2023 ANNUAL REPORT

IIIA-CSIC

INSTITUT D'INVESTIGACIÓ
EN INTEL·LIGÈNCIA
ARTIFICIAL

ANNUAL REPORT 2023

IIIA-CSIC Institut d'investigació en Intel·ligència Artificial

PUBLISHED BY

IIIA-CSIC
Campus de la UAB,
Carrer de Can Planes, zona 2,
08193 Bellaterra
Barcelona
935809570
info@iiia.csic.es
www.iiia.csic.es

CSIC
Consejo Superior de Investigaciones Científicas

IIIA-CSIC
ARTIFICIAL
INTELLIGENCE
RESEARCH
INSTITUTE

TABLE OF CONTENTS

WELCOME

Our institute is currently in a dynamic growth phase in research scope and human resources. We are broadening our research lines through the addition of new researchers, bringing fresh perspectives from fields such as neuroscience, education, and natural language processing, among others. As we expand, we are securing additional resources to further enhance our capacity for innovative research.

Since our previous annual report, our institute has grown to an active team of 80 members. This growth includes a rejuvenation with recent hires and more expected in the coming years. We remain deeply engaged with Catalonia and Spain's research ecosystem while fostering strong international collaborations. Our involvement extends to shaping the strategic direction of AI, as we actively participate in the management of conferences and advisory roles within key organisations.

Artificial intelligence continues to present novel solutions to longstanding problems. At IIIA-CSIC, we maintain a thoughtful and balanced approach, closely monitoring technological advances while remaining measured in our expectations of what AI can achieve. A key part of our mission is to ensure that the public receives clear and accurate information about AI, and we actively engage with the media to fulfil this role.

We are committed to open science, leveraging AI for societal benefit, and fostering collaboration across the scientific community. We hope this report provides valuable insights that inspire further connections and collaborations with our institute.

Carles Sierra – IIIA-CSIC Director

1. ABOUT

The **Artificial Intelligence Research Institute** (IIIA) is a publicly funded research centre belonging to the Spanish National Research Council (CSIC) and located at the Universitat Autònoma de Barcelona. The IIIA was founded in 1994 as a continuation of a small group that started its research activities in 1985. In 1994 we moved from the Centre for Advanced Studies (CEAB) in the city of Blanes to the UAB campus in Bellaterra.

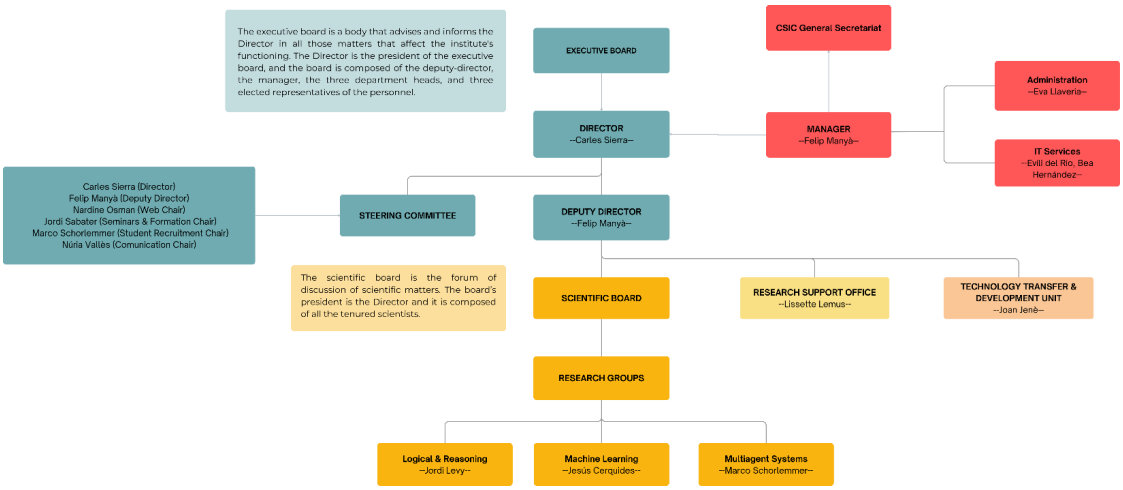
The IIIA is one of Spain's leading research centres in Artificial Intelligence (AI), with expertise in many areas, including machine learning, knowledge representation, multiagent systems, reasoning technologies, natural language processing, reasoning, optimisation, semantics, law, and science and technology studies.

The IIIA develops basic and applied research in three main research areas: Machine Learning; Multiagent Systems and; Reasoning and Logic. There is also a Technological Development Unit (UDT-IA) dedicated to technology transfer.

The Institute is an international reference with more than 3000 publications since 1985, and contributes to the AI community through many scientific leadership positions. These include editorial boards (JAAMAS, AIJ, JAIR, Fuzzy Sets and Systems), scientific boards (IFAAMAS, IJCAI Board of Trustees) and conference organising committees (IJCAI-2007, -2011, -2017, AAMAS-2004, -2009).

The training of new generations of scientists is a fundamental task of IIIA researchers. Throughout the history of IIIA, 113 high quality Ph.D. theses have been presented on various topics in AI, ranging from mathematical foundations to applied AI, covering different domains.

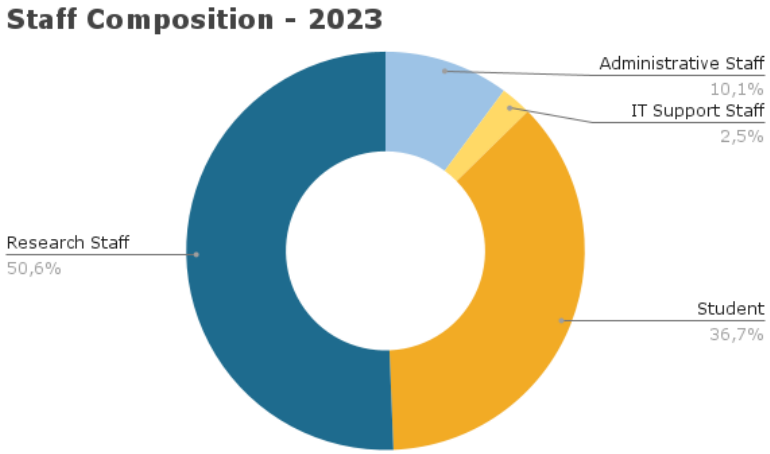
1.2 ORGANISATION CHART

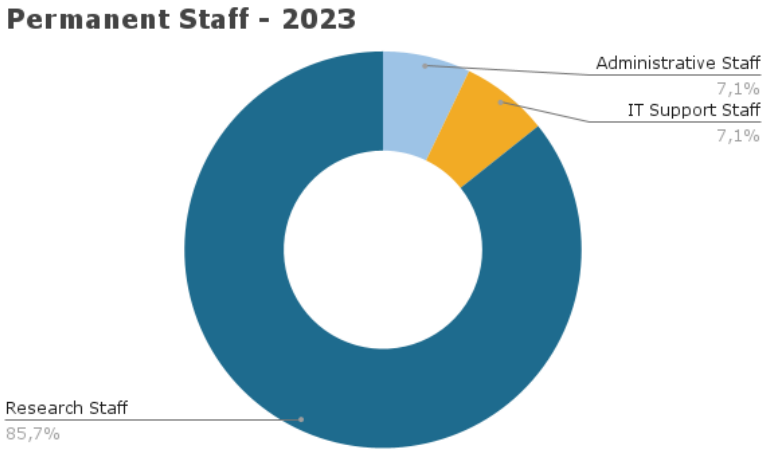


2. PERSONNEL

In 2023, the IIIA had **79 full-time staff**, including Research Staff (40), Administrative Staff (8), IT Support Staff (2) and Student (29).

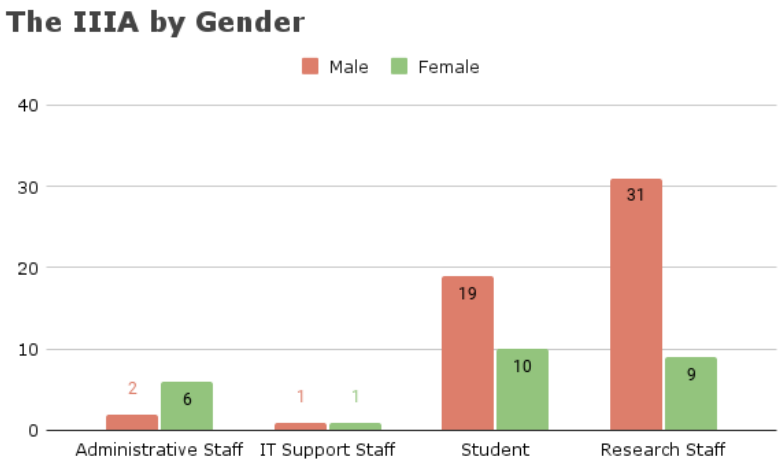
Depending on the employment relationship, there are civil servants (29) and contract staff (50).



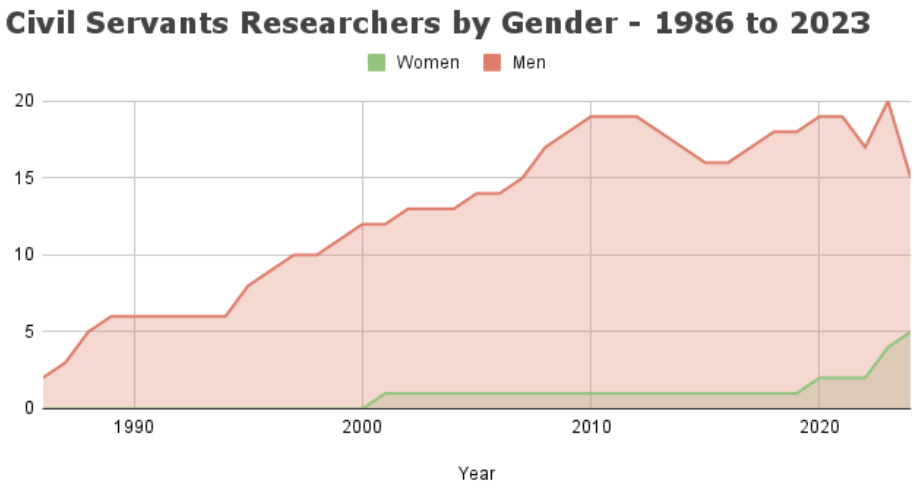


2.1 THE IIIA BY GENDER

In 2023, **women represent 32% of the total full-time staff**: 75% Administrative Staff; 50% Technical Staff; 34,5% Students, and 22,5% Research Staff.



The percentage of women researchers in the IIIA is substantially lower than that of men, reflecting the same trend in AI research worldwide. However, the IIIA has a strong commitment to equality and equity and has been working to reverse this trend, in an effort that will continue in the coming years.

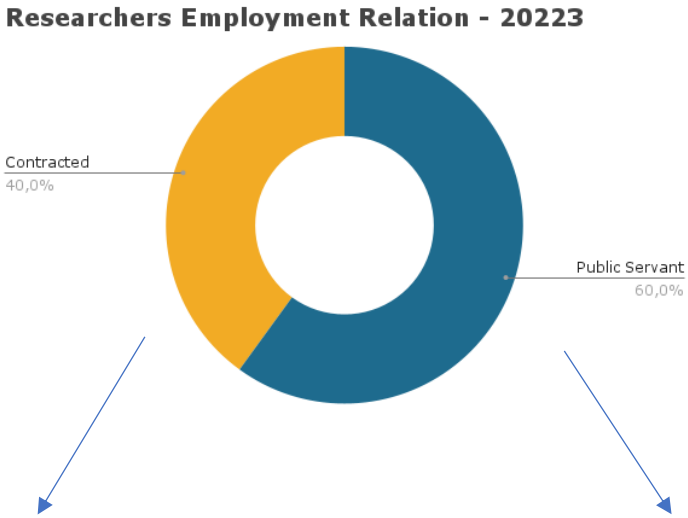


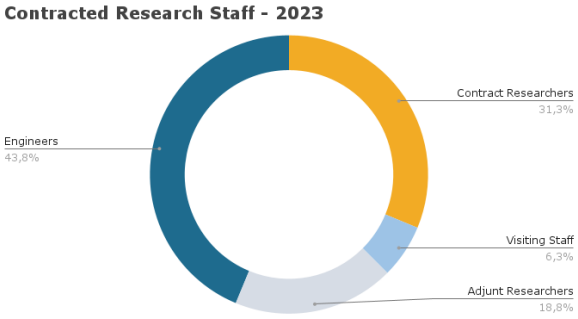
2.2 RESEARCH STAFF

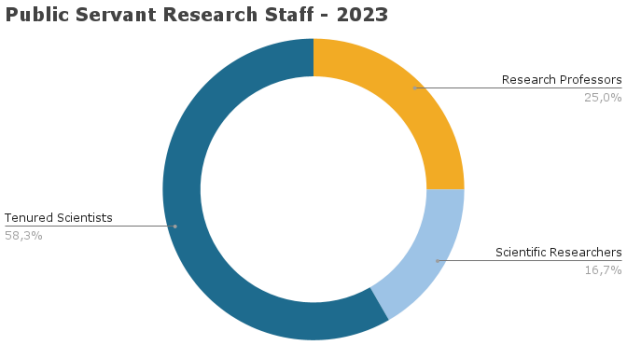
Within the research staff, there are 24 civil servants and 16 contracted researchers.

Among the civil servants, there are three categories of researchers: Research Professors (6), Scientific Researchers (4) and Tenured Scientists (14).

Among the contracted researchers, there are the following profiles: Contract Postdocs (5), Adjunct Researchers (3), Engineers (7) and Visiting Staff (1).

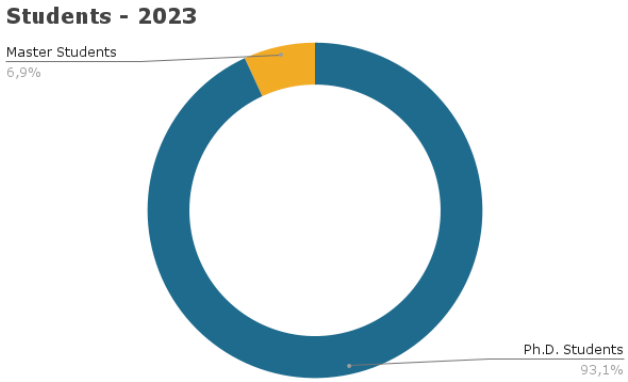






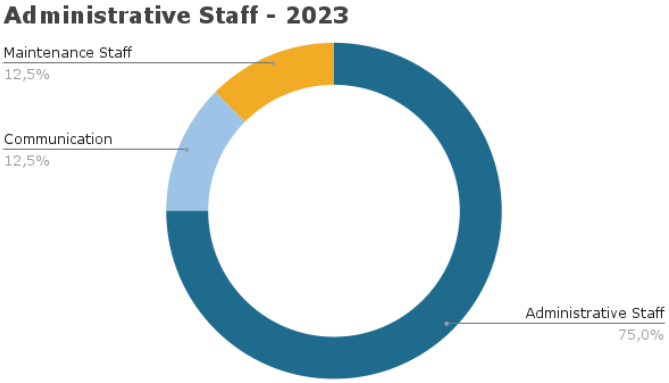
2.3 STUDENTS

There are Doctoral Students (27) and Master's Students (2).



2.4 ADMINISTRATIVE STAFF

The IIIA administration consists of Administrative Staff (6), Communication Staff (1), and Maintenance Staff (1).

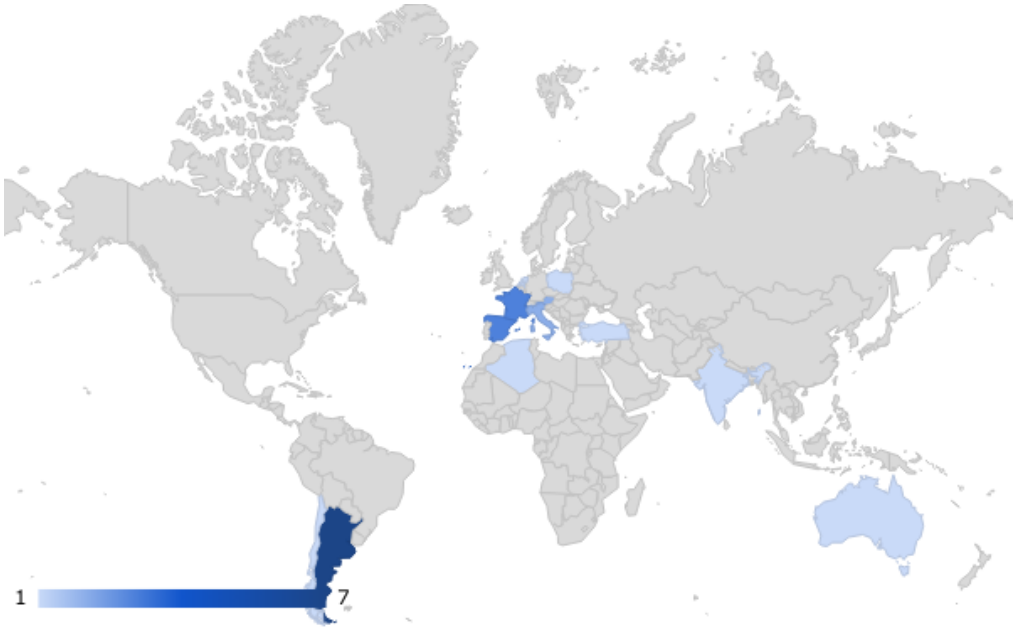


2.5 IT SUPPORT STAFF

The IT Support Staff consists of two professionals.

2.6 VISITORS

In 2023, we had 24 visitors, mainly from Argentina (7), France (3) and Spain (3).



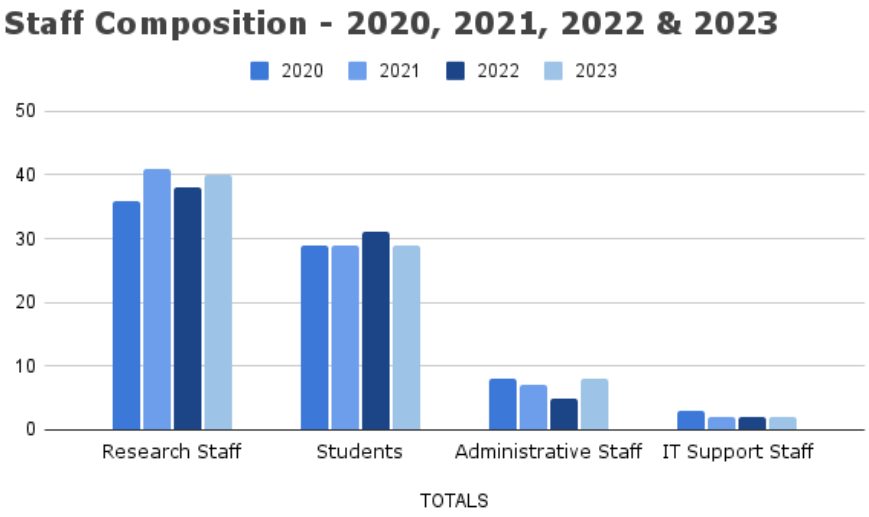
2.7 THE EVOLUTION OF THE INSTITUTE

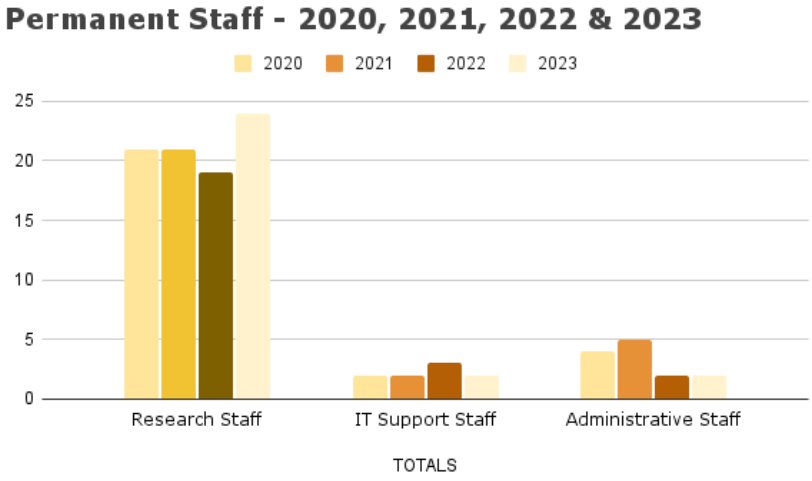
In 2020, the IIIA had 76 full-time staff, including research staff (36), administrative staff (8), IT support staff (3) and student staff (29).

In 2021, the IIIA had 79 full-time staff, including research staff (41), administrative staff (7), IT support staff (2) and student staff (29).

In 2022, the IIIA had 76 full-time staff, including research staff (38), administrative staff (5), IT support staff (2) and student staff (31).

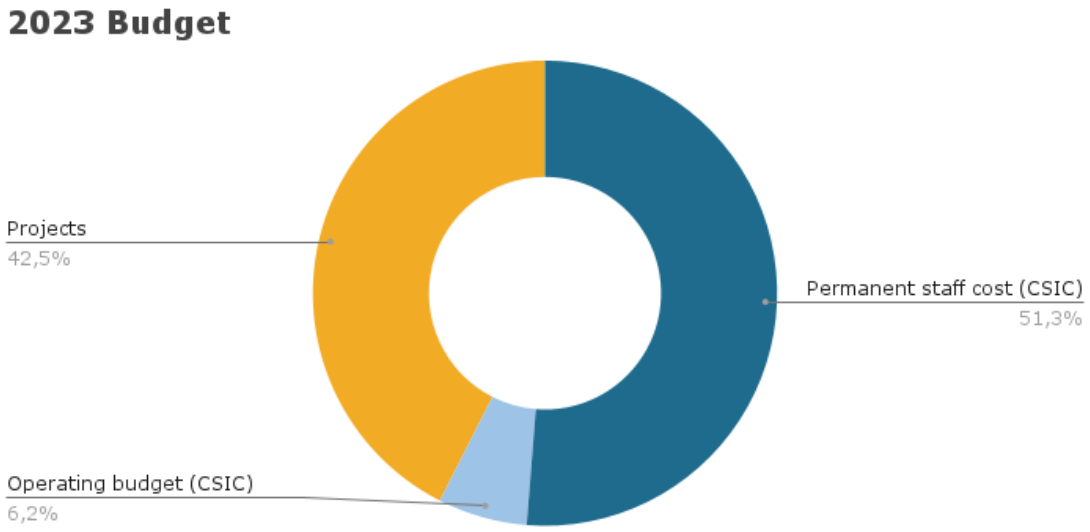
In 2023, the IIIA had 79 full-time staff, including research staff (40), administrative staff (8), IT support staff (2) and student staff (29).



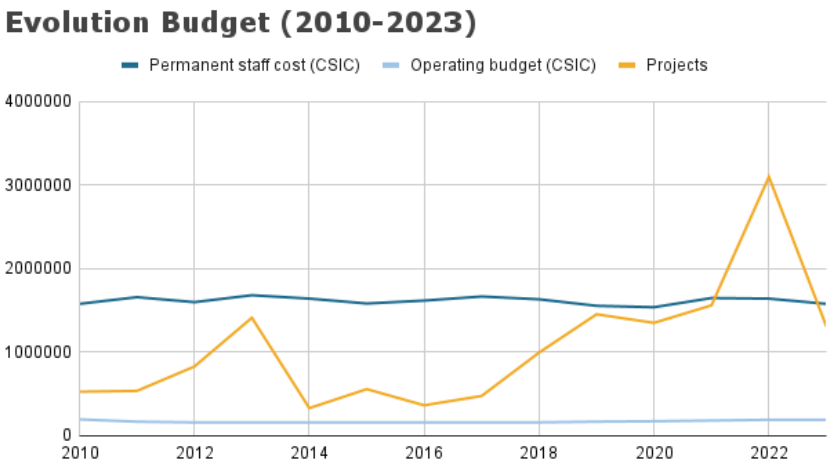


3. BUDGET

In 2023, **the IIIA had a total budget of €3,080,794**, of which 52% represents the permanent staff cost (€1,579,099) and 42.5% represents the money obtained through the achievement of projects and contracts (€1,310,058).



The following graph shows the evolution of the IIIA budget between 2010 and 2023, according to the CSIC's *Productividad por cumplimiento de objetivos (PCO)* (Productivity by achievement of objectives) dataset.



4. SCIENTIFIC RESULTS

4.1. LEARNING SYSTEMS

The group's research focuses on the development of machine learning algorithms, models, software, and applications. From an algorithmic/modeling perspective, the group pursues research in Probabilistic Graphical Models, Case-Base Reasoning, Transfer Learning, and Deep Learning. From the software and applications perspective, the group focuses on application areas such as Social Networks, Music, Robotics, Multiagent Systems, Bioinformatics, and Healthcare.

Head of Department: Jesus Cerquides

Research Team: Josep Lluis Arcos, Eva Armengol, Rocco Ballester Benito, Jesús Cerquides, David Gómez Guillén, Bjoern Komander, Ramon López de Màntaras (ad honorem), Oguz Mulayim, Pau Oliver Tarres, Enric Plaza, Pol Rodríguez Farres, Alessia Sabia, Martí Sánchez Fibla, Antoni Valls Cifre, Borja Velasco.

PROJECTS:

- **European Oocyte Biology Research Innovation Training Net (2019-2024)**
  EUROVA – MSCA-ITN-2019-860960
  PI: Jesús Cerquides Bueno
  European Commission
- **Citizen Science for Monitoring Climate Impacts and Achieving Climate Resilience (2020-2023)**
  CROWD4SDG – H2020-SwafS-2019-1 - 872944
  PI: Jesús Cerquides Bueno
  European Commission
- **HumanE AI Network (2020-2024)**
  HUMANE-AI-NET – H2020-ICT-2018-20 952026
  PI: Jesús Cerquides Bueno
  European Commission
- **Knowledge for improving indoor AIR quality and HEALTH (2022-2026)**
  K-HEALTHINAIR – HORIZON-HLTH-2021-ENVHLTH-02 101057693
  PI: Jesús Cerquides Bueno

European Commission

- **DispositiVo regIStro hOlter seRas EEG (2022-2025)**
  VISOR EEG – CPP2021-008311
  PI: Jesús Cerquides Bueno
  Ministerio de Ciencia e Innovación
- **SafeGUARDing biodivErsity aNd critical ecosystem services across sectors and scales (2022-2025)**
  GUARDEN – HORIZON-CL6-2021-GOVERNANCE-01 101060693
  PI: Jesús Cerquides Bueno
  European Commission
- **Quantum Cognitive Digital Industry (2022-2025)**
  QDCI – 247433
  PI: Jesús Cerquides Bueno
  Private funding: Enzyme Advising Group

PUBLICATIONS:

Arweiler, J., Ates, C., Cerquides, J., Koch, R., & Bauer, H.-J. (2023). Similarity-based framework for unsupervised domain adaptation: Peer reviewing policy for pseudo-labeling. Machine Learning and Knowledge Extraction, 5, 1474-1492. https://doi.org/10.3390/make5040074

Athanasiou, G., Arcos, J. L., & Cerquides, J. (2023). Enhancing medical image segmentation: Ground truth optimization through evaluating uncertainty in expert annotations. Mathematics, 11. https://doi.org/10.3390/math11173771

Ballester, R., Labeyrie, Y., Mulayim, O., Marquez, J. L., & Cerquides, J. (2023). Mathematical and computational models for crowdsourced geolocation. In I. Sanz, R. Ros, & J. Nin (Eds.), Frontiers in Artificial Intelligence and Applications, Vol. 375: Artificial Intelligence Research and Development (pp. 301-310). IOS Press. https://doi.org/10.3233/FAIA230699

Bono, C., Mülâyim, M. O., Cappiello, C., Carman, M. J., Cerquides, J., Fernandez-Marquez, J. L., Mondardini, M. R., Ramalli, E., & Pernici, B. (2023). A citizen science approach for analyzing social media with crowdsourcing. IEEE Access, 11, 15329-15347. https://doi.org/10.1109/ACCESS.2023.3243791

Correa Mañas, N., Cerquides, J., Arcos, J. L., Vassena, R., & Popovic, M. (2023). O-185 A clinically robust machine learning model for selecting the first FSH dose during controlled ovarian hyperstimulation: Incorporating clinical knowledge to the learning process. Human Reproduction, 38(Supplement_1), dead093-226. https://doi.org/10.1093/humrep/dead093.226

Firmansyah, H. B., Fernandez-Marquez, J. L., Cerquides, J., & Di Marzo Serugendo, G. (2023). Single or ensemble model? A study on social media images classification in disaster

response. In The 10th Multidisciplinary International Social Networks Conference (pp. 48-54). Association for Computing Machinery. https://doi.org/10.1145/3624875.3624884

Firmansyah, H. B., Fernandez-Marquez, J. L., Cerquides, J., Lorini, V., Bono, C. A., & Pernici, B. (2023). Enhancing disaster response with automated text information extraction from social media images. In 2023 IEEE Ninth International Conference on Big Data Computing Service and Applications (BigDataService) (pp. 71-78).

Gómez-Guillén, D., Díaz, M., Arcos, J. L., & Cerquides, J. (2023). Bayesian optimization with additive kernels for the calibration of simulation models to perform cost-effectiveness analysis. In Artificial Intelligence Research and Development (pp. 143-152). IOS Press. https://doi.org/10.3233/FAIA230677

Komander, B., Cerquides, J., & Piera, J. (2023). Developing and validating tools for the automated analysis and enhancement of online discussions. In HHAI 2023: Augmenting Human Intellect (pp. 433-435). IOS Press.

Komander, B., Cerquides, J., Piera, J., Chan, J., & Alavi, A. (2023). Expert finding for citizen science. In Artificial Intelligence Research and Development (pp. 59-69). IOS Press. https://doi.org/10.3233/FAIA230659

López de Mántaras, R. (2023). ¿Inteligencia artificial o habilidades sin comprensión? Revista de Occidente, 511, 95-111. (ISSN: 0034-8635)

López de Mántaras, R. (2023). Creativitat computacional. La maleta de Portbou, 61, 106-110. (ISSN: 2339-6768)

López de Mántaras, R. (2023). Intel·ligència Artificial versus intel·ligència humana. In IA: Intel·ligència Artificial (pp. 46-53). CCCB. (ISBN: 978-19091-77-2)

López de Mántaras, R. (2023). Mites i realitats de la intel·ligència artificial. Barcelona Metrópolis, 127, 5-9. Ajuntament de Barcelona. (ISSN: 2340-129X)

López de Mántaras, R., & Brunet Crosa, P. (2023). ¿Qué es la inteligencia artificial? Papeles de relaciones ecosociales y cambio global, 164, 13-21. (ISSN: 1888-0576)

Perez-Cerrolaza, J., Abella, J., Borg, M., Donzella, C., Cerquides, J., Cazorla, F. J., Englund, C., Tauber, M., Nikolakopoulos, G., & Flores, J. L. (2023). Artificial intelligence for safety-critical systems in industrial and transportation domains: A survey. ACM Computing Surveys. https://doi.org/10.1145/3626314

Raes, A., Azari-Dolatabad, N., Athanasiou, G., Arcos, J. L., Cerquides, J., Opsomer, G., Smits, K., Angel-Velez, D., & Van Soom, A. (2023). Measuring cumulus expansion of bovine cumulus-oocyte complexes: Comparing the reliability of three methods. Animal - Science Proceedings, 14, 449-450. https://doi.org/10.1016/j.anscip.2023.03.032

Velasco-Regulez, B., & Cerquides, J. (2023). Hydranet: A neural network for the estimation of multi-valued treatment effects. In Artificial Intelligence Research and Development (pp. 16-27). IOS Press. https://doi.org/10.3233/FAIA230655

White, B. K., Gombert, A., Nguyen, T., Yau, B., Ishizumi, A., Kirchner, L., León, A., Wilson, H., Jaramillo-Gutierrez, G., Cerquides, J., D'Agostino, M., Salvi, C., Sreenath, R. S., Rambaud, K., Samhouri, D., Briand, S., & Purnat, T. D. (2023). Using machine learning technology (Early Artificial Intelligence-Supported Response With Social Listening Platform) to enhance digital social understanding for the COVID-19 infodemic: Development and implementation study. JMIR Infodemiology, 3, e47317. https://doi.org/10.2196/47317

White, B., Gombert, A., Nguyen, T., Yau, B., Ishizumi, A., Kirchner, L., León, A., Wilson, H., Jaramillo-Gutierrez, G., Cerquides, J., & Purnat, T. (2023). Using artificial intelligence to inform infodemic insights: The development of the WHO EARS platform. APHA 2023 Annual Meeting and Expo.

4.2. LOGIC AND REASONING

The activity of this group is centered around the logical and mathematical modelling of reasoning, with particular emphasis to mathematical fuzzy logic, uncertainty models, logics for incomplete information and computational argumentation, and the design of efficient algorithms for solving satisfaction and optimisation problems using methods based on SAT, constraints, and metaheuristics.

Head of the Group: Jordi Levy

Research Team: Mehmet Anil Akbay**,** Christian Blum, Eduardo Calò, Camilo José Chacón Sartori, Vicent Costa, Pilar Dellunde, Gonçal E. Imaz, Raül Espejo Boix, Francesc Esteva (ad honorem), Tommaso Flaminio, Diego Fraile Parra, Valeria Giustarin, Lluís Godo, Jordy Levy, Francesco Manfucci, Felip Manyà, Vanina Martínez, Gonçalo Melo de Magalhães, Pedro Meseguer, Jaume Reixach I Perez, Guillem Rodríguez Corominasa, Sara Ugolini, Elifnaz Yangin.

PROJECTS:

- **Inteligencia computacional avanzada para alcanzar objetivos de desarrollo sostenible (2020-2023)**
  CI-SUSTAIN – PID2019-104156GB-I00
  PI: Christian Blum / Juan Antonio Rodríguez-Aguilar
  Ministerio de Ciencia e Innovación
- **Sistemas de inferencia para información inconsistente: fundamentos lógicos (2020-2023)**
  ISINC – PID2019-111544GB-C21
  PI: Lluís Godo / Felip Manyà
  Ministerio de Ciencia e Innovación
- **Modalities in Substructural Logics: Theory, Methods and Applications (2021-2026)**
  MOSAIC – H2020-MSCA-RISE-2020 101007627
  PI: Tommaso Flaminio
  European Commission
- **Metaheurísticas Híbridas (2021-2023)**
  META – 202150E087
  PI: Christian Blum
  Consejo Superior de Instituciones Científicas (CSIC)
- **Lógicas y Algebras para Condicionales (2022-2023)**
  PIE INCORPORACIÓN – 202250I196
  PI: Tommaso Flaminio
  Consejo Superior de Instituciones Científicas (CSIC)
- **Transporte y entrega de mercancías sostenibles en ciudades (2022-2024)**
  E-TRANS – TED2021-129319B-I00
  PI: Christian Blum

Ministerio de Ciencia e Innovación

- **Caracterización y cuantificación de desinformación en contenido de redes sociales (2023-2026)**
  DESINFSOC – 20235AT010
  PI: Vanina Martínez
  Consejo Superior de Instituciones Científicas (CSIC)
- **Algebraic construcZons in substructural logics (2023-2026)**
  ASUBS – 20235AT019
  PI: Sara Ugolini
  Consejo Superior de Instituciones Científicas (CSIC)
- **Procesamiento de inconsistencias basado en lógica para sistemas inteligentes explicables: fundamentos (2023-2026)**
  LINEXSYS – PID2022-139835NB-C21
  PI: Lluís Godo / Felip Manyà
  Ministerio de Ciencia e Innovación
- **Técnicas avanzadas de inteligencia computacional usadas en beneficio del desarrollo sostenible (2023-2026)**
  ACISUD – PID2022-136787NB-I00
  PI: Christian Blum / Juan Antonio Rodríguez-Aguilar
  Ministerio de Ciencia e Innovación
- **La forma del razonamiento: lógicas multivaluadas y incertidumbre (2023-2027)**
  SHORE – PID2022-141529NB-C22
  PI: Tommaso Flaminio
  Ministerio de Ciencia e Innovación

PUBLICATIONS:

Abriola, S., Cifuentes, S., Martinez, M. V., Pardal, N., & Pin, E. (2023). An epistemic approach to model uncertainty in data-graphs. International Journal of Approximate Reasoning, 160, 108948.

Abriola, S., Martinez, M. V., Pardal, N., Cifuentes, S., & Pin Baque, E. (2023). On the complexity of finding set repairs for data-graphs. Journal of Artificial Intelligence Research, 76, 721–759.

Aglianò, P., & Ugolini, S. (2023). Projectivity and unification in substructural logics of generalized rotations. International Journal of Approximate Reasoning, 153, 172–192. https://doi.org/10.1016/j.ijar.2022.11.018

Aglianò, P., & Ugolini, S. (2023). Projectivity in (bounded) commutative integral residuated lattices. Algebra Universalis, 84(2). https://doi.org/10.1007/s00012-022-00798-x

Akbay, M. A., Kalayci, C. B., & Blum, C. (2023). Application of Adapt-CMSA to the two-echelon electric vehicle routing problem with simultaneous pickup and deliveries. In Proceedings of EvoCOP 2023 -- European Conference on Evolutionary Computation in

Combinatorial Optimization (pp. 16–33). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-30035-6_2

Alonso-Moral, J.M., & Costa, V. (2023). The Role of Speculations for Explainable and Trustworthy Artificial Intelligence: A Use Case on Art Genre Classification. Sebastià Massanet, Susana Montes, Daniel Ruiz-Aguilera, & Manuel González Hidalgo (Eds.), Fuzzy Logic and Technology, and Aggregation Operators, pp. 455--467. Springer. https://doi.org/10.1007/978-3-031-39965-7_38.

Blum, C., & Pinacho-Davidson, P. (2023). Application of negative learning ant colony optimization to the far from most string problem. In Proceedings of EvoCOP 2023 -- European Conference on Evolutionary Computation in Combinatorial Optimization (pp. 82–97). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-30035-6_6

Bonzio, S., Cevolani, G., & Flaminio, T. (2023). How to believe long conjunctions of beliefs: Probability, quasi-dogmatism and contextualism. Erkenntnis, 88(3), 965–990. https://link.springer.com/article/10.1007/s10670-021-00389-7

Budan, P. D., Escañuela Gonzalez, M. G., Budán, M. C. D., Martinez, M. V., & Simari, G. R. (2023). Strength in coalitions: Community detection through argument similarity. Argument Computation, 14(3), 275–325.

Budan, P. D., Escañuela Gonzalez, M. G., Budán, M. C. D., Martinez, M. V., & Simari, G. I. (2023). A summary of community detection from coalitions through argument similarity. AI^3@AIIA 2023.

Chacon Sartori, C., Blum, C., & Ochoa, G. (2023). STNWeb: A new visualization tool for analyzing optimization algorithms. Software Impacts, 17, 100558. https://doi.org/10.1016/j.simpa.2023.100558

Chacón-Sartori, C., Blum, C., & Ochoa, G. (2023). Search trajectory networks meet the web: A web application for the visual comparison of optimization algorithms. In Proceedings of ICSCA 2023 -- 12th International Conference on Software and Computer Applications (pp. 89–96). ACM press. https://doi.org/10.1145/3587828.3587843

Coll, J., Li, C. M., Manyà, F., & Yangin, E. (2023). A complete tableau calculus for the regular MaxSAT problem. CCIA 2023, 359–368. https://doi.org/10.3233/FAIA230706

Coll, J., Li, C. M., Manyà, F., & Yangin, E. (2023). MaxSAT resolution for regular propositional logic. International Journal of Approximate Reasoning, 162, 109010. https://doi.org/10.1016/j.ijar.2023.109010

Corsi, E. A., Flaminio, T., Godo, L., & Hosni, H. (2023). A modal logic for uncertainty: A completeness theorem. Proceedings of the 13th International Symposium on Imprecise Probabilities: Theories and Applications - ISIPTA 2023, PMLR, 215, 119–129. https://proceedings.mlr.press/v215/corsi23a.html

Costa, J.M.Alonso, Z. Falomir, P. Dellunde. (2023). An art painting style explainable classifier grounded on logical and commonsense reasoning. Soft Computing 1-23. https://doi.org/10.1007/s00500-023-08258-x

Costa, V. (2023). El fracàs de Radar COVID. NODES, 59, 34–39.

Dellunde, P., Pujol, O., & Vitrià, J. (2023). Cerrando una brecha: una reflexión multidisciplinar sobre la discriminación algorítmica. Daimon Revista Internacional de Filosofia, (90), 63-80. https://doi.org/10.6018/daimon.562811

Djukanovic, M., Kartelj, A., & Blum, C. (2023). Self-adaptive CMSA for solving the multidimensional multi-way number partitioning problem. Expert Systems with Applications, 232, 120762. https://doi.org/10.1016/j.eswa.2023.120762

Dubois, D., Godo, L., & Prade, H. (2023). An elementary belief function logic. Journal of Applied Non-Classical Logics, 33, 582–605. https://doi.org/10.1080/11663081.2023.2244366

Flaminio, T., & Godo, L. (2023). Conditional objects as possibilistic variables. In European Conference on Symbolic and Quantitative Approaches with Uncertainty (pp. 303–312). Springer. https://link.springer.com/chapter/10.1007/978-3-031-45608-4_28

Flaminio, T., & Ugolini, S. (2023). Encoding de Finetti's coherence within Lukasiewicz logic and MV-algebras. Annals of Pure and Applied Logic. https://doi.org/10.1016/j.apal.2023.103337

Flaminio, T., Gilio, A., Godo, L., & Sanfilippo, G. (2023). On conditional probabilities and their canonical extensions to Boolean algebras of compound conditionals. International Journal of Approximate Reasoning, 159, 108943. https://doi.org/10.1016/j.ijar.2023.108943

Flaminio, T., Godo, L., Madrid, N., & Ojeda-Aciego, M. (2023). A logic to reason about f-indices of inclusion over $\L_n$. In S. Massanet et al. (Eds.), Fuzzy Logic and Technology, and Aggregation Operators. EUSFLAT 2023, AGOP 2023 (pp. 530–539). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-39965-7_44

Flaminio, T., Preto, S., & Ugolini, S. (2023). Reasoning about probability via continuous functions. In Proceedings of the 20th International Conference on Principles of Knowledge Representation and Reasoning, KR2023. https://proceedings.kr.org/2023/28/kr2023-0028-flaminio-et-al.pdf

Furman, D. A., Malvicini, S. A., Martinez, M. V., Shakarian, P., Simari, G. I., & Soto, Y. O. (2023). A neuro-symbolic approach to argument comparison in structured argumentation. AI^3@AIIA 2023.

Furman, D. A., Torres, P., Rodríguez, J., Alonso Alemany, L., Letzen, D., & Martinez, M. V. (2023). High-quality argumentative information in low-resources approaches improves counter-narrative generation. Empirical Methods in Natural Language Processing (EMNLP Findings), 2942–2956.

Furman, D. A., Torres, P., Rodríguez, J., Alonso Alemany, L., Letzen, D., & Martinez, M. V. (2023). Argumentative information improves automatic generation of counter-narratives against hate speech. In First International Workshop on Argumentation and Applications, International Conference on Principles of Knowledge Representation and Reasoning (KR 2023).

Furman, D. A., Torres, P., Rodríguez, J., Alonso Alemany, L., Letzen, D., & Martinez, M. V. (2023). Which argumentative aspects of hate speech in social media can be reliably identified? In International Workshop on Designing Meaning Representation (DMR 2023).

Galatos, N., & Ugolini, S. (2023). Gluing residuated lattices. Order, 40, 623–664. https://doi.org/10.1007/s11083-023-09626-w

Garcia, A. C., Martinez, M. V., Deagustini, C. A. D., & Simari, G. I. (2023). A multi-agent system for addressing cybersecurity issues in social networks. In ENIGMA 2023 Workshop - AI-driven heterogeneous data management: Completing, merging, handling inconsistencies and query-answering (pp. 43–54). International Conference on Principles of Knowledge Representation and Reasoning (KR 2023).

Giustarini, V., & Ugolini, S. (2023). Maximal theories of product logic. In S. Massanet, S. Montes, D. Ruiz-Aguilera, & M. González-Hidalgo (Eds.), Fuzzy Logic and Technology, and Aggregation Operators. EUSFLAT AGOP 2023 (pp. 43–54). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-39965-7_42

Haniková, Z., Manyà, F., & Vidal, A. (2023). The MaxSAT problem in the real-valued MV-algebra. TABLEAUX, 386–404. https://doi.org/10.1007/978-3-031-43513-3_21

Idrovo, J. E., Llivisaca, M. D., Torres, S. P., Blum, C., Ergun, H., Van Hertem, D., Jara-Alvear, J., Gavela, X. P., Ballari, D., Torres, M. A., Zurita, A. F., Calero, F., Aguilar, R., & Saavedra, J. (2023). Hybrid AC/DC static transmission expansion planning using a new efficient iterated greedy algorithm. In Proceedings of ISGT-LA 2023 -- IEEE PES Innovative Smart Grid Technologies Latin America (pp. 515–519). IEEE press. https://doi.org/10.1109/ISGT-LA56058.2023.10328220

Imaz, G. E. (2023). A first polynomial non-clausal class in many-valued logic. Fuzzy Sets and Systems, 456, 1–37. https://doi.org/10.1016/j.fss.2022.10.008

Imaz, G. E. (2023). The possibilistic horn non-clausal knowledge bases. International Journal of Approximate Reasoning, 152, 357–389. https://doi.org/10.1016/j.ijar.2022.11.002

Jiang, H., Bai, K., Liu, H. J., Li, C. M., Manyà, F., & Fu, Z. H. (2023). Parallel bounded search for the maximum clique problem. Journal of Computer Science and Technology, 38(5), 1187–1202. https://doi.org/10.1007/s11390-022-1803-8

Li, S., Coll, J., Habet, D., Li, C. M., & Manyà, F. (2023). A tableau calculus for signed maximum satisfiability. International Symposium on Multiple-Valued Logic (ISMVL), 170–175. https://doi.org/10.1109/ISMVL57333.2023.00041

Li, S., Li, C. M., Luo, M., Coll, J., Habet, D., & Manyà, F. (2023). A new variable ordering for in-processing bounded variable elimination in SAT solvers. International Joint Conference on Artificial Intelligence (IJCAI) 2023, 1979–1987. https://doi.org/10.24963/ijcai.2023/220

Manfucci, F., & Ugolini, S. (2023). Free product hoops. In S. Massanet, S. Montes, D. Ruiz-Aguilera, & M. González-Hidalgo (Eds.), Fuzzy Logic and Technology, and Aggregation Operators. EUSFLAT AGOP 2023 (pp. 530–539). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-39965-7_43

Nurcahyadi, T., & Blum, C. (2023). Ant colony optimization for packing process optimization in multi-head weigher machines. In AIP Conference Proceedings (Vol. 2837, No. 1). AIP Publishing. https://doi.org/10.1063/

Preto, S., Manyà, F., & Finger, M. (2023). Benchmarking Łukasiewicz logic solvers with properties of neural networks. International Symposium on Multiple-Valued Logic (ISMVL), 158–163. https://doi.org/10.1109/ISMVL57333.2023.00039

Preto, S., Manyà, F., & Finger, M. (2023). Linking Łukasiewicz logic and Boolean maximum satisfiability. International Symposium on Multiple-Valued Logic (ISMVL), 164–169. https://doi.org/10.1109/ISMVL57333.2023.00040

Ramírez Sánchez, J. E., Chacón Sartori, C., & Blum, C. (2023). Q-learning ant colony optimization supported by deep learning for target set selection. In Proceedings of GECCO 2023 -- Genetic and Evolutionary Computation Conference (pp. 357–366). ACM press. https://doi.org/10.1145/3583131.3590396

Rodriguez Corominas, G., Blesa, M. J., & Blum, C. (2023). AntNetAlign -- A software package for network alignment. Software Impacts, 15, 100476. https://doi.org/10.1016/j.simpa.2023.100476

Rosella, G., Flaminio, T., & Bonzio, S. (2023). Counterfactuals as modal conditionals, and their probability. Artificial Intelligence, 323, 103970. https://www.sciencedirect.com/science/article/pii/S0004370223001169

Sans, Pinillos A. & Costa, C. (2023). Más allá de los datos: la transformación digital del museo tradicional. Daimon, 90, 81-94. https://doi.org/10.6018/daimon.563231.

Tarrés-Puertas, M. I., Costa, V., Pedreira Álvarez, M., Lemkow-Tovias, G., Josep M. Rossell, & Dorado, A.D., (2023). Child-Robot Interactions Using Educational Robots: An Ethical and Inclusive Perspective. Sensors, 23, 1675. https://doi.org/10.3390/S23031675.

Ugolini, S. (2023). The polyhedral geometry of Wajsberg hoops. Journal of Logic and Computation. https://doi.org/10.1093/logcom/exad007

Zanitti, G. E., Soto, Y., Iovene, V., Martinez, M. V., Rodríguez, R. O., Simari, G. I., & Wassermann, D. (2023). Scalable query answering under uncertainty to neuroscientific ontological knowledge: The NeuroLang approach. Neuroinformatics, 21(2), 407–425.

4.3. MULTIAGENT SYSTEMS

The Multiagent Systems (MAS) group at IIIA-CSIC carries out scientific research at the highest level in areas that are central to autonomous agents and multiagent systems: computational models of negotiation, control and organisation, trust and reputation, optimisation, semantics, and recommender systems. It positions itself at the intersection of CSIC's global areas SOCIETY and MATTER through interdisciplinary research with high socio-economic impact. The group's objectives are guided by a human-centred approach to AI, developing computational systems in line with the ethical and social values of the communities that use them, empowering people in the interactions mediated by these systems, respecting and promoting diversity, and exploring new forms of collaboration.

Head of the Group: Marco Schorlemmer

Research Team: Alba Aguilera, Davide Audrito**,** Filippo Bistaffa, Dimitra Bourou, Pompeu Casanovas Romeu, Olena Chebanyuk, Dave de Jonge, Thiago Freitas Dos Santos, Pere García Calvés, Andrea Guillen Gil, Mohammed Zakaria Mohammed Hassan, Jairo Alejsndro Lefebre Lobaina, Roger Xavier Lera Leri, Zhou Long, Alejandra López de Aberasturi Gómez, Arnau Mayoral Macau, Nieves Montes, Pablo Noriega, Nardine Osman, Shuxian Pan, Israel Puerta Merino, Josep Puyol- Gruart, Juan A. Rodríguez Aguilar, Laura Rodríguez Cima, Manel Rodríguez Soto, Gerard Rovira Parra, Jordi Sabater Mir, Marco Schorlemmer, Carles Sierra, Núria Vallès Peris.

PROJECTS:

- **WeNet - The Internet of US (2019-2023)**
  WENET – H2020-FETPROACT-2018-01 823783
  PI: Nardine Osman
  European Commission
- **Nou format audiovisual amb funcionalitats tecnològiques avançades per a laprenentatge (2019-2023)**
  NANOMOOCS – RIS3CAT COMRDI18-1-0010
  PI: Jordi Sabater
  ACCIÓ – Generalitat de Catalunya
- **e-Interactive Natural Language Technology for Explainable Artificial Intelligence (2019-2024)**
  NL4XAI – H2020-MSCA-ITN-2019 860621
  PI: Carles Sierra
  European Commission
- **Verificació intel·ligent de normes arquitectòniques i de la construcció en models BIM (2019-2023)**
  SMARTNORMS4BIM – INNOTECRD19-1-0045
  PI: Marco Schorlemmer
  ACCIÓ – Generalitat de Catalunya

- **Teoria y computacion de la conceptualizacion corporizada para sistemas de información (2020-2024)**
  CORPORIS – PID2019-109677RB-I00
  PI: Marco Schorlemmer
  Ministerio de Ciencia e Innovación
- **Desarrollo de mecanismos avanzados de interacción humano-máquina en el contexto de recomendadores argumentativos (2020-2023)**
  MARA – 202050E132
  PI: Jordi Sabater
  Consejo Superior de Instituciones Científicas (CSIC)
- **Foundations of Trustworthy AI - Integrating Reasoning, Learning and Optimization (2020-2024)**
  TAILOR – H2020-ICT-2018-20 952215
  PI: Carles Sierra
  European Commission
- **Razonamiento diagramático y su formalización con esquemas de imagen (2020-2023)**
  DIAGRAFIS – 202050E243
  PI: Marco Schorlemmer
  Consejo Superior de Instituciones Científicas (CSIC)
- **Plataforma de aprendizaje competencial personalizado mediante el uso de Inteligencia Artificial (2021-2023)**
  ADDIA – INNOTEC ACE014/20/000039
  PI: Jordi Sabater
  Generalitat de Catalunya
- **Simulaciones hibridas multi escala basadas en agentes en tiempo real para el entrenamiento en emergencias (2021-2024**)
  RHYMAS – PID2020-113594RB-100
  PI: Jordi Sabater / Nardine Osman
  Ministerio de Ciencia e Innovación
- **Ajuts a Grups de Recerca Consolidats / Projecte de Recerca "IDT- Institut de Dret i Tecnologia (2021-2024)**
  SGR-Cat2021 – 2021 SGR 00532
  PI: Pompeu Casanovas
  AGAUR – Generalitat de Catalunya
- **Ajuts a Grups de Recerca Consolidats (2022-2024)**
  SGR-Cat 2021 – 2021 SGR 00754
  PI: Carles Sierra
  AGAUR – Generalitat de Catalunya
- **Yoma Operational Research (2022-2024)**
  YOMA OR – OPE02570
  PI: Juan Antonio Rodríguez-Aguilar
  UNICEF
- **Value-Aware Artificial Intelligence (2022-2026)**
  VALAWAI – HORIZON-EIC-2021-PATHFINDERCHALLENGES-01-01 - Awareness Inside - 101070930
  PI: Carles Sierra
  European Commission
- **Verificació intel·ligent de normes de la construcció en base a models BIM (2022-2024)**

SMARTNORMS – 2021 PROD 00031
PI: Marco Schorlemmer
AGAUR – Generalitat de Catalunya

- **Interventions against polarisation in society for TRUSTworthy social media: From diagnosis to therapy (2022-2026)**
  iTRUST – PCI2022-135010-2
  PI: Carles Sierra / Vanina Martínez
  Ministerio de Ciencia e Innovación
- **Fundamentos de la conciencia de valores (2022-2024)**
  VAE – TED2021-131295B-C31
  PI: Nardine Osman
  Ministerio de Ciencia e Innovación
- **Desarrollo de una estrategia de formación y seguimiento de los desafíos éticos del uso de la inteligencia Artificial en una perspectiva 2030 (2023-2024)**
  DESAFIA2030 – BILTC22005
  PI: Pablo Noriega
  Consejo Superior de Instituciones Científicas (CSIC)
- **La inteligencia artificial en las transiciones educativas. oportunidades y riesgos (2023-2025)**
  TRANSICIONES EDUCATIVAS IA – 20237553
  PI: Núria Vallès Peris
  Private Funding: Ayuda en Acción

PUBLICATIONS:

Bistaffa, F. (2023). Faster exact MPE and constrained optimization with deterministic finite state automata. In Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI). https://www.ijcai.org/proceedings/2023/209

Casanovas, P. (2023). De la impenetrabilitat: Llenguatge, cognició, intel·ligència artificial. Col·loquis de Vic. La Llengua, XXVII, 45–69. https://revistes.iec.cat/index.php/CV/article/view/150936

Casanovas, P. (2023). La història intel· lectual que practiquem, tal com és. Anuari de la Societat Catalana de Filosofia, 34, 79-109. http://revistes.iec.cat/index.php/ASCF.

Casanovas, P., & Noriega, P. (2023). Cómo regular lo altamente complejo. Nuevos Diálogos, 2, 25–32. Dirección General de Divulgación de la Ciencia/Dirección General de Divulgación de las Humanidades, UNAM.

Casanovas, P., de Koker, L., Hashmi, M., Noriega, P., & Keyzer, P. (Eds.). (2023). Proceedings of selected papers of the Workshop on Artificial Intelligence Governance, Ethics, and Law (AIGEL 2022). Trier: CEUR. https://ceur-ws.org/Vol-3531/

Casanovas, P., Hashmi, M., & Poblet, M. (2023). Generative AI and the rule of law. In P. Casanovas, L. de Koker, M. Hashmi, P. Noriega, & P. Keyzer (Eds.), Proceedings of selected papers of the Workshop on Artificial Intelligence Governance, Ethics, and Law (AIGEL 2022) (pp. 22–38). Trier: CEUR. https://ceur-ws.org/Vol-3531/LPaper_03.pdf

Chetouani, M., Dignum, V., Lukowicz, P., & Sierra, C. (Eds.). (2023). Human-centered artificial intelligence: Advanced lectures, 18th European Advanced Course on AI, ACAI 2021, Berlin, Germany, October 11-15, 2021, extended and improved lecture notes (Lecture Notes in Computer Science 13500). Springer. ISBN 978-3-031-24348-6.

Freitas dos Santos, T., Cranefield, S., Savarimuthu, B. T. R., Osman, N., & Schorlemmer, M. (2023). Cross-community adapter learning (CAL) to understand the evolving meanings of norm violation. In Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI) (pp. 109–117).

Freitas dos Santos, T., Osman, N., & Schorlemmer, M. (2023). A multi-scenario approach to continuously learn and understand norm violations. Autonomous Agents and Multi-Agent Systems, 37(2), 38.

Ganzer, J., Criado, N., Lopez-Sanchez, M., Parsons, S., & Rodriguez-Aguilar, J. A. (2023). A model to support collective reasoning: Formalization, analysis, and computational assessment. Journal of Artificial Intelligence Research, 77, 1021–1086. https://doi.org/10.1613/jair.1.14409

Garcia-Calvés, P., Sabater-Mir, J., Aramendia, P., Corominas, J., & Perez, B. (2023). Recommenders for improved lesson planning in formal education. Artificial Intelligence Research and Development, 375, 250–255. https://doi.org/10.3233/FAIA230689

Georgara, A., Kazhamiakin, R., Mich, O., Palmero Aprosio, A., Pazzaglia, J. C., Rodriguez Aguilar, J. A., & Sierra, C. (2023). The AI4Citizen pilot: Pipelining AI-based technologies to support school-work alternation programmes. Applied Intelligence, 53(20), 24157–24186. https://doi.org/10.1007/s10489-023-04758-3

Georgara, A., Kazhamiakin, R., Mich, O., Palmero Aprosio, A., Pazzaglia, J. C., Rodriguez-Aguilar, J. A., & Sierra, C. (2023). The AI4Citizen pilot: Pipelining AI-based technologies to support school-work alternation programmes. Applied Intelligence, 53(20), 24157–24186. https://doi.org/10.1007/s10489-023-04758-3

Georgara, A., Kazhamiakin, R., Mich, O., Palmero Aprosio, A., Pazzaglia, J. C., Rodriguez-Aguilar, J. A., & Sierra, C. (2023). The AI4Citizen pilot: Pipelining AI-based technologies to support school-work alternation programmes. Applied Intelligence, 53(20), 24157–24186. https://doi.org/10.1007/s10489-023-04758-3

Liscio, E., Lera Leri, R., Bistaffa, F., Dobbe, R. I. J., Jonker, C. M., Lopez-Sanchez, M., Rodriguez-Aguilar, J. A., & Murukannaiah, P. K. (2023). Inferring values via hybrid intelligence. In Proceedings of the 2nd International Conference on Hybrid Human Artificial Intelligence (HHAI '23). (in press)

Liscio, E., Lera-Leri, R., Bistaffa, F., Dobbe, R. I. J., Jonker, C. M., Lopez-Sanchez, M., Rodriguez-Aguilar, J. A., & Murukannaiah, P. K. (2023). Value inference in sociotechnical systems.

In Proceedings of the 2023 International Conference on Autonomous Agents and Multiagent Systems (pp. 1774–1780).

Liscio, E., Lera-Leri, R., Bistaffa, F., Dobbe, R., Jonker, C., Lopez-Sanchez, M., Rodriguez-Aguilar, J. A., & Murukannaiah, P. (2023). Value inference in sociotechnical systems. In Proceedings of the International Conference on Autonomous Agents and Multiagent Systems (AAMAS). https://dl.acm.org/doi/10.5555/3545946.3598838

López de Aberasturi-Gómez, A., Sabater-Mir, J., & Sierra, C. (2023). Modelling group performance in multiagent systems: Introducing the CollabQuest simulation game. In Proceedings of EUMAS 2023 (pp. 186–199).

López de Aberasturi-Gómez, A., Sabater-Mir, J., & Sierra, C. (2023). Modelling group performance in multiagent systems: Introducing the CollabQuest simulation game. In Proceedings of the European Conference on Multi-Agent Systems (pp. 186–199).

Montes, N., Curto, G., Osman, N., & Sierra, C. (2023). An agent-based model for poverty and discrimination policy-making. arXiv. https://arxiv.org/abs/2303.13994

Montes, N., Luck, M., Osman, N., Rodrigues, O., & Sierra, C. (2023). Combining theory of mind and abductive reasoning in agent-oriented programming. Autonomous Agents and Multi-Agent Systems, 37(2), 36. https://doi.org/10.1007/s10458-023-09613-w

Montes, N., Osman, N., & Sierra, C. (2023). A computational model of Ostrom's institutional analysis and development framework (Extended Abstract). In Proceedings of the International Joint Conference on Artificial Intelligence 2023 (IJCAI) (pp. 6937–6941).

Osman, N., Rosell i Gui, B., & Sierra, C. (2023). Leveraging diversity in online interactions (Short Paper). In Proceedings of the HHAI Workshops 2023 (pp. 248–253).

Osman, N., Rosell, B., Sierra, C., Schorlemmer, M., Sabater-Mir, J., & Lemus, L. (2023). uHelp: Intelligent volunteer search for mutual help communities. arXiv. https://arxiv.org/abs/2301.11112

Pan, S., & Sierra, C. (2023). Towards convention-based game strategies. In Proceedings of the International Workshop on Coordination, Organizations, Institutions, Norms, COINE 2023 (pp. 182–196).

Qiao, J., de Jonge, D., Zhang, D., Simoff, S., Sierra, C., & Du, B. (2023). Price of anarchy of traffic assignment with exponential cost functions. Autonomous Agents and Multi-Agent Systems, 37(2), 42.

Rodriguez-Soto, M., Lopez-Sanchez, M., & Rodriguez-Aguilar, J. A. (2023). Multi-objective reinforcement learning for designing ethical multi-agent environments. Neural Computing and Applications, 35(1), 1–26. https://doi.org/10.1007/s00521-023-08898-y

Rodriguez-Soto, M., Rădulescu, R., Rodriguez-Aguilar, J. A., Lopez-Sanchez, M., & Nowé, A. (2023, March). Multi-objective reinforcement learning for guaranteeing alignment with multiple values. In 2023 Adaptive and Learning Agents Workshop at AAMAS.

Salas-Molina, F., Bistaffa, F., & Rodriguez-Aguilar, J. A. (2023). A general approach for computing a consensus in group decision making that integrates multiple ethical principles. Socio-Economic Planning Sciences, 89, 101694. https://doi.org/10.1016/j.seps.2023.101694

Salas-Molina, F., Pla-Santamaria, D., & Rodriguez-Aguilar, J. A. (2023). An analytic derivation of the efficient frontier in biobjective cash management and its implications for policies. Annals of Operations Research, 328(2), 1523–1536. https://doi.org/10.1007/s10479-023-05433-z

Salas-Molina, F., Rodriguez-Aguilar, J. A., & Guillen, M. (2023). A multidimensional review of the cash management problem. Financial Innovation, 9(1), 67. https://doi.org/10.1186/s40854-023-00473-7

Serramia, M., Lopez-Sanchez, M., Moretti, S., & Rodriguez-Aguilar, J. A. (2023). Building rankings encompassing multiple criteria to support qualitative decision-making. Information Sciences, 631, 288–304. https://doi.org/10.1016/j.ins.2023.02.063

Serramia, M., Rodriguez-Soto, M., Lopez-Sanchez, M., Rodriguez-Aguilar, J. A., Bistaffa, F., Boddington, P., Wooldridge, M., & Ansotegui, C. (2023). Encoding ethics to compute value-aligned norms. Minds and Machines, 33(1), 1–30. https://doi.org/10.1007/s11023-023-09649-7

Sierra, C., & Sabater-Mir, J. (2023). Intelligència artificial i realitat estesa en l'educació i la formació [Video]. Universitat de Barcelona, Institut de Desenvolupament Professional (IDP-ICE).

Veronese, C., Meli, D., Bistaffa, F., Rodríguez-Soto, M., Farinelli, A., & Rodriguez-Aguilar, J. A. (2023). Inductive logic programming for transparent alignment with multiple moral values. In CEUR Workshop Proceedings of the second edition of the BEWARE workshop on Bias, Risk, Explainability, and the role of Logic and Logic Programming (pp. 84–88).

5. DOCTORAL THESES

In 2023, 4 doctoral theses were defended by IIIA students:

Smart Traffic Control for the Era of Autonomous Driving
Author: Jianglin Qiao
University: Universitat Autònoma de Barcelona / University Western Sidney
Advisors: Carles Sierra; Dongmo Zhang; Simeon Simoff; Dave De Jonge

Reinforcement learning for value alignment
Author: Manel Rodríguez-Soto
University: University of Barcelona
Advisors: Maite López-Sánchez; Juan A. Rodríguez-Aguilar

AI with care: Integrating machine learning with expert knowledge for In Vitro Fertilization
Author: Núria Correa Mañas
University: Universitat Autònoma de Barcelona
Advisors: Josep Lluís Arcos Rosell; Rita Vassena; Jesús Cerquides Bueno

Trustworthy Task Allocation for Human Teams
Author: Athina Georgara
University: Universitat Autònoma de Barcelona
Advisors: Carles Sierra; Juan A. Rodríguez-Aguilar; Luís Manuel Artiles Martínez

6. ALLIANCES

6.1 ASSOCIATED UNITS

Research Group on AI and Law – Universitat Autònoma de Barcelona (UAB) - *Associated unit since 26 June 2023.*

The Research Group on AI and Law, the new associated unit between the IIIA and the Institute of Law and Technology (IDT) of the UAB, seeks to cooperate and jointly research in the field of Artificial Intelligence (AI) regulation from an ethical and legal perspective.

The objectives include equipping IIIA-CSIC researchers with ethical and legal knowledge, understanding the complexity of regulatory systems in specific scenarios, collaborating on research projects of excellence, developing joint research proposals and establishing a Legal Knowledge Hub. It also aims to train young researchers in the field, contribute to the IIIA-CSIC's gender policy, and promote collaboration in leading projects in the field of AI regulation and law, especially on issues related to human rights and ethical values.

Virtual Worlds, Visualisation and Artificial Intelligence Group – Universidad de Barcelona (UB) - *Associated unit since 02 Jun 2020.*

The WAI research group is composed of researchers from different areas related to Computer Graphics, Human-Computer Interaction and Artificial Intelligence. Specifically, we work on Data Visualization, 3D Virtual Worlds, Gamification and Serious Games, Natural Language Processing, Recommender Systems, Machine Learning/Data Science, Multiagent Systems, Conversational Agents and how Ethics relate to Artificial Intelligence.

Most of our research is applied to Education, Medicine, Personalization, and Social Interaction/Citizen Participation. The WAI research group is part of the Language and Computation Centre (CLiC) SGR group, and the WAI researchers are also members of the Universitat de Barcelona Institute of Complex Systems (UBICS) and the Institute of Mathematics of the University of Barcelona (IMUB).

6.2 NETWORKS

European Association for Artificial Intelligence EurAI – EURAI

The European Association for Artificial Intelligence EurAI (formerly ECCAI) was founded in July 1982 as the representative body of the European Artificial Intelligence community. Its aim is to promote the study, research and application of Artificial Intelligence in Europe. The association is composed of 28 European scientific associations concerned with artificial intelligence. Carles Sierra was President of EurAI between 2020 and 2024.

European Laboratory for Learning and Intelligent Systems – ELLIS

The focus of the ELLIS unit in Barcelona is to promote fundamental research in machine learning and related fields (vision, robotics, natural language processing), and to foster interdisciplinary research in AI, in the interactions of AI systems with humans and societies, a topic with important implications for the life sciences and humanities. The ELLIS Unit Barcelona brings together researchers from 9 academic institutions: the 5 major universities of Barcelona, as well as the 4 public research centres in the region dedicated to AI.

Artificial Intelligence Research Alliance of Catalonia – AIRA

The Artificial Intelligence Research Alliance of Catalonia (AIRA) is the Catalan government's alliance to promote "scientific research, talent management and the acceleration of the development of solutions based on AI in Catalonia". AIRA is promoted by the Department of Vice-Presidency and Digital and Territorial Policies and the Department of Research and Universities as part of the Catalan Artificial Intelligence Strategy.

Associació Catalana d'Intel·ligència Artificial – ACIA

The Associació Catalana d'Intel·ligència Artificial (ACIA) is a non-profit association dedicated to the promotion of Artificial Intelligence (AI) in Catalan society. Its main objective is to facilitate communication between people and organisations involved in AI and to promote social, cultural, scientific, economic and governmental awareness of AI. Several members of the IIIA are members of the ACIA, and some of them have served as its presidents.

6.3 AIHUB CONNECTION

The AIHUB Connection is CSIC's network of centres which brings together the CSIC research staff dedicated to AI. The goal is to collaborate on research, training, transfer and communication activities. AIHUB unites over 400 researchers from 92 research groups across 45 centres applying AI in 20 fields as diverse as as disciplines as physics, microelectronics or philosophy.

The IIIA is honoured to serve as the primary coordinator of the CSIC's AIHUB Connection. This initiative, led by Carles Sierra (IIIA) and Carme Torras (IRI), is dedicated to fostering the links between these groups and society.

Achieved Impact (2021-2023)

-To date, more than 16 inter-group collaborative projects have been developed in competitive programmes around the eight Artificial Intelligence Challenges defined in the Connection.

-The collaborative action to date has generated €5 million in income for the AIHUB groups.

-45 Research Initiation Grants have been managed and implemented, with a 30% retention rate of students continuing their research careers at the CSIC.

-17 postdoctoral positions co-funded by the Horizon Europe MSCA-Cofund ALLIES programme.

-Six AI workshops and courses were organised and held to train CSIC and external researchers in the use of AI in research (AI4Science).

-We have increased our outreach to industry by organising two industry days and promoting AIHUB's participation in other CSIC industry programmes such as ImPriME, Ciceron and PTIs events.

-We are present in regional, national and international research networks related to basic research in AI, such as EurAI, ELLIS, TAILOR, AI4EU, Humane-AI-Network, AIRA, ACIA, etc.

-We have promoted and developed AI schools for teachers and students in collaboration with third sector organisations such as Fundació La Caixa and Fundació La Pedrera. Two summer schools for teachers and three for students have been held so far.

-We are co-founders of the Artificial Intelligence degree at UAB.

During 2023, the AIHUB Connection has organised the following activities and events:

Summer School 2023

The second edition of the AIHUB Connection: Educating in Artificial Intelligence, co-organised with EduCaixa, took place in July. With 150 participants, including speakers, students and teachers, the school proved to be an effective forum for learning about the theoretical aspects and applications of artificial intelligence in different sectors, with a particular focus on education. It also served as a valuable platform for reflection among teachers and researchers in the field of AI.

Industrial Day 2023

The second AIHUB-Industry Connection meeting was held in February. This meeting brought together CSIC researchers with expertise in AI and company representatives from various industrial sectors. The aim was to promote and consolidate public-private cooperation in R&D&I in artificial intelligence.

Becas JAE Intro AIHUB

This year we have offered 10 Introductory AI Research Fellowships. These fellowships are an invaluable first step for young students who want to start their career alongside dedicated researchers specialising in both fundamental AI research and its practical applications in different scientific fields in Spain.

Workshop The many challenges of Artificial Intelligence

In November, the AIHUB Connection, in collaboration with ICMAT and CNB, hosted a meeting for around twenty researchers at the forefront of AI research, as well as more experienced researchers. The meeting provided a forum for in-depth discussions on the current challenges, advances and limitations of AI.

MSCA COFUND ALLIES

In December, the European Commission informed us that it has co-funded ALLIES (Artificial Intelligence in Development Goals), an interdisciplinary, international and cross-sectoral postdoctoral training programme in artificial intelligence. It will host 17 postdocs in 2025 and 2026, who will work with two CSIC centres that share a research interest with implications for the SDGs.

7. TRANSFERENCE ACTIVITIES

The main objective of the Transfer Department is to facilitate the dissemination of knowledge generated within the Centre to society by establishing collaborations with both companies and educational institutions. These collaborations can take various forms, ranging from private contracts with companies to collaborative projects at both national and European levels. In addition, programmes that promote cooperation between companies and universities, such as industrial doctorates, are encouraged.

Alongside these initiatives, the Department offers a range of scientific and technical services, including consultancy and specialised training. While the creation of spin-offs from technologies developed within the Centre is a significant part of our work, the Department's primary focus is on direct collaboration with companies and educational institutions to maximise the impact of our knowledge on society. In line with this focus, the Artificial Intelligence Technology Development and Transfer Unit (UDT-IA) has been established. This unit comprises specialised engineers who work closely with researchers to develop software prototypes and conduct proof-of-concept studies based on artificial intelligence algorithms.

Throughout 2023, the Department maintained an active presence in both the business and academic spheres, participating in various activities such as meetings with companies, round tables, interviews and networking events. These activities were carried out in collaboration with relevant clusters such as the TECNIO association, the Digital Cluster, the DCA and the RDI-IA. As a result of these collaborations, the department has contributed significantly to the integration of various technologies in companies, including recommendation systems, predictive analytics using machine learning, argumentation based on natural language processing, optimisation, among others.

These technologies have helped to improve the efficiency and competitiveness of companies in various sectors. In addition to the above services, the department also provides high performance computing services with our cluster. This enables companies and educational institutions to efficiently and effectively access advanced computing resources for research and development projects. Here are some of the companies we've worked with this year.

8. COMMUNICATION & OUTREACH

2023 has been a pivotal year for generative AI, with our institute striving to shape discourse through strategic media engagement and impactful internal initiatives. While AI communication and outreach extends beyond ChatGPT, the institute and its researchers have made over 60 appearances across various media platforms, including interviews, opinion articles, and news coverage.

Below, we show some of the activities we have carried out:

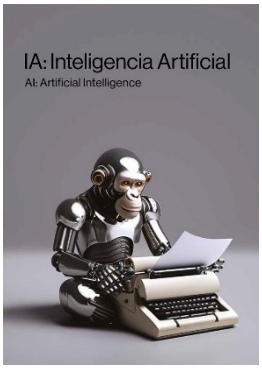
Alter Ego – Inteligencia Artificial y Sociedad (Alter Ego – Artifical Intelligence and Society):

Ramon López de Mántaras participated in the RTVE documentary series 'Alter Ego', presented by Almudena Ariza and Carles Tamayo, which seeks to answer all the doubts and uncertainties raised by artificial intelligence. In three episodes, 'Alter Ego' explores two contrasting potential futures for humanity, based on real data and the opinions of national and international experts.

Bojos per la Intel·ligència Artificial (Crazy about Artificial Intelligence):

For the third year in a row, the IIIA researcher Pedro Meseguer coordinated the programme *Bojos per la IA* (Crazy about Artificial Intelligence), a course aimed at students in their first year of baccalaureate/high school which aims to give a broad overview of what AI is today. Every Saturday, for an entire school year, students delved into the different aspects, tools and domains areas of AI. This programme is run in collaboration with the Catalunya La Pedrera Foundation.

Exhibition AI: Artificial Intelligence:



In October, the Centre de Cultura Contemporània de Barcelona (CCCB) opened the exhibition 'Artificial Intelligence'. Within this exhibition, the IIIA-CSIC presented the interactive installation Common-AI-Verse. This project engages visitors with AI agents that learn from emotions and respond with visual and sound effects. It was developed in collaboration between digital artists and AI experts from the IIIA-CSIC, led by Jordi Sabater, and with professionals from computer science, visual, and sound arts.

Link to the exhibition website ***here***.

Link to the talk by Ramon López de Màntaras: *Is it possible to have an AI ethic?* ***here***.

Exhibition #LaNUBE{IA}:

The potential of AI in education was the leitmotif of the exhibition *#LaNUBE{IA}, educando en inteligencia artificial* (Educating in AI) which took place at the CaixaForum in Valencia, and in which our institute was involved in the entire process of creation and implementation. Our director, Carles Sierra, was the curator of the exhibition. It was an interactive tour in which visitors could learn about different active research projects on the topic.

100 Coses que cal saber de la Intel·ligència Artificial (100 Things to know about artificial intelligence):

The book by IIIA researcher Ramon López de Mántaras is a comprehensive guide to artificial intelligence (AI) that has become a standard reference work in the field. It addresses key topics in AI and provides insights into the current state of the discipline. With four editions published to date, the book also addresses aspects of AI that may be overlooked or not fully explained in other sources.

Link to the book ***here***.

Ciencia en el Barrio (Science in the Hood):

Our researchers Vanina Martínez and Vicent Costa delivered a presentation to students at high schools in Barcelona as part of the educational project "Ciencia en el Barrio." The presentation, entitled "Del teléfono móvil al ChatGPT: cuestiones éticas de la inteligencia artificial para la generación y predicción de textos," addressed ethical considerations related to artificial intelligence in text generation and prediction. The project's objective is to bring scientific education to neighborhoods in large cities that may lack access to such opportunities.

ChatGPT y el fin del mundo (GPT Chat and the end of the world):

The institute's research team, comprising Lluis Godo, Tommaso Flaminio and Núria Vallès, contributed to the EduCaixa project, 'Chat GPT y el fin del mundo'. This initiative aims to facilitate discussions in the classroom on the impact of technology and its relationship with society in the context of generative artificial intelligence.Link to the guides ***here***.

Ciceron Programme:

Vanina Martínez and Ramon López de Mántaras participated in the CICERON programme, a CSIC initiative designed to showcase the research conducted at its various centres and demonstrate how it benefits society. The event was attended by representatives from a range of organisations, including businesses, political entities and the media, who were invited to gain insight into the work of the CSIC institutes and the challenges they face in their research.

9. AWARDS & RECOGNITION

This year the IIIA has won the following awards and recognitions:

Carles Sierra won the **IFAAMAS Influential Paper Award 2023** thanks to the paper *Negotiation decision functions for autonomous agents*. The article has been fundamental for the field of agent negotiation in the multiagent research community.

> *Faratin, P., Sierra, C., & Jennings, N. R. (1998). Negotiation decision functions for autonomous agents. Robotics and Autonomous Systems, 24(3-4), 159-182.*

Lluís Godo won the **EUSFLAT Scientific Excellence Award** for his outstanding contributions to providing logical foundations to the theory of fuzzy sets and systems. This award belongs to European Society for Fuzzy Logic and Technology.

Vanina Martínez has become a **member of the new High-level Advisory Body on Artificial Intelligence of the United Nations (UN).**

Dave de Jonge won the **second prize in the Automated Negotiating Agents Competition** (ANAC) at the 22nd International Conference on Autonomous Agents and Multiagent Systems (AAMAS).

Borja Velasco and Jesús Cerquides won the 1st prize for **the best article of the 25th conference of the Catalan Association of Artificial Intelligence** thanks to the paper *Hydranet: A Neural Network for the Estimation of Multi-Valued Treatment Effects.*

> *Velasco, B., Cerquides, J., & Arcos, J. L. (2022). Hydranet: A neural network for the estimation of multi-valued treatment effects. In NeurIPS 2022 Workshop on Causality for Real-world Impact*.

Alumni Marc Serramià has won the **Spanish Scientific Computer Society (SCIE) - BBVA Foundation 2023 Young Computer Science Researchers Award** for his contributions in the fields of multiagent systems and ethics for artificial intelligence. Marc Serramià was an IIIA PhD student and presented his thesis *Value-aligned norm selection* in 2021, with which he also won other distinctions as best AI thesis at the CIAA 2022.