1. L. González, **Jamal Toutouh**, and S. Nesmachnow. “Low-Cost Deep Learning for Building Detection with Application to Informal Urban Planning.” *ISPRS International Journal of Geo-Information*, 15(1), 2026.
2. S. Nesmachnow, D. G. Rossit, **Jamal Toutouh**, and F. Luna. “An explicit evolutionary approach for multiobjective energy consumption planning considering user preferences in smart homes.” *International Journal of Industrial Engineering Computations*, 12(4), 2021. doi:10.5267/j.ijiec.2021.5.005.
3. D. D. Pedroza-Perez, G. Luque, S. Nesmachnow, and **Jamal Toutouh**. “Uncertainty-aware multi-objective optimization for rebalancing bike shared systems.” *Journal of Combinatorial Optimization*, 52(18), 2026. doi:10.1007/s10878-026-01460-1.
4. M. Mohamed Si Ali, **Jamal Toutouh**, S. Segado Sánchez-Cabezudo, and N. Gilbert. “Socioeconomic barriers and educational pathways of unaccompanied foreign minors in Europe’s southern border.” *International Journal of Social Welfare*, 34(3), pp. 1–9, 2025. doi:10.1111/ijsw.70025.
5. **Jamal Toutouh**, S. Nalluru, E. Hemberg, and U.-M. O’Reilly. “Semi-supervised generative adversarial networks with spatial coevolution for enhanced image generation and classification.” *Applied Soft Computing*, 2023.
6. **Jamal Toutouh** and E. Alba. “A low cost IoT cyber-physical system for vehicle and pedestrian tracking in a smart campus.” *Sensors*, 22(17), 2022. doi:10.3390/s22176585.
7. I. Lebrusán and **Jamal Toutouh**. “¿Son efectivas las zonas de bajas emisiones? El caso del centro de Madrid.” *Papeles de Economía Española*, 171, 2022.
8. D. G. Rossit, S. Nesmachnow, **Jamal Toutouh**, and F. Luna. “Scheduling deferrable electric appliances in smart homes: a bi-objective stochastic optimization approach.” *Mathematical Biosciences and Engineering*, 2021. doi:10.3934/mbe.2022002.
9. S. Nesmachnow, D. G. Rossit, G. Colacurcio, **Jamal Toutouh**, and F. Luna. “Optimizing household energy planning in smart cities: A multiobjective approach.” *Revista Facultad de Ingeniería*, 2021. doi:10.17533/udea.redin.20200587.
10. E. Hemberg, **Jamal Toutouh**, A. Al-Dujaili, T. Schmiedlechner, and U.-M. O’Reilly. “Spatial Coevolution for Generative Adversarial Network Training.” *ACM Transactions on Evolutionary Learning and Optimization*, 1(2), pp. 1–28, 2021.
11. Z. H. Mir, **Jamal Toutouh**, F. Filali, and Y.-B. Ko. “Enabling DSRC and C-V2X Integrated Hybrid Vehicular Networks: Architecture and Protocol.” *IEEE Access*, 8, pp. 180909–180927, 2020. doi:10.1109/ACCESS.2020.3027074.
12. I. Lebrusán and **Jamal Toutouh**. “Car restriction policies for better urban health: a low emission zone in Madrid, Spain.” *Air Quality, Atmosphere & Health*, 2020. doi:10.1007/s11869-020-00938-z.
13. A. Camero, **Jamal Toutouh**, and E. Alba. “Random error sampling-based recurrent neural network architecture optimization.” *Engineering Applications of Artificial Intelligence*, 96, 2020. doi:10.1016/j.engappai.2020.103946.
14. I. Lebrusán and **Jamal Toutouh**. “Using Smart City Tools to Evaluate the Effectiveness of a Low Emissions Zone in Spain: Madrid Central.” *Smart Cities*, 2020. doi:10.3390/smartcities3020025.
15. U.-M. O’Reilly, **Jamal Toutouh**, M. Pertierra, D. P. Sanchez, D. Garcia, A. E. Luogo, J. Kelly, and E. Hemberg. “Adversarial genetic programming for cyber security: a rising application domain where GP matters.” *Genetic Programming and Evolvable Machines*, 21(1–2), pp. 219–250, 2020. doi:10.1007/s10710-020-09389-y.
16. D. G. Rossit, **Jamal Toutouh**, and S. Nesmachnow. “Exact and heuristic approaches for multi-objective garbage accumulation points location in real scenarios.” *Waste Management*, 105, pp. 467–481, 2020. doi:10.1016/j.wasman.2020.02.016.
17. **Jamal Toutouh**, D. Rossit, and S. Nesmachnow. “Soft computing methods for multiobjective location of garbage accumulation points in smart cities.” *Annals of Mathematics and Artificial Intelligence*, 88(1–3), pp. 105–131, 2019. doi:10.1007/s10472-019-09647-5.
18. D. G. Rossit, S. Nesmachnow, and **Jamal Toutouh**. “A bi-objective integer programming model for locating garbage accumulation points: A case study.” *Revista Facultad de Ingeniería*, 93, pp. 70–81, 2019. doi:10.17533/udea.redin.20190509.
19. A. Camero, **Jamal Toutouh**, J. Ferrer, and E. Alba. “Waste generation prediction under uncertainty in smart cities through deep neuroevolution.” *Revista Facultad de Ingeniería*, 93, pp. 128–138, 2019. doi:10.17533/udea.redin.20190736.
20. **Jamal Toutouh** and E. Alba. “A swarm algorithm for collaborative traffic in vehicular networks.” *Vehicular Communications*, 12, pp. 127–137, 2018. doi:10.1016/j.vehcom.2018.04.003.
21. E. Fabbiani, S. Nesmachnow, **Jamal Toutouh**, A. Tchernykh, A. Avetisyan, and G. Radchenko. “Analysis of Mobility Patterns for Public Transportation and Bus Stops Relocation.” *Programming and Computer Software*, 44(6), pp. 508–525, 2018. doi:10.1134/S0361768819010031.
22. **Jamal Toutouh**, J. Arellano, and E. Alba. “BiPred: A Bilevel Evolutionary Algorithm for Prediction in Smart Mobility.” *Sensors*, 18(12), 2018. doi:10.3390/s18124123.
23. S. Nesmachnow, D. Rossit, and **Jamal Toutouh**. “Comparison of Multiobjective Evolutionary Algorithms for Prioritized Urban Waste Collection in Montevideo, Uruguay.” *Electronic Notes in Discrete Mathematics*, 69, pp. 93–100, 2018.
24. R. Massobrio, **Jamal Toutouh**, S. Nesmachnow, and E. Alba. “Infrastructure Deployment in Vehicular Communication Networks Using a Parallel Multiobjective Evolutionary Algorithm.” *International Journal of Intelligent Systems*, 32(8), pp. 801–829, 2017.

doi:10.1002/int.21890.

25. **Jamal Toutouh** and E. Alba. “Parallel multi-objective metaheuristics for smart communications in vehicular networks.” *Soft Computing*, 21(8), pp. 1949–1961, 2017. doi:10.1007/s00500-015-1891-2.
26. **Jamal Toutouh** and E. Alba. “Light commodity devices for building vehicular ad hoc networks: An experimental study.” *Ad Hoc Networks*, 37, pp. 499–511, 2016. doi:10.1016/j.adhoc.2015.09.013.
27. **Jamal Toutouh** and E. Alba. “Metaheuristics for energy-efficient data routing in vehicular networks.” *International Journal of Metaheuristics*, 4(1), pp. 27–56, 2015. doi:10.1504/IJMHEUR.2015.071750.
28. **Jamal Toutouh**, S. Nesmachnow, and E. Alba. “Fast energy-aware OLSR routing in VANETs by means of a parallel evolutionary algorithm.” *Cluster Computing*, 16(3), pp. 435–450, 2013. doi:10.1007/s10586-012-0208-9.
29. **Jamal Toutouh**, J. García-Nieto, and E. Alba. “Intelligent OLSR routing protocol optimization for VANETs.” *IEEE Transactions on Vehicular Technology*, 61(4), pp. 1884–1894, 2012. doi:10.1109/TVT.2012.2188552.
30. J. García-Nieto, **Jamal Toutouh**, and E. Alba. “Automatic tuning of communication protocols for vehicular ad hoc networks using metaheuristics.” *Engineering Applications of Artificial Intelligence*, 23(5), pp. 795–805, 2010. doi:10.1016/j.engappai.2010.01.012.

Other Scholarly Publications and Research Communication

1. **Jamal Toutouh**. “Xin Yao & Siang Yew Chong: Coevolutionary Computation and Its Applications.” *Genetic Programming and Evolvable Machines*, 27(4), p. 487, 2026. [Book review].
2. **Jamal Toutouh**, S. Nesmachnow, M. Draper, and M. Bove. “Learning Wind-Turbine Wakes with Generative Adversarial Networks.” *ERCIM News*, 143, 2026.
3. C. Cintrano, G. Luque, and **Jamal Toutouh**. “Human-centred Smart Mobility: Shaping the Future of Urban Transport.” *ERCIM News*, 138, 2024.
4. D. Urda, P. Ruiz, E. G. Talbi, P. Bouvry, and **Jamal Toutouh**. “Editorial of the Special Issue Intelligent Solutions for Efficient Logistics and Sustainable Transportation.” *Applied Soft Computing*, 2022. [Editorial].
5. I. Lebrusán and **Jamal Toutouh**. “Lo que nos dicen los datos sobre Madrid Central.” *El País / Agenda Pública*, 21 Jan 2020.

Book Chapters

1. **Jamal Toutouh**, E. Hemberg, and U.-M. O’Reilly. “Data Dieting in GAN Training.” In *Deep Neural Evolution*, Natural Computing Series, pp. 379–400. Springer, 2020. doi:10.1007/978-981-15-3685-4_14.
2. A. Muñoz, **Jamal Toutouh**, and F. Jaime. “A Review of Dynamic Verification of Security and Dependability Properties.” In *Artificial Intelligence and Security Challenges in Emerging Networks*, pp. 162–187. IGI Global, 2019.
3. R. Massobrio, **Jamal Toutouh**, and S. Nesmachnow. “Multi-Objective Evolutionary Algorithms for Smart Placement of Roadside Units in Vehicular Networks.” In *Evolutionary Multi-Objective System Design: Theory and Applications*, pp. 86–114. Chapman & Hall/CRC, 2017. doi:10.1201/9781315366845-5.

Selected Peer-Reviewed Conference Publications

The list below emphasizes internationally established peer-reviewed conference venues. CORE rank is retained as contextual metadata rather than as the primary indicator of research quality or significance.

CORE A Venues

1. L. Araújo, I. Fernández, S. Nesmachnow, P. Moreno, and **Jamal Toutouh**. “Hybrid Multiobjective Evolutionary Search for Realistic Synthetic Face Image Generation.” *Parallel Problem Solving from Nature (PPSN XIX)*, 2026. **CORE A**. doi:10.1007/978-3-032-36223-0_13.
2. P. Gerry, E. Hemberg, **Jamal Toutouh**, and U.-M. O’Reilly. “Coevolutionary Federated Learning with Differential Privacy.” *Parallel Problem Solving from Nature (PPSN XIX)*, 2026. **CORE A**. doi:10.1007/978-3-032-36229-2_29.
3. **Jamal Toutouh**. “Cooperative Coevolution versus Monolithic Evolutionary Search for Semi-Supervised Tabular Classification.” *Genetic and Evolutionary Computation Conference (GECCO 2026)*, 2026. **CORE A**. doi:10.1145/3795095.3805161.
4. D. D. Pedroza-Perez, G. Luque, S. Nesmachnow, and **Jamal Toutouh**. “Robust Multi-Objective Optimization for Bicycle Rebalancing in Shared Mobility Systems.” *GECCO 2026*, 2026. **CORE A**. doi:10.1145/3795095.3805158.
5. M. H. Fajardo, **Jamal Toutouh**, E. Hemberg, U.-M. O’Reilly, and P. K. Lehre. “Runtime Bounds for a Coevolutionary Algorithm on Classes of Potential Games.” *Foundations of Genetic Algorithms (FOGA 2025)*, 2025. **CORE A**.
6. S. Nesmachnow and **Jamal Toutouh**. “Adversarial attacks to image classification systems using evolutionary algorithms.” *GECCO 2025*, 2025. **CORE A**. doi:10.1145/3712256.3726429.
7. Jorgensen, E. Hemberg, **Jamal Toutouh**, and U.-M. O’Reilly. “Guiding Evolutionary AutoEncoder Training with Activation-Based Pruning Operators.” *GECCO 2025*, 2025. **CORE A**. doi:10.1145/3712256.3726449.
8. M. H. Fajardo, **Jamal Toutouh**, E. Hemberg, U.-M. O’Reilly, and P. K. Lehre. “A Self-adaptive Coevolutionary Algorithm.” *GECCO 2024*, 2024. **CORE A**. doi:10.1145/3638529.3654132.
9. E. Hemberg, **Jamal Toutouh**, and U.-M. O’Reilly. “Cooperative Coevolutionary Spatial Topologies for Autoencoder Training.” *GECCO 2024*, 2024. **CORE A**. doi:10.1145/3638529.3654127.
10. C. Cintrano, **Jamal Toutouh**, and S. Nesmachnow. “Optimizing Electric Vehicle Charging Station Placement Integrating Daily Mobility Patterns and Residential Locations.” *GECCO 2024*, 2024. **CORE A**.
11. D. D. Pedroza-Perez, **Jamal Toutouh**, and G. Luque. “Redesigning road infrastructure to integrate e-scooter micromobility as part of

- multimodal transportation.” *GECCO 2024*, 2024. **CORE A**. doi:10.1145/3638529.3654142.
12. P. K. Lehre, M. H. Fajardo, **Jamal Toutouh**, and E. Hemberg. “Analysis of a Pairwise Dominance Coevolutionary Algorithm And DefendIt.” *GECCO 2023*, 2023. **CORE A**. doi:10.1145/3583131.3590411.
 13. **Jamal Toutouh**, S. Nalluru, E. Hemberg, and U.-M. O’Reilly. “Semi-Supervised Learning with Coevolutionary Generative Adversarial Networks.” *GECCO 2023*, 2023. **CORE A**. doi:10.1145/3583131.3590426.
 14. D. Flores, E. Hemberg, **Jamal Toutouh**, and U.-M. O’Reilly. “Coevolutionary generative adversarial networks for medical image augmentation at scale.” *GECCO 2022*, 2022. **CORE A**. doi:10.1145/3512290.3528742.
 15. B. Machín, S. Nesmachnow, and **Jamal Toutouh**. “Multi-target evolutionary latent space search of a generative adversarial network for human face generation.” *GECCO 2022 Companion*, 2022. **CORE A**.
 16. **Jamal Toutouh** and U.-M. O’Reilly. “Signal propagation in a gradient-based and evolutionary learning system.” *GECCO 2021*, 2021. **CORE A**. doi:10.1145/3449639.3459319.
 17. **Jamal Toutouh**, E. Hemberg, and U.-M. O’Reilly. “Analyzing the Components of Distributed Coevolutionary GAN Training.” *Parallel Problem Solving from Nature (PPSN XVI)*, 2020. **CORE A**. doi:10.1007/978-3-030-58112-1_38.
 18. **Jamal Toutouh**, E. Hemberg, and U.-M. O’Reilly. “Re-purposing heterogeneous generative ensembles with evolutionary computation.” *GECCO 2020*, 2020. **CORE A**. doi:10.1145/3377930.3390229.
 19. **Jamal Toutouh**, E. Hemberg, and U.-M. O’Reilly. “Spatial evolutionary generative adversarial networks.” *GECCO 2019*, 2019. **CORE A**. doi:10.1145/3321707.3321860.
 20. **Jamal Toutouh** and E. Alba. “Green OLSR in VANETs with differential evolution.” *GECCO 2012*, 2012. **CORE A**. doi:10.1145/2330784.2330787.
 21. **Jamal Toutouh** and E. Alba. “An efficient routing protocol for green communications in vehicular ad-hoc networks.” *GECCO 2011 Companion*, 2011. **CORE A**. doi:10.1145/2001858.2002076.

CORE B Venues

1. R. Massobrio, S. Nesmachnow, **Jamal Toutouh**, and S. Pérez. “Evolutionary Approach for Sewer Network Design Under the Condominal Model.” *EvoApplications 2026*, 2026. **CORE B**. doi:10.1007/978-3-032-23607-4_3.
2. F. Sedeño, **Jamal Toutouh**, and F. Chicano. “Generate more than one child in your co-evolutionary semi-supervised learning GAN.” *EvoApplications 2025*, 2025. **CORE B**. doi:10.1007/978-3-031-90065-5_4.
3. D. D. Pedroza-Perez, **Jamal Toutouh**, and G. Luque. “Optimizing Urban Infrastructure for E-Scooter Mobility.” *EvoApplications 2024*, 2024. **CORE B**. doi:10.1007/978-3-031-56852-7_22.
4. C. Cintrano and **Jamal Toutouh**. “Multiobjective Electric Vehicle Charging Station Locations in a City Scale Area: Malaga Study Case.” *EvoApplications 2022*, 2022. **CORE B**. doi:10.1007/978-3-031-02462-7_37.
5. **Jamal Toutouh**, A. Muñoz, and S. Nesmachnow. “Evolution Oriented Monitoring oriented to Security Properties for Cloud Applications.” *13th International Conference on Availability, Reliability and Security (ARES 2018)*, 2018. **CORE B**. doi:10.1145/3230833.3232856.
6. **Jamal Toutouh** and E. Alba. “Multi-objective OLSR optimization for VANETs.” *IEEE International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob 2012)*, 2012. **CORE B**.
7. **Jamal Toutouh** and E. Alba. “Performance analysis of optimized VANET protocols in real world tests.” *International Wireless Communications and Mobile Computing Conference (IWCMC)*. **CORE B**.
8. **Jamal Toutouh**, S. Nesmachnow, and E. Alba. “Evolutionary power-aware routing in VANETs using Monte-Carlo simulation.” *International Conference on High Performance Computing & Simulation (HPCS 2012)*, 2012. **CORE B**.

Doctoral and Research Supervision

I currently supervise or co-supervise five doctoral researchers, forming an emerging research portfolio around generative AI, coevolutionary learning, large language models, privacy-aware learning, climate AI, and sustainable mobility. Two of these PhD projects are under my primary supervision, and several build directly on research directions established through earlier Master’s-level supervision.

Fernando Pinto Gómez

2026–Present

University of Málaga

Role: Supervisor.

Thesis: *Efficient Generative Modeling of Air Pollution and Climate Change*.

Francisco José Sedeño Guerrero

2026–Present

University of Málaga

Role: Supervisor.

Thesis: *Coevolutionary Generative Machine Learning for Efficient and Effective Model Design*.

María Trinidad Maldonado Recio

2026–Present

University of Málaga

Role: Co-supervisor.

Thesis: *Psychological Capabilities of Large Language Models and Their Applications in Neurological Treatments*.

Adriana Novoa Hurtado

2026–Present

University of Málaga

Role: Co-supervisor.

Thesis: *Machine Learning and Evolutionary Computation for Zero-Carbon Cities.*

Diego Daniel Pedroza Pérez

University of Málaga

Role: Co-supervisor.

Thesis: *Machine Learning and Evolutionary Computation for Sustainable Micromobility in Smart Cities.*

2022–Present

Additional supervision: 13 Master's theses and more than 25 selected undergraduate dissertations.

Teaching Experience

My teaching profile combines Artificial Intelligence and Machine Learning with core Computer Science and interdisciplinary applications. I have taught at undergraduate, Master's, and doctoral levels; delivered courses in English; supervised research and capstone projects; and designed specialized international teaching in generative AI, evolutionary learning, data science, cloud computing, and responsible use of AI. My most recent formal teaching evaluation received the rating **Excellent**.

Artificial Intelligence and Machine Learning

- **Deep Generative Neural Networks: Foundations and Problem Solving**, MSc and PhD in Computer Science (PEDECIBA), Universidad de la República, Uruguay: taught in 2021, 2022, 2023, 2024, and 2025/2026.
- **Methodologies for the Development of Artificial Intelligence Projects** (*Metodologías para el Desarrollo de Proyectos de Inteligencia Artificial*), MSc in Computer Engineering, University of Málaga: 2026/2027.
- **Data Science and Machine Learning in Python**, Fundación General de la Universidad de Málaga: editions in 2022, 2023, 2024, 2025, and 2026; 15–20 teaching hours per recorded edition.
- **Generative AI for Everyday Life: Study, Learn, Analyze and Create with ChatGPT**, Fundación General de la Universidad de Málaga: 2025 and 2026; 25 hours.
- **Generative AI for University Students: Foundations, Tools and Responsible Use**, Fundación General de la Universidad de Málaga: 2026; 12.5 hours.
- **Copilot in the Context of Programming Courses at the School of Computer Science**, University of Málaga: 2025; 20 hours.
- **Tourism Intelligence** (*Inteligencia Turística*), MSc in E-Tourism: Technologies Applied to Tourism Management and Marketing, University of Málaga, 2026/2027. Theoretical and practical teaching in data-driven tourism technologies.

Core Computer Science and Software Systems

- **Cloud Application Development** (*Desarrollo de Aplicaciones en la Nube*), MSc in Computer Engineering: taught in 2023 and 2025/2026.
- **Distributed Programming** (*Programación Distribuida*), BSc in Computer Engineering: taught in 2021, 2022, and 2023.
- **Internet Information Systems** (*Sistemas de Información para Internet*), BSc in Computer Science: taught in 2014 and 2022.
- **Data Structures** (*Estructura de Datos*), BSc programmes in Computer Science, Computer Engineering, and Software Engineering: 2021.
- **Data Structures and Algorithms** (*Estructura de Datos y Algoritmos*), BSc in Health Engineering: 2021.
- **Programming Fundamentals** (*Fundamentos de la Programación*), BSc in Software Engineering: 2017.
- **Programming II** (*Programación 2*), Telecommunications Engineering / Sound and Image Engineering: taught in 2014 and 2015.

Interdisciplinary Computing

- **Applied Computing for Tourism Business Management** (*Informática Aplicada a la Gestión de Empresas Turísticas*), BSc in Tourism and associated double-degree pathways: taught from 2021 onward and repeatedly delivered in **English**.
- **Tourism Database Management** (*Gestión de Bases de Datos del Turismo*), BSc in Tourism: taught in 2021, 2022, 2023, and 2024/2025.
- **Web Design and Development** (*Diseño y Desarrollo Web*), MSc in Digital Marketing Management: taught in 2024/2025, 2025/2026, and 2026/2027.

Teaching Innovation

PIE17-122 GAMONING: Gamification for Motivation and Student Leveling in Engineering Schools

2017–2019

University of Málaga

Teaching innovation project led by María Cristina Alcaraz Tello. Team: 6 participants. Funding: €1,500.

Invited Tutorials & Talks

Graduate Seminars, Tutorials, and International Teaching International venues

2019–2026

- **Coevolution for Multi-Model Neural Networks: Training Beyond End-to-End Gradients.** Tutorial at the *Parallel Problem Solving from Nature (PPSN 2026)*, 2026.
- **Co-evolutionary Algorithms for Training Generative Neural Models (VAEs & GANs).** Tutorial at the *International Summer School on Generative AI: From NLP to LLMs to Agentic AI: Theory, Applications, and Practice*, 2026.
- **Coevolution for Multi-Model Neural Networks: Training Interacting Modules Beyond End-to-End Gradients.** Tutorial at the *General-Purpose AI Systems Winter School 2026*, 2026.
- **Adversarial Deep Learning by Using Coevolutionary Computation.** Tutorial at the *IEEE Congress on Evolutionary Computation (CEC 2025)*, Hangzhou, China, June 2025. Co-instructor: Una-May O'Reilly (MIT).
- **Coevolutionary Computation for Adversarial Deep Learning.** Tutorial at the *Genetic and Evolutionary Computation Conference (GECCO 2025)*, Málaga, Spain, July 2025. Co-instructor: Una-May O'Reilly (MIT).
- **Coevolutionary Computation for Adversarial Deep Learning.** Tutorial at the *Genetic and Evolutionary Computation Conference (GECCO 2024)*, Melbourne, Australia, July 2024. Co-instructor: Una-May O'Reilly (MIT). Hybrid format; approximately 50 in-person and online attendees.
- **Coevolutionary Computation for Adversarial Deep Learning.** Tutorial at the *Genetic and Evolutionary Computation Conference (GECCO 2023)*, Lisbon, Portugal, July 2023. Co-instructor: Una-May O'Reilly (MIT). Hybrid format; approximately 50 in-person and online attendees.
- **Robust and Resilient Generative Adversarial Networks Training by Using Distributed Coevolution.** Invited seminar at the *School of Computer Science and Engineering, University of Málaga*, Spain, November 2022.
- **Adversarial Deep Learning by Using Distributed Coevolutionary Computation.** Tutorial at the *17th International Conference on Parallel Problem Solving from Nature (PPSN XVII)*, September 2022. In-person audience: approximately 45 attendees.
- **Coevolutionary Computation for Adversarial Deep Learning.** Tutorial at the *Genetic and Evolutionary Computation Conference (GECCO 2022)*, Boston, MA, USA, July 2022. Co-instructor: Una-May O'Reilly (MIT). Hybrid format; approximately 50 in-person and 34 online attendees.
- **Robust and Resilient GAN Training through Spatially Distributed Coevolution.** Invited seminar at the *Centre for Informatics and Systems, University of Coimbra*, Portugal, March 2022.
- **Adversarial Deep Learning by Using Coevolutionary Computation.** Tutorial at the *IEEE Congress on Evolutionary Computation (CEC 2021)*, virtual, June 2021. Co-instructor: Una-May O'Reilly (MIT). Audience: approximately 100 attendees.
- **Coevolutionary Computation for Adversarial Deep Learning.** Tutorial at the *Genetic and Evolutionary Computation Conference (GECCO 2021)*, virtual, July 2021. Co-instructor: Una-May O'Reilly (MIT). Audience: approximately 100 attendees.
- **Lipizzaner: Distributed Coevolution for Resilient Generative Adversarial Networks Training.** Invited webinar at the *Faculty of Engineering, Universidad de la República*, Uruguay, April 2020. Audience: approximately 30 attendees.
- **Deep Neuroevolution Applied to Generative Adversarial Networks.** Invited webinar at the *Spain AI Association*, April 2020.
- **Lipizzaner: Spatially Distributed Coevolution for Robust and Resilient GAN Training.** Invited talk at *Schlumberger Limited*, December 2019. Audience: approximately 20 attendees.
- **Spatial Coevolutionary Deep Neural Networks Training.** Invited talk at the *Faculty of Engineering, Universidad de la República*, Uruguay, May 2019. Audience: approximately 30 attendees.

International Research Experience

Forthcoming Research Visit — Center for Astrophysics | Harvard & Smithsonian (CfA) Cambridge, MA, USA

May–Aug 2027

Four-month research visit supported by a confirmed senior research mobility scholarship, hosted by Gonzalo González Abad and focused on FARO+ research in atmospheric NO₂ inference, heterogeneous Earth-observation data, uncertainty, and domain-aware validation.

Postdoctoral Research Stay — MIT CSAIL Massachusetts Institute of Technology, Cambridge, MA, USA

Sep 2018–Sep 2020

Two-year stay funded through the Marie Skłodowska-Curie Global Fellowship.

Research Stay — MIT CSAIL Massachusetts Institute of Technology, Cambridge, MA, USA

Sep–Dec 2020

Postdoctoral research continuation.

Predocutorial Research Stay — Qatar Mobility Innovations Center (QMIC) Doha, Qatar

Sep–Dec 2014

Three-month FPU short research stay.

Predocctoral Research Stay — Centria University of Applied Sciences

Ylivieska, Finland

Twenty-eight-day doctoral research stay.

2012

Awards and Fellowships

Competitive Fellowships

- **Marie Skłodowska-Curie Global Fellowship**, Horizon 2020, 2018–2021.
- **University of Málaga Postdoctoral Fellowship**, Research Plan, 2017–2018.
- **FPU Predocctoral Fellowship**, Spanish national competitive programme, 2012–2016.

Awards and Distinctions

1. **Best Paper Award**, European Conference on Applications of Evolutionary Computation (EvoApplications), 2022.
2. **Best Paper Award**, Conference of the Spanish Association for Artificial Intelligence (CAEPIA), 2021.
3. **Best Oral Presentation**, ECUSA — Spanish Scientists in the USA, Cambridge, MA, 2019.
4. **Best Spanish Doctoral Thesis of 2018 in Smart Cities**, Spanish Smart Cities Research Network CI-RTI, 2018.
5. **Extraordinary Doctorate Award**, Information Technologies Doctoral Programme, University of Málaga, 2018.
6. **Best Doctoral Thesis for the Development of Smart Governance**, Aytos Berger-Levrault Chair for Smart Governance, 2018.
7. **Runner-up / Accésit, Doctoral Consortium**, Spanish Association for Artificial Intelligence (AEPIA), 2013.

Academic Leadership & Professional Service

Institutional and International Academic Leadership

- **Secretary, Faculty of Tourism, University of Málaga**: 13-month academic management appointment involving faculty administration, governance, coordination, and institutional decision-making.
- **Previous vice-dean-level responsibilities, Faculty of Tourism, University of Málaga**, together with service on the Faculty Board and academic committees.
- **Executive Board Member, SPECIES Society**: two-year term supporting the international evolutionary-computation research community.
- **Board Member, Marie Curie Alumni Association – North America Chapter**: two-year term supporting international researcher networking and career development.
- **Board Member, MIT Postdoctoral Association, and Chair of its Sports Committee**, during the MIT postdoctoral period.

Selected Public Engagement & Scientific Outreach

- Regular participant in the **European Researchers' Night**, communicating research in artificial intelligence, evolutionary computation, and societal applications to non-specialist audiences.
- **Pint of Science 2024**: public talk on generative artificial intelligence, its foundations, capabilities, and limitations.
- **Technology with Purpose: How AI Can Improve Life and the Common Good**, public lecture in Melilla, 2025, addressing AI, smart cities, ethics, privacy, equity, and transparency; additional outreach through public science events, webinars, podcasts, interviews, summer courses, and professional training.

Editorial Roles

- **Section Editor / Board Member**, *Mathematical and Computational Applications*, since July 2025.
- **Guest Editor**, Special Issue “Intelligent Solutions for Efficient Logistics and Sustainable Transportation,” *Applied Soft Computing*, since 2021.
- **Associate Guest Editor**, *Frontiers in Robotics and AI*, since 2019.

Conference and Scientific Event Organization

- **Programme Chair**, 30th International Conference on the Application of Evolutionary Computation (EvoApplications).
- Organizer, EGML-EC — **Enhancing Generative Machine Learning with Evolutionary Computation**, special session at GECCO, 2022, 2023, 2024, and 2025.
- Organizer, CIS — **Computational Intelligence for Sustainability**, special session at EvoApplications, 2024, 2025, and 2026.
- Organizer, **Computational Intelligence for Smart Cities**, special session at OLA 2020.
- Local Organizer, **Fourth Euro-China Conference on Intelligent Data Analysis and Applications (ECC 2017)**, Málaga.
- Organizer, **Smart Cities** special session, Metaheuristics International Conference (MIC 2017).

- Local Organizer, **Smart-CT 2017**, Málaga.
- Local Organizer, **Smart-CT 2016**, Málaga.
- Organizer, **Metaheuristics for Smart Cities**, special session, MIC 2015.
- Local Organizer, **Second International Summer School on Search-Based Software Engineering**, University of Málaga, 2017.

Programme Committee Service

Programme committee member for more than 25 conferences, including:

- **GECCO**: 2016, 2022, 2023, 2024, 2025, 2026.
- **EvoApplications**: 2024, 2025, 2026.
- **ICSC-CITIES**: 2018, 2019, 2020, 2021, 2022.
- **LOD**: 2019, 2020.
- **ARES**: 2018, 2020.
- **LION**: 2018.
- **MIC**: 2015, 2017.
- **CAEPIA**: 2018.
- Additional committees: ICPR Americas 2020; SEA² 2019; CISTI 2018; SITIS 2017; ECC 2017; Smart-CT 2016–2017; IEEE SmartCity 2016; CEDI 2016; IIT Innovations 2015; WVNT 2013–2015; HPCLatam 2012.

Journal Reviewing

Reviewer for:

- *Applied Soft Computing*;
- *Engineering Applications of Artificial Intelligence*;
- *IEEE Communications Letters*;
- *IEEE Transactions on Cybernetics*;
- *IEEE Transactions on Evolutionary Computation*;
- *IEEE Transactions on Vehicular Technology / Vehicular Communications*;
- *International Journal of Metaheuristics*;
- *Sensors*;
- *Smart Cities*;
- *Soft Computing*.

Research Proposal Evaluation

- External evaluator, **PROCIENCIA Peru**, Posdoctoral Research Projects, 2026.
- External evaluator, **AyudasPRI**, Secretaría General de Ciencia, Tecnología e Innovación, Junta de Extremadura, 2026.
- External evaluator, **FONDECYT Peru**, Basic Research Projects, 2021.
- Expert evaluator, **CONEX-Plus Programme**, Universidad Carlos III de Madrid, 2020.

Languages

- **English**: C1 in reading, interaction, speaking, and writing.
- **Arabic**: B1 in reading, interaction, speaking, and writing.
- **French**: A1 in reading, interaction, and speaking; B1 in writing.
- **Spanish**: Native.

Selected Research Software and Resources

- **Lipizzaner**: open-source distributed coevolutionary framework for GAN training, developed through the MIT–University of Málaga research line on evolutionary deep learning.