basque center for applied mathematics

Activity Report

Basque Center for Applied Mathematics

2024

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01

Introduction

Let's keep writing together the mathematics for the future!

Scientific Director Jose A. Lozano

In the pursuit of mathematical discovery, perseverance is often the catalyst for breakthroughs. As Fields medalist Maryam Mirzakhani once said, *"The beauty of mathematics only shows itself to more patient followers."* At BCAM, this spirit of dedication has once again driven a year of outstanding progress, marked by significant scientific advances, new research projects, and impactful outreach initiatives.

One of the most remarkable milestones of the past year was the resolution of a long-standing mathematical challenge: a conjecture posed by Oscar Zariski, now solved by our own Javier Fernández de Bobadilla (Ikerbasque Professor at BCAM) and Tomasz Pelka (former BCAM postdoc). This groundbreaking achievement underscores the depth of mathematical research at BCAM and its far-reaching impact on the field.

Beyond fundamental mathematics, BCAM has continued expanding its role in addressing pressing societal challenges. A key new initiative in this direction is Act.AI, our ERC Proof-of-Concept project focused on developing bias auditing and mitigation tools for AI models. This project aligns with the EU AI Act, providing an innovative framework to assess fairness and ensure compliance, particularly for high-risk applications in healthcare, finance, and recruitment. Act.AI represents BCAM's commitment to pioneering research at the interface of mathematics, technology, and ethics.

Outreach and public engagement have also reached new heights. "Be Zientzia", a joint initiative with BC3 and Achucarro, has now established itself as a landmark in BCAM's science communication efforts. This collaborative program brings together expertise from applied mathematics, climate change, and neuroscience, offering a unique interdisciplinary approach to engaging society with cutting-edge research. Furthermore, the recognition of the Special Gender Mention at the STEAM Euskadi Sariak Awards received for the "Mathematikariak"; program is a testament to our continuous efforts to inspire the next generation of mathematical talent and foster a deeper appreciation for the discipline.

These new achievements build upon BCAM's solid foundation, reinforcing our mission to advance mathematical knowledge and its real-world applications.

As always, these successes are made possible by the people who shape BCAM every day: our researchers, whose passion and expertise drive scientific progress; those who organize events, knowledge transfer activities, and outreach initiatives; and our dedicated administrative team, whose support is essential to our mission.

Together, we continue to push the boundaries of mathematical inquiry and its applications. The path ahead is full of new challenges and opportunities, but as Mirzakhani reminds us, the beauty of mathematics belongs to those who persist.

02

BCAM in Numbers

2.1. Scientific Outputs[1]

159 Indexed articles

72,4% Q1

49,7% D1

66 H Index

1,746 BCAM documents are cited 37,124 times until 2024

2.2. Grants in Place

3 ERC

5 Marie Skłodowska-Curie

2 HE Cluster 4 (Digital, Industry & Space)

1 H2020/ Horizonte Europa

■ International public projects

11 National public projects

24 Regional public projects

7 Private projects

2.3. Personnel

171 People at BCAM

157 Research staff

25% Women

14 Administrative staff

\+

36 New Researchers

20 Visiting Fellows

45 Interns

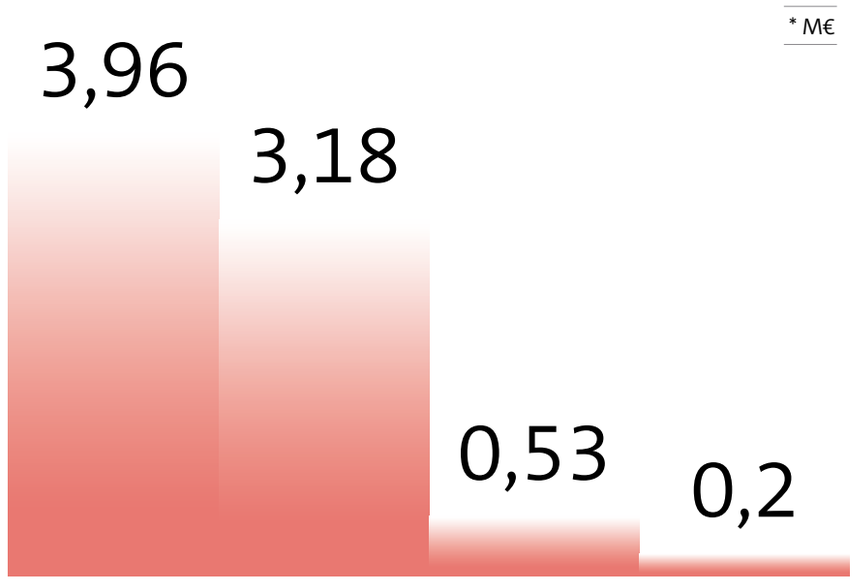
131 Visitors

*at 31 December 2024

2.4. Funding

7,87 M€

* M€



2.5. Training and Knowledge Transfer

9	Defended Doctoral theses	51	Ongoing Doctoral theses	53	Ongoing Postdoctoral Trainees
5	Ongoing Joint Positions	2	Ikerbasque Visiting Research Professors	1	Ikerbasque Associate
2	Ikerbasque Fellows + RYC2022	2	Ikerbasque Fellows + RYC2023	1	RYC2023
3	RYC garantees pending merge in the Ikerbasque process				

2.6. Scientific Activities

Working group 37

Seminar 52

BCAM Course 6

Workshops 11

BCAM SO Course 4

Colloquium 2

Summer Schools 1

2.7. Social Media

X (Twitter)

2,293 Followers	297 Tweets	247,889 Impressions
165 ReTweets	2,906 Likes	634 Replies

LinkedIn

3,386 Followers	297 Posts	2,632 Reactions
256,101 Impressions	165 Shares	

Youtube

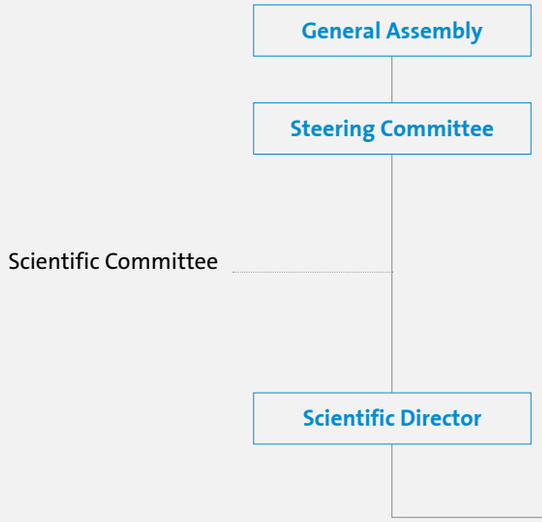
322 Suscribers	4,908 FollowersViews

*Data source: Hootsuite, Twitter, LinkedIn and Youtube. Data exported: 31/12/2024.

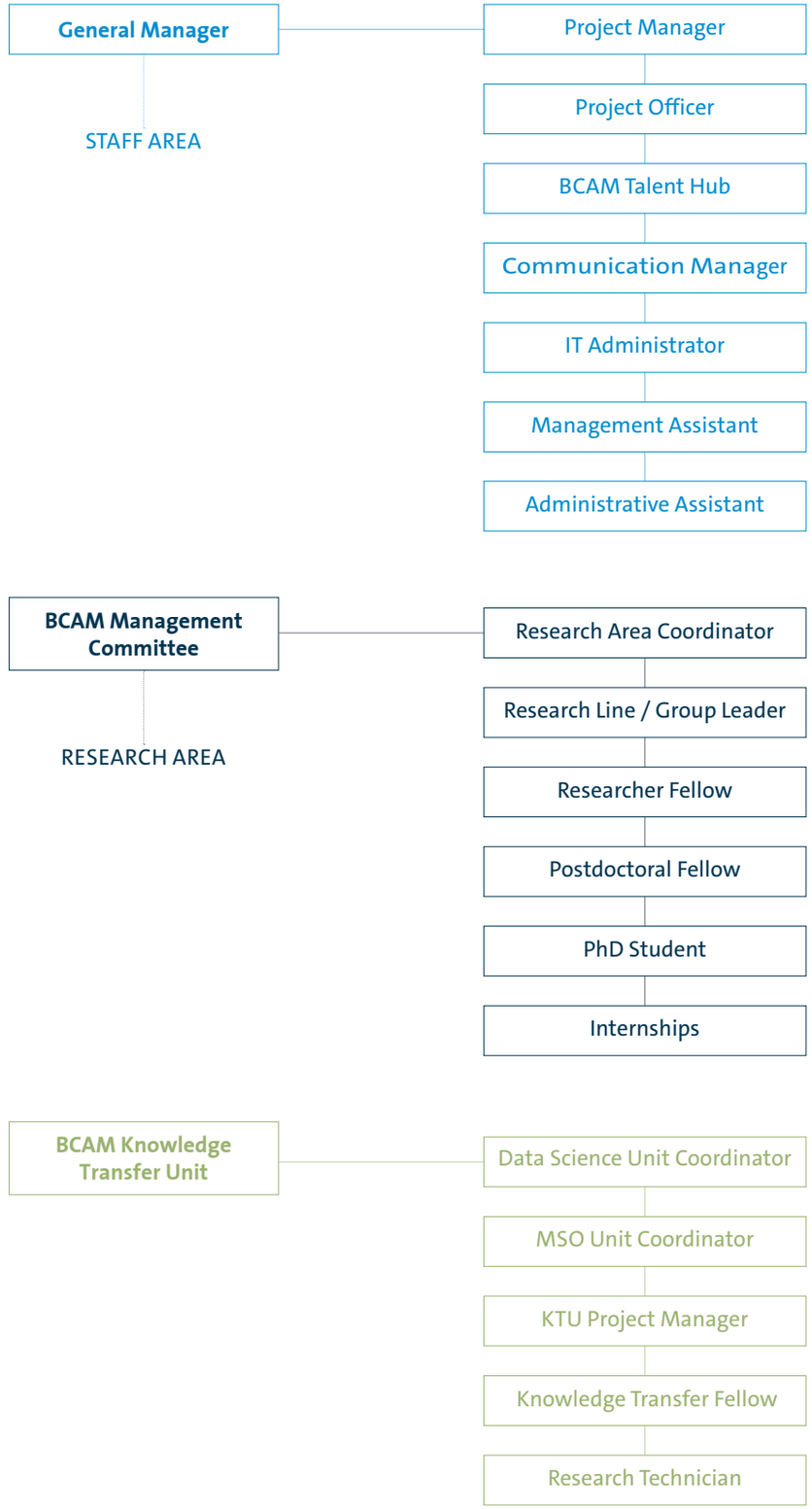
03 People

BCAM's organizational chart

Governance

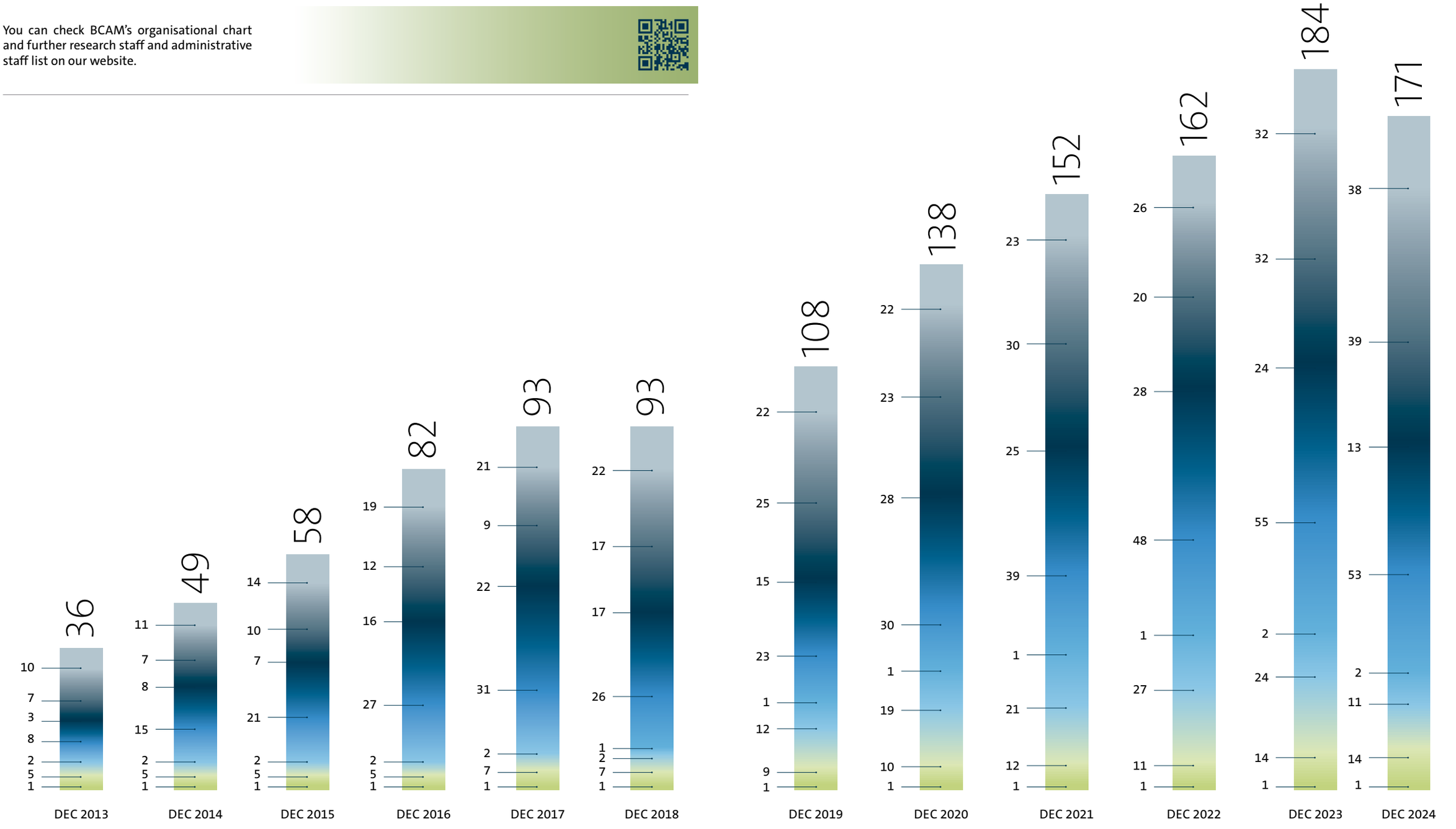


Operations



Evolution of personnel

You can check BCAM's organisational chart and further research staff and administrative staff list on our website.



Research Areas and Lines

During 2024, BCAM continues to develop its research through the established research lines, organised thematically in 5 areas in relation to its scientific field.

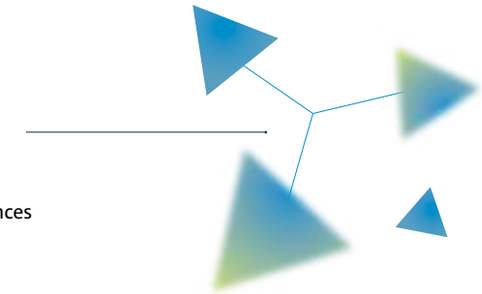
01CM

Computational Mathematics

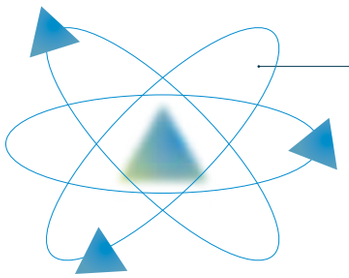
- Mathematical Design, Modelling and Simulations
  MATHDES
- CFD Modelling and Simulations
  CFDMS

02M3A

Mathematical Modelling with Multidisciplinary Applications



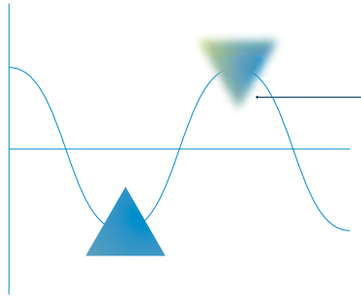
- Modelling and Simulation in Life and Material Sciences
  MSLMS
- Mathematical and Theoretical Biology
  MTB
- Mathematical, Computational and Experimental Neuroscience
  MCEN



03MP

Mathematical Physics

- Quantum Mechanics
  QM
- Statistical Physics
  SP
- Singularity Theory and Algebraic Geometry
  STAG



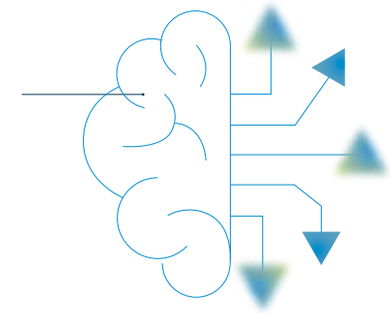
04APDE

Analysis of Partial Differential Equations

- Linear and Non-Linear Waves
  WAVE
- Harmonic Analysis
  HA
- Applied Analysis
  AA

05DS

Data Science and Artificial Intelligence



- Combinatorial Optimization
  CO
- Computational and Applied Statistics
  CAS
- Machine Learning
  ML

BCAM Scientific Advisory Committee

The Scientific Committee is an external and strategic advisory council of BCAM made up of internationally recognised researchers in mathematics. They provide an independent view of BCAM's researchers and activities. This committee meets once a year to monitor the development of the centre's strategic plan, provide advice on different topics and validate the results obtained.

Prof. David Lannes

Institut de Mathématiques de Bordeaux,
Bordeaux, FRANCE

DIRECTOR OF RESEARCH AT THE CNRS

CHAIR

Prof. Annalisa Buffa

Institute de Mathématiques - Ecole polytechnique Fédérale de Lausanne
Lausanne, SWITZERLAND

CHAIR OF NUMERICAL MODELLING AND SIMULATION (MNS)

Prof. Montserrat Fuentes

St. Edward's University
Austin, Texas, USA

PRESIDENT

Prof. Laure Saint-Raymond

UMPA, ENS de Lyon
Lyon, FRANCE

PROFESSOR

Prof. Jesús María Sanz Serna

Royal Academy of Sciences of Spain and Carlos III University of Madrid
Madrid, SPAIN

ACADEMICIAN AND FORMER PRESIDENT OF THE ROYAL ACADEMY OF SCIENCES OF SPAIN AND APPLIED MATHEMATICS
PROFESSOR

Prof. Marc Shoenauer

INRIA Saclay - Île-de-France
Orsay Cedex, FRANCE

CO-HEAD (WITH MICHÈLE SEBAG) OF PROJECT-TEAM TAU

Deputy Research Director at INRIA, in charge of AI

Prof. Jan Philip Solovej

University of Copenhagen
Copenhagen, DENMARK

CHAIR OF NUMERICAL MODELLING AND SIMULATION (MNS)

04 Funding

You can check BCAM's research projects on our website

Highlighted projects

HE-101123000

Act.AI

Developing Bias Auditing and Mitigation Tools for Self-Assessment of AI Conformity with the EU AI Act through Statistical Matching

FUNDED BY
ERC-2023-POC

DURATION
2024/06 – 2025/11

PI
Prof. Quadrianto, N.

The vision behind Act.AI is to utilize statistical matching for mitigating and auditing bias in Artificial Intelligence (AI) models. AI has been rapidly growing in various industries, from financial services to healthcare, education, and job recruitment. However, as AI algorithms have become increasingly sophisticated and pervasive in decision-making processes, concerns have arisen about their fairness and compliance with regulations. In particular, the EU AI Act requires that AI providers in high-risk applications -- such as employment, credit, or healthcare -- to identify (and thereby address) discrimination by their algorithms against certain demographics of people. However, ensuring compliance with the Act can be challenging, particularly for AI startups that may not have the resources or expertise to fully understand and implement the Act's requirements. Addressing existing disconnects between AI fairness toolkits' capabilities and current practitioner needs, the Act.AI tool can be easily integrated into any AI workflow, in a plug and play fashion, to continuously monitor and improve its fairness. A key aspect of Act.AI is the ability to operate with different types of data (tabular, images, and text) in a variety of contexts (binary and multiclass classification and regression). It is also able to match datasets in different domains including out-of-distribution data even if these datasets have different numbers of variables or features. To ensure usability of Act. AI, it will integrate feedback from relevant stakeholders from two immediate target markets: financial service and healthcare.

About the PI

Novi Quadrianto is currently a Professor of Machine Learning at the University of Sussex, UK. Prior to Sussex, Novi was a Newton International Fellow of the Royal Society and the British Academy at the Machine Learning Group in the Department of Engineering, University of Cambridge. Novi received his Ph.D. in Computer Science from the Australian National University, Canberra, Australia in 2012. In 2019, Novi was awarded a European Research Council ERC Starting Grant for a project on developing Bayesian models and algorithms for fairness and transparency (BayesianGDPR). Since March 2021, Novi also leads a BCAM Severo Ochoa Strategic Lab on Trustworthy Machine Learning in Spain. Since July 2022, Novi holds an Adjunct position at Monash University in Indonesia.

You can learn more about **Act. AI** on our website.

HE-101162248

ORE4Citizens

Bringing Offshore Renewable Energy to Society

FUNDED BY
HORIZON-MSCA-2023-CITIZENS-01

DURATION
2024/04 – 2026/03

PI
Dr. Nava, V.

ORE4citizens is an alliance driven by Basque female scientists, joined by over 60 researchers and 15 Basque entities, with the goal of promoting science among the public, raising awareness about the effects of climate change on the Basque coast, and highlighting the crucial role of marine renewable energies in combating global warming. Additionally, the initiative aims to showcase the Basque industry's global leadership in this sector and its potential benefits for society and the planet.

Marine renewable energies in the Basque Country: Climate change poses significant challenges for the Basque coast, both in terms of physical impacts on the environment and socio-economic impacts on coastal communities. It is important to take measures to adapt to these changes and mitigate the effects of climate change in the region. The development and deployment of marine renewable energies contribute to this mitigation effort and represent a key element in the global energy transition in the medium and long term due to their generation potential. At the same time, they represent an industrial, economic, and social opportunity for the Basque Country, compatible with the protection of the marine environment.

This sector is crucial for achieving decarbonization goals in the European Union and is expected to grow fivefold by 2030 and twenty-fivefold by 2050.

About the PI

Vincenzo Nava graduated and obtained a Master's degree in Civil Engineering from the Mediterranean University of Reggio Calabria (Italy). In 2009 he obtained a PhD in Ocean Engineering at the same university. He worked in a research project at BP America (Houston, USA) and later as a lecturer and postdoctoral researcher at the Mediterranean University of Reggio Calabria (Italy) and the Technical Superior Institute in Lisbon (Portugal). In 2013 he joined Tecnalia as a Marie Skłodowska-Curie fellow and since 2017 he has been working as a researcher in the field of offshore renewable energies at the Basque Center for Applied Mathematics - BCAM and Tecnalia.

Since 2017 he has also been teaching in the Erasmus Mundus Master's Degree in Renewable Energies in the Marine Environment (REM). He is a member of the Scientific Committee of the Joint Research Laboratory for Renewable Marine Energies (JRL-ORE) of Tecnalia, the UPV/EHU and BCAM.

In the last few years, he has participated in several R&D projects at European, national and local level, all of them in the field of offshore renewable energies, with special attention to the optimization of offshore marine energy farms.

You can learn more about **ORE4Citizens** on our website.

PCI2024-155055-2

AEI-DFG-BMZ

Classical Singularity theory meets positive characteristic methods

FUNDED BY
DFG-AEI 2023

DURATION
2024/12 – 2027/12

PI
Prof. Fernández Bobadilla, J.

While singularities in commutative algebra and geometry are studied with different motivations and apparently distant methods, they are really the same objects. A polynomial over the integers defines a hypersurface over the complex numbers, or over a number field of any characteristic by reduction modulo a prime, so that in the same object complex geometry, topology, arithmetics and positive characteristic interacts. History has shown there is a fruitful transfer of information between these aspects. This project sits at the intersection of algebraic methods for the study of singularities as pursued by Blickle and Smirnov, and geometric aspects of classical singularity theory of spaces and maps as pursued by de Bobadilla and van Straten. Reduction modulo a prime establishes a precise connection point, but also the transfer of viewpoint and comparison of methods from one school to the other may prove very useful in finding new ideas.

Answering the AEI-DFG Call for Joint Spanish-German Research Projects in the Field Mathematics we propose a joint research program among researchers from the Basque Center for Applied Mathematics (BCAM) in Bilbao, Spain and Johannes Gutenberg Univeristy (JGU) Mainz,Germany, investigating connections between classical singularity theory and modern methods of positive characteristic geometry. Duco van Straten (JGU) and Javier Fernandez de Bobadilla (BCAM) are experts in the former and Ilya Smirnov (BCAM) and Manuel Blickle (JGU) of the latter.

About the PI

Prof. Javier Fernández de Bobadilla, is the leader of the Singularity Theory and Algebraic Geometry group at the Basque Center for Applied Mathematics - BCAM and research professor at Ikerbasque since 2015, has a PhD in Mathematics since 2001 and did his doctorate at the University of Nijmgen (The Netherlands). His research experience has been developed at the University of Nijmengen, the University of Utrecht, the UNED and the CSIC previously. He is a member of the Institute for Advanced Study (Princeton), and has been visiting professor at the RENYI Institute of Mathematics (Hungary) and IMPA (Brazil). During the semester from July to December 2021, the BCAM researcher and Ikerbasque research professor is holding the Jean-Morley Chair and organise the Singularity Theory from Modern Perspectives programme together with Prof. Anne Pichon.

You can learn more about **AEI-DFG-BMZ** on our website.

HE-101119556

IN-DEEP

Real-time inversion using self-explainable deep learning driven by expert knowledge

DURATION
2024/01 – 2028/01

PI
Muñoz-Matute, J.

Inverse problems use partial differential equations (PDEs) to establish links between unknown parameters and experimental data. They find extensive applications, such as assessing cancer growth, ensuring the safety of civil infrastructure, and enhancing geothermal energy production. Nonetheless, Deep Learning (DL) approaches for PDEs come with limitations, notably a lack of theoretical foundation and interpretability, which impedes their integration into high-stakes applications. The MSCA-funded IN-DEEP project unites doctoral candidates and scientists with the goal of training postgraduates in crafting, implementing, and harnessing knowledge-driven Deep Learning algorithms. These algorithms aim to swiftly and accurately address inverse problems driven by PDEs. IN-DEEP is committed to developing advanced DL-based solvers for PDEs with substantial societal and industrial relevance.

About the PI

Judit Muñoz-Matute is currently a Marie Skłodowska-Curie Fellow at the Basque Center for Applied Mathematics (BCAM) in Bilbao, Spain. Before this, she held several postdoctoral positions: from January 2021 to December 2023, she was a Postdoctoral Fellow at the Oden Institute for Computational Engineering and Sciences at The University of Texas at Austin (USA); from February to December 2020, a Postdoctoral Fellow at BCAM; and from November 2019 to January 2020, a Postdoctoral Fellow at the Euskampus Foundation in Leioa, Spain. She holds an International PhD in Applied Mathematics (Cum Laude) from the University of the Basque Country (UPV/EHU), completed between November 2015 and October 2019. Prior to that, she obtained a Master's degree in Mathematical Modelling and Research, Statistics and Computing (2014–2015), as well as a Bachelor's degree in Mathematics (2009–2014), both from the University of the Basque Country. Her research interests include numerical analysis and computational partial differential equations (PDEs), with a focus on numerical methods for transient PDEs, deep learning techniques for solving PDEs, and Minimum Residual and Discontinuous Petrov-Galerkin (DPG) methods. Further areas of expertise include exponential time integrators, DPG-based time-marching schemes, finite element methods, finite differences, and IsoGeometric Analysis, with particular emphasis on adaptivity, goal-oriented adaptivity, and a posteriori error estimation.

You can learn more about **IN-DEEP** on our website.

Funding Institutions

Distinctions

EXCELENCIA SEVERO OCHOA
Jul. 2014 - Dec. 2027

HR EXCELLENCE IN RESEARCH

Public Funding Institutions

EUSKO JAURLARITZA
GOBIERNO VASCO

ikerbasque
Basque Foundation for Science

Bizkaia
foru aldundia
diputación foral

05

Scientific Activities

Throughout 2024, BCAM has actively engaged in organizing and hosting a range of scientific activities. The center has conducted 11 specialized courses, including 8 BCAM Courses and 3 BCAM Severo Ochoa Courses, taught by its own researchers as well as experts from other institutions. These courses are designed to enhance the expertise of PhD students and research personnel. In collaboration with the University of the Basque Country (UPV/EHU), BCAM has co-hosted biannual math colloquiums and facilitated 45 joint sessions in Analysis and PDE, fostering a deeper understanding in these fields.

During 2024, many scientific activities have been organized by BCAM. The topics cover all areas of knowledge of the centre: BCAM also promotes the exchange of knowledge through its seminar program, contributing to the broader academic and industrial community. Additionally, BCAM researchers travel widely for collaboration and attend various international conferences and workshops to both share and augment their knowledge, as well as to forge new professional ties.

IKUR talks on Quantum Technologies

The IKUR Quantum Talks are organized by the Donostia International Physics Center (DIPC), the University of the Basque Country (UPV/EHU) and the Basque Center for Applied Mathematics (BCAM) to publicize the scientific basis and potential of quantum technologies

In Bilbao, after the talk, Luz Roncal, Ikerbasque researcher at the BCAM interviewed Professor Artur Ekert (University of Oxford) and moderated the colloquium. Artur Ekert is a leading figure in the field of quantum cryptography, with research spanning several sides of quantum information processing. His interdisciplinary approach spans theoretical and experimental quantum physics, computer science, and information theory, with promising implications in both fundamental physics and commercial applications. His contributions have paved the way for perfectly secure communication through quantum cryptography, providing a glimpse into the future of cybersecurity amid the imminent arrival of quantum computers.

DATE
7 March, Donostia
8 Marh, Bilbao

BCAM holds the workshop “Bilbao-Bordeaux Workshop on PDEs”

The Basque Centre for Applied Mathematics - BCAM organised the workshop Bilbao- Bordeaux Workshop on PDEs at the centre in Bilbao from 08 to 09 April, in a face-to-face format, in collaboration with the project TRANSMATH, the University of Bordeaux, and BCAM. Around 40 Bilbao-Bordeaux network participants attended the workshop. The workshop aimed to foster interactions and collaborations between the mathematical institute of Bordeaux and the ones in Bilbao (BCAM and UPV-/EHU) and, at the same time, to create a global dynamic involving the mathematical institutes of the Bay of Biscay area.

DATE
8-9 April, 2024

The first Spring School and Workshop “Spectral Theory, Fourier Analysis and PDEs”

The main objective of this scientific meeting was to foster a gathering between researchers at different stages of their careers, including master’s students, PhD students, early postdoctoral researchers, as well as leading experts in the fields of Spectral Theory, Fourier Analysis and Partial Differential Equations.

It has long been recognised that there is a large overlap and intricate interplay among Spectral Theory, Fourier Analysis and PDEs. In fact, they complement, motivate, and inspire each other. Despite this, there has been a scarcity of scientific events designed to explore their concurrent developments. Therefore, in this first Spring School and Workshop, the aim was to address this deficiency by placing a strong emphasis on interdisciplinarity as a fundamental hallmark.

DATE
27-31 May, 2024

The first edition of the workshop “QuMA: Queer and Trans in Mathematical Analysis”

The Basque Center for Applied Mathematics – BCAM hosted the first Queer and Trans Workshop in Mathematical Analysis (QuMa) 2024 in Bilbao. The event featured a hybrid format over three days, including talks and roundtable discussions, bringing together mathematics researchers and activists from around the world in an inclusive environment. The main objective of this scientific meeting was to foster collaboration between researchers in mathematical analysis and activists from marginalized groups.

DATE
12-14 June, 2024

BCAM co-organizes the Workshop “The Mathematics of Machine Learning” in Collaboration with ETH Zurich

This year, BCAM has once again brought together leading experts in the field of machine learning, this time in collaboration with ETH Zurich. The event, titled “The Mathematics of Machine Learning,” took place in Zurich, further expanding its reach and impact within the mathematical community. The workshop was organized by Prof. F. Yang and Prof. N. He from ETH Zurich together with Prof. S. Mazuelas from BCAM.

Building on the success of last year’s workshop held at the Basque Center for Applied Mathematics (BCAM) in Bilbao, which saw over 70 national and international participants, this year’s event maintained its high standards of excellence and collaboration. Last year’s workshop, held from 25 to 28 October, was supported by the AXA Research Fund, the Spanish Research Agency, and the Basque Government. It aimed to increase the visibility of machine learning mathematics within the broader mathematical community.

DATE
18-21 June, 2024

World’s leading experts in residual minimisation methods for the sixth edition of the MINRES conference at BCAM

The Basque Center for Applied Mathematics, promoted by the Department of Education of the Basque Government; part of the BERC network; and awarded the Severo Ochoa Centre of Excellence accreditation on three consecutive occasions, the latest in the 2021 call, has hosted the sixth edition of the Residual Minimisation Methods Conference and welcomed the world’s leading experts in the field to the city.

This biennial event aims to bring together prominent international researchers in the area of residual minimisation methods (MINRES), including the Discontinuous Petrov-Galerkin method and Least Squares Finite Elements.

DATE
24-27 June, 2024

6th BCAM- UPV/EHU summer school on Harmonic Analysis and PDEs: Strichartz and resolvent estimates

The Basque Centre for Applied Mathematics – BCAM and the University of the Basque Country UPV/EHU organized the 6th edition of BCAM-UPV/EHU summer school on Harmonic Analysis and PDEs: Strchartz and resolvent estimates. The Summer School consisted of mini courses and student group projects. On the last day, the student groups presented each other the work they did during the school.

DATE
1-5 July, 2024

Workshop on “Theoretical and Experimental Approaches to Goal-Directed Behavior”

The Basque Center for Applied Mathematics (BCAM) in Bilbao, Spain, hosted a workshop entitled “Theoretical and Experimental Approaches to Goal-Directed Behavior” from October 16-18, 2024.

Experts from a wide range of disciplines gathered to explore goal-directedness in biological and non-biological systems.

This interdisciplinary workshop tackled a profound question: how do systems transition from seemingly purposeless physical processes to exhibiting purposeful, goal-directed behavior, a hallmark of life? Researchers from fields such as mathematics, thermodynamics, and machine learning discussed this question together with chemists and biologists. The workshop considered the question from theoretical, experimental, and operational perspectives.

DATE
16-18 October, 2024

06

Highlighted Publications

Computational Mathematics

Robust Variational Physics-Informed Neural Networks

Mathematical Design, Modelling and Simulations

We propose a Robust Variational Physics-Informed Neural Networks (RVPINNs) method. Similar to VPINNs, it uses a Petrov–Galerkin variational formulation, with trial spaces as Neural Network manifolds and test spaces as finite-dimensional vectors. Unlike VPINNs, RVPINNs minimize the residual's discrete dual norm, yielding sharp energy norm error estimates. Thus, the loss employed in RVPINNs is robust with respect to the energy-norm error. Numerical tests on advection–diffusion problems confirm the method's robustness and theoretical accuracy.

AUTHORS
Rojas, S. | Maczuga, P. | Muñoz-Matute, J. | Pardo, D. | Paszynski, M.

Computer Methods in Applied Mechanics and Engineering (CMAME), Vol. 425, 116904, May. 2024. doi.org/10.1016/j.cma.2024.116904

Rheology of a crowd: from faster-is-slower to shear thickening

CFD Modelling and Simulation

This study links the faster-is-slower (FIS) phenomenon in pedestrian evacuations to the shear-thickening behavior of (non)Brownian suspensions. Using Social Force Model simulations, researchers observed discontinuous shear thickening (DST) near exits, where viscosity sharply rises during FIS. The findings reveal two critical jamming densities—frictional and frictionless—and show that social forces, not just contact forces, are key to preventing FIS at low speeds. The work offers a novel rheological framework for understanding pedestrian crowd dynamics.

AUTHORS
Hernández-Delfin, D. | García, A. | Ellero, M.

Commun Phys 7, 152 (2024) https://doi.org/10.1038/s42005-024-01646-1

Mathematical Modelling with Multidisciplinary Applications

A Data-Mining Approach to Understanding the Impact of Multi-doping on the Ionic Transport Mechanism of Solid Electrolytes Materials: The Case of Dual-doped Ga0.15/Scy Li7La3Zr2O12

Modelling and Simulation in Life and Materials Sciences

We present novel computational methods for studying Li-ion dynamics in the technologically significant solid electrolyte materials Ga0.15/Scy-LLZO. Combining a specifically designed DFT-based force field and an advanced hybrid Monte Carlo with molecular dynamics simulations, we systematically examine the material's transport properties for a range of cationic concentrations. In addition, we introduce innovative post-processing data mining clustering techniques which help shed light on conductivity mechanisms, providing key insights for advanced electrolyte design.

AUTHORS
H. A. Cortés | M. R. Bonilla | H. Früchtl | T. van Mourik | J. Carrasco | E. Akhmatskaya

Journal of Materials Chemistry A, 12 (2024) 5181-5193.

Bifurcation analysis of a two infection SIR-SIR epidemic model with temporary immunity and disease enhancement

Mathematical and Theoretical Biology

We study a two-infection SIR-SIR model incorporating waning immunity during the first infection and enhancement or protection effects in recurrent infections. Bifurcation analysis identifies two codim-2 bifurcations as organizing centers. A cusp bifurcation describes the transition from disease-free to endemic equilibrium. Analytical solutions provide geometric insights into stationary dynamics, while a Bogdanov-Takens point reveals oscillatory endemic dynamics and a homoclinic connection.

AUTHORS
Aguiar, M. | Steindorf, V. | Srivastav, A.K. | Stollenwerk, N. | Kooi, B.W.

Nonlinear Dyn 112, 13621–13639 (2024). https://doi.org/10.1007/s11071-024-09710-9

Monitoring Alzheimer's disease via ultraweak photon emission

Mathematical, Computational and Experimental Neuroscience

An innovative study detected ultraweak photon emission (UPE) from rat hippocampi, revealing strong links between UPE intensity, Alzheimer's disease (AD), memory decline, and oxidative stress. Using a rodent model of sporadic AD, researchers found that UPE increased with disease but decreased with donepezil treatment. The study highlights UPE's potential as a noninvasive diagnostic tool and proposes a brain-computer interface chip for real-time monitoring of AD-related brain activity.

AUTHORS
Sefati, N. | Esmaeilpour, T. | Salari, V. | Zarifkar, A. | Dehghani, F. | Ghaffari, M. K. | Zadeh-Haghighi, H. | Császár, N. | Bókkon, I. | Rodrigues, S. | Daniel Oblak, D.

iScience, Volume 27, Issue 1, 2024, 108744, ISSN 2589-0042, https://doi.org/10.1016/j.isci.2023.108744.

Mathematical Physics

From Short-Range to Mean-Field Models in Quantum Lattices

Quantum Mechanics (QM)

Realistic interparticle interactions of quantum many-body systems are widely seen as being short-range, but their analysis is extremely difficult. By contrast, mean-field models are less realistic but technically advantageous, by allowing explicit computations while capturing surprisingly well many real physical phenomena. In 2024 a precise mathematical relationship between the mean-field and short-range models has been found, using the long-range limit that is known in the literature as the Kac, or van der Waals, limit, leading to unexpected results.

AUTHORS
Bru J-B. | de Siqueira Pedra W. | Rodrigues Alves K.

Advances in Theoretical and Mathematical Physics. 28. 69-159. 10.4310/ATMP.2024.v28.n1.a3.

Fire-spotting modelling in operational wildfire simulators based on Cellular Automata: A comparison study

Statistical Physics

One crucial mechanism in the spread of wildfires is the so-called fire-spotting: a random phenomenon that occurs when embers are transported over large distances. Unfortunately, operational fire-spread simulators may not account for spotting events, thus overlooking the associated harmful consequences. The performance of the routine developed by the line is compared to other 2 existing similar routines against a dataset from a real wildfire occurred in 2021 in Campomarino (Italy).

AUTHORS
López-De-Castro M. | Trucchia A. | Morra di Cella U. | Fiorucci P. | Cardillo A. | Pagnini G.

Agricultural and Forest Meteorology, Volume 350, 2024, 109989, ISSN 0168-1923, https://doi.org/10.1016/j.agrformet.2024.109989

Symplectic monodromy at radius 0 and equimultiplicity of families with constant Milnor number

Singularity Theory and Algebraic Geometry

The Zariski multiplicity conjecture is one of the major open problems in Singularity Theory. Its family version for constant Milnor number families has a prominent independent status, investigated independently of the general case, staring by Teissier works in equisingularity in the late 60's and 70's among others. See the following surveys for a summary of previous contributions:

(a) C. Eyral, Zariski's multiplicity question—a survey, New Zealand J. Math. 36 (2007), 253–276. (b) C. Eyral. Topics in equisingularity theory, IMPAN Lecture Notes, vol. 3, Polish Academy of Sciences, Institute of Mathematics, Warsaw, 2016.

The result proved in this paper is precisely the Zariski multiplicity conjecture for constant Milnor number families. Besides the result the most important aspect of the paper are the new techniques introduced for its solution. The technique combines ideas of hybrid geometry (complex, tropical and log-geometry) and ideas of symplectic geometry to endow the classical A'Campo space of a normal crossing degeneration with a symplectic structure that exhibits a symplectic monodromy with very special dynamical properties, and is symplectically isotopic to the monodromy of the Milnor fibration in the tube. Combining a slight generalization a spectral sequence converging to fixed point Floer homology, due to McLean (M. McLean, Floer Cohomology, Multiplicity and the Log Canonical Threshold. Geometry & Topology. 23 (2019), no. 2, 957-1056), with a classical argument of Lê and Ramanujam the authors establish the constancy of multiplicity in a family with constant Milnor number.

AUTHORS
Fernández de Bobadilla, J. | Pelka, T.

Annals of Mathematics 200(1): 153-299 (2024). DOI: 10.4007/annals.2024.200.1.4

Analysis of Partial Differential Equations

Quantitative Hardy inequalities for magnetic Hamiltonians

Linear and Non-Linear Waves

In this paper we present a new method of proof of Hardy type inequalities for two-dimensional quantum Hamiltonians with a magnetic field of finite flux. Our approach gives a quantitative lower bound on the best constant in these inequalities both for Schrödinger and Pauli operators. Pauli operators with Aharonov-Bohm magnetic field are discussed as well.

AUTHORS
Fanelli, L. | Kovařík, H.

Communications in Partial Differential Equations, 49(10–12), 873–891, 2024. https://doi.org/10.1080/03605302.2024.2403010

On (global) unique continuation properties of the fractional discrete Laplacian

Harmonic Analysis

We study various qualitative and quantitative (global) unique continuation properties for the fractional discrete Laplacian. We show that while the fractional Laplacian enjoys striking rigidity properties in the form of (global) unique continuation properties, the fractional discrete Laplacian does not enjoy these in general.

AUTHORS
Fernández–Bertolin, A. | Roncal, L. | Rüland A.

Journal of Functional Analysis, Volume 286, Issue 9, 2024, 110375, ISSN 0022-1236, https://doi.org/10.1016/j.jfa.2024.110375.

Well-posedness theory for non-homogeneous incompressible fluids with odd viscosity

Applied Analysis

Several fluid systems present a parity breaking. In these situations, the viscosity tensor, named odd viscosity, becomes anti-dissipative. Mathematically, this property translates into a loss of derivatives in the a priori estimates. In this work, we establish a well-posedness theory for a system of incompressible non-homogeneous fluids with odd viscosity. The crucial point is the introduction of a set of good unknowns highlighting a hidden hyperbolic structure of the system, which in turn allows to circumvent the derivative loss and propagate high enough Sobolev regularity.

AUTHORS
Fanelli. F. | Granero-Belinchón R. | Scrobogna S.

Journal de Mathématiques Pures et Appliquées, Volume 187, 2024, Pages 58-137, ISSN 0021-7824, https://doi.org/10.1016/j.matpur.2024.05.006.

Data Science & Artificial Intelligence

A localized decomposition evolutionary algorithm for imbalanced multi-objective optimization

Combinatorial Optimization

This paper proposes a Localized Decomposition Evolutionary Algorithm (LDEA) to address performance issues in Multi-objective Evolutionary Algorithms based on Decomposition (MOEA/Ds) when solving imbalanced multi-objective problems (MOPs). LDEA restricts solution updates within local regions, enhancing diversity and preventing domination by few solutions. It evolves only the best-associated solutions and adapts decomposition methods for better convergence. LDEA outperforms nine MOEAs on various benchmark and real-world MOPs, proving its effectiveness.

AUTHORS
Ye, Y. | Lin, Q. | Wong, K-C. | Li, J. | Ming, Z. | Coello Coello, C.A.

Engineering Applications of Artificial Intelligence, Volume 129, 2024, 107564, ISSN 0952-1976, https://doi.org/10.1016/j.engappai.2023.107564.

Cost-sensitive ordinal classification methods to predict SARS-CoV-2 pneumonia severity

Applied Statistics

This study assessed cost-sensitive ordinal AI-ML strategies for predicting SARS-CoV-2 pneumonia severity using data from 1,548 patients across four Spanish hospitals. A model using 148 features, ordinal decomposition, cost-based resampling, and Histogram-based Gradient Boosting outperformed five clinical severity scores and a standard AI-ML baseline. It achieved 68.1% accuracy and 0.802 AUC. The research highlights the effectiveness and rarity of combining ordinal classification with cost sensitivity in clinical prognosis tasks.

AUTHORS
García-García F. | Lee D-J. | España Yandiola, P.P. | Landa, I.U. | Martínez-Minaya, J. | Hayet-Otero, M. | Ermecheo, M.N. | Quintana, J. M. | Menéndez, R. | Torres, A. | Zalacain Jorge, R.

IEEE Journal of Biomedical and Health Informatics, Volume 28, Number 5, 2024, pages 2613-2623. https://doi: 10.1109/JBHI.2024.3363765

Pac-Bayes-Chernoff bounds for unbounded losses

Machine Learning

Our paper introduces a new family of PAC-Bayes bounds for measuring generalization in machine learning, especially with unbounded losses like squared loss or log-loss. Unlike existing methods that require inefficient tuning of a free parameter, our approach eliminates this need, yielding more precise bounds. By accounting for individual model properties, our bounds are also more interpretable, providing theoretical support for well-known regularization strategies and inspiring new learning algorithms.

AUTHORS
Casado, I. | Ortega, L.A. | Pérez, A. | Masegosa A.R.

Advances in Neural Information and Processing Systems (NeurIPS) 2024.

07

Severo Ochoa Joint Research Lab Program

This initiative is part of the actions promoted by BCAM thanks to the accreditation of "Severo Ochoa Centre of Excellence" granted by the Ministry of Science and Innovation through the State Research Agency and that BCAM has for the period 2023-2027.

01 To promote collaborative research on hot topics such as machine learning methods and PDEs, Elliptic and Dispersive PDEs and their relation with Geometry and Fluid Mechanics and thus strengthen the centre's research areas and generate synergies

02 To contribute to BCAM projects on mathematical modelling applied to health

03 Explore the connection between pure/applied mathematics and new research topics in collaboration with BCAM research areas

04 Strengthen contacts within the international scientific community

05 To provide specialized training for the members of the centre

This program highlights the importance of international collaboration between research centres and universities, as well as the strengthening that this can mean for the centre's lines of research and its international positioning. The agreement will materialize through different activities such as the joint supervision of postdoctoral researchers or visits to the centre and joint participation in scientific activities.

BCAM Severo Ochoa Strategic Labs

Joint Research Lab
U. Sussex

The "BCAM Severo Ochoa Strategic Lab on Trustworthy Machine Learning" is held together with Prof. Novi Quadrianto at the University of Sussex and co-led by Jose A. Lozan, Scientific Director of BCAM and coordinator of the Data Science and Artificial Intelligence research area.

Joint Research Lab
U. Oxford

The "BCAM Severo Ochoa Strategic Lab on Modelling with Partial Differential Equations in Mathematical Biology" is held together with Prof. Jose Antonio Carrillo at Mathematical Institute, Oxford University and co-led by Prof. Elena Akhmatskaya, Ikerbasque Professor at BCAM who coordinates the area of Mathematical Modelling with Multidisciplinary Applications.

Joint Research Lab
ETH Zurich

The "BCAM Severo Ochoa Strategic Lab on Analysis of PDEs" is held in collaboration with Prof. Joaquim Serra from ETH Zurich. The laboratory is co-led by Prof. Luis Vega, coordinator of the APDE research area.

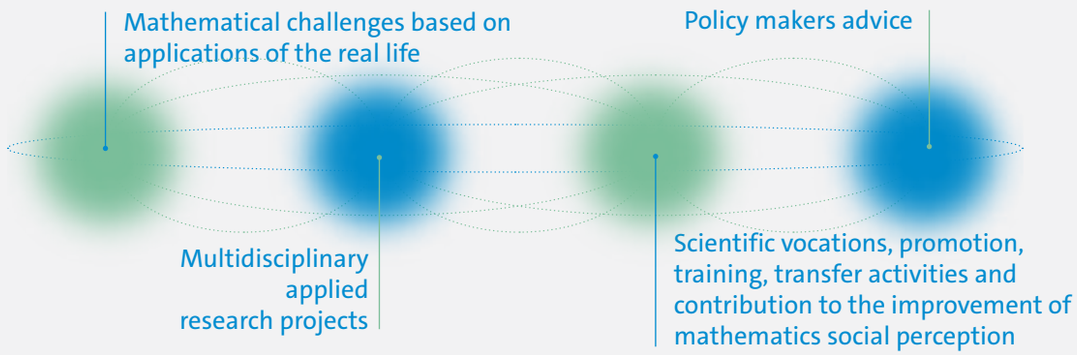
Joint Research Lab
Rényi Insitute

The "BCAM Severo Ochoa Strategic Lab on Singularity Theory" is held together with Prof. Andras Némethi (Renyi Institute Budapest), Prof. Duco van Straten (Mainz University) Prof. Nero Budur (KU Leuven). The laboratory is co-led by Prof. Javier Fernández de Bobadilla, Ikerbasque Professor at BCAM and research area coordinator of Mathematical Physics.

08

Knowledge & Technology Transfer Ongoing Projects

The aim of BCAM Knowledge Transfer Unit is structured around four main objectives:



One of BCAM's most important missions is to spread knowledge and technology in the industry and the society in general.

It is critical for the Basque Center for Applied Mathematics to transfer the obtained research results to sectors as biosciences, health, energy, advanced manufacturing, telecommunications and transport, including local, national and international entities.

For that purpose, BCAM offers expertise in many research fields to SMEs and large industrial groups, and supports the creation of new companies.

01 Strategic partnerships

02 Collaborative R&D&I projects

03 Joint positions/Research teams

04 Supervision of Master and PhD students

05 Training courses

06 Organization of dissemination activities

Private Funding Ongoing Projects

Sedical

Research new technologies for the industrial valorisation of low-temperature residual thermal flows as support for decarbonisation.

FAGOR

Investigate the possibility of creating a development environment where different digital models and CAM coexist and interact. Achieve what has been termed the process metaverse through research into technologies for the virtualisation of workpieces and machining.

Research on the structural integrity of high value-added components, enabling companies in the Basque Country to access the vast potential market of floating offshore wind energy.

Identify techniques aimed at estimating the current state of a dynamic system characterised by a nonlinear model. In addition to determining the initial state, it would be valuable if these techniques allowed for the adjustment of model parameters using a set of the most recent observations. Ideally, the selected techniques should enable the imposition of constraints on state and parameter values to prevent the identification of physically inadmissible situations. An example of such a technique is Moving Horizon Estimation (MHE).

Generating scientific knowledge that can be transferred to society and thus jointly develop knowledge and projects, as well as bringing applied research in the field of sports performance data analysis, advanced mathematical modelling techniques and machine learning and statistical modelling techniques to the sports industry sector. To this end, the objectives will focus on the scientific, scientific-technological, generation of new knowledge and dissemination and transfer of knowledge.

Provide local authorities and mobility-related companies with a tool for pedestrian mobility management, to be applied in organising the growing number of local, national, and international mass events taking place in the region. This tool will simulate the movement of attendees in venues, streets, or squares where the events are held.

Joint Positions And Industrial Doctorates

Joint Research Labs

Joint Research Laboratory on Offshore Renewable Energy

Tecnalia | UPV/EHU | BCAM

The Joint Research Laboratory on Offshore Renewable Energy is composed of researchers from TECNALIA, UPV/EHU and BCAM.

Joint Research Laboratory on Applied Artificial Intelligence (JRL-A2I)

Tecnalia | UPV/EHU | BCAM

The Joint Research Lab team is composed of fully collaborative and open-minded researchers. The research areas of the JRL-AI are: Time Series Analysis, Stream Learning, Optimization, Lifelong Machine Learning, Adversarial Machine Learning.

LTC Sarea

Transmath
Transborder Laboratory for Mathematics and its Applications

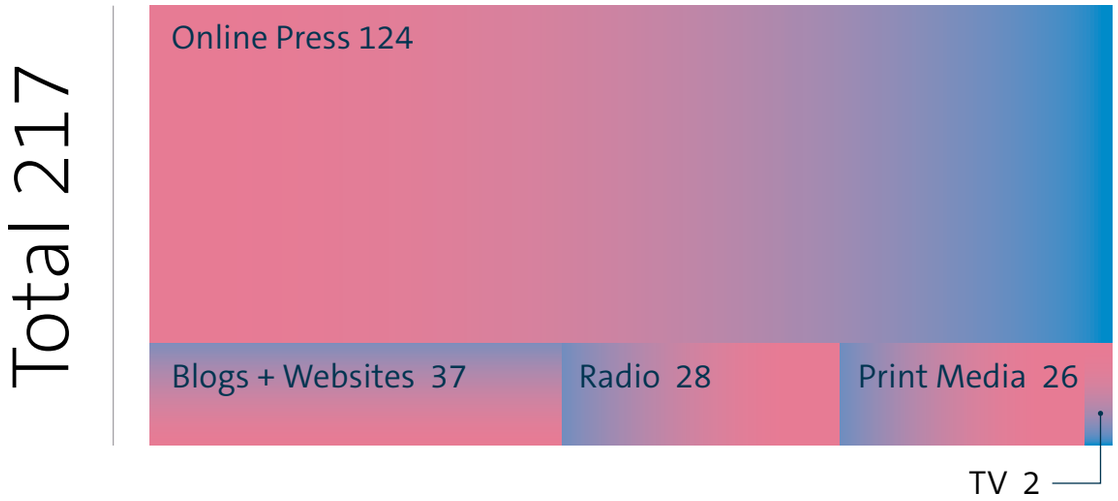
The Laboratories for Trans-border Cooperation (LTCs) are a formula for collaboration that have been developed since 2015 in the frame of the Campus Euskampus-Bordeaux. TRANSMATH is a project created in 2017 for mathematics to work in the specific subject of: 1) cutting edge research in the classical fields of mathematics: ge,etru, algebra, analysis of PDEs, etc., 2) modeling and simulation, in particular in the applications to environment and health releated issues, and 3) data science.

09

BCAM in the Media

To make BCAM's work known to society, the appearance in the media helps the message reach more people. This year we can highlight the following appearances:

- Interview with Daniel Eceizabarrena in XL Semanal
- Report with Javier Fernández de Bobadilla on TVE about the conjecture solved together with Tomasz Pełka and published in Annals of Mathematics
- Report on BCAM and the Day of Women and Science in the programme Boulevard on Radio Euskadi
- Report on BCAM's health projects (BMTF) in Grupo Noticias (Deia, Noticias de Gipuzkoa, Deia, Noticias de Gipuzkoa, Diario de Noticias de Álava and Diario de Noticias de Navarra).
- Interview with Verónica Álvarez in Deia
- Interview with Judit Muñoz Matute in Berria
- Interview with Luca Fanelli and '2M - Mathematics and Music' in Distrito Euskadi (Radio Euskadi)
- BCAM Naukas in El Correo



10

Gender Balance Actions

BCAM is dedicated to integrating a gender lens into all its endeavors, striving to eradicate disparities and advance genuine equality between genders on a global scale. In pursuit of this mission, BCAM engages in various initiatives aimed at advancing women's contributions in research and cultivating the enthusiasm of young girls for STEM careers. In 2024, BCAM actively participated in the following endeavor:

Emakumeak Zientzian

BCAM participates in Emakumeak Zientzian, an initiative that promotes, organises, develops, presents and executes an extensive programme of activities around 11 February. This proposal aims to make women scientists visible, break down stereotypes and encourage scientific vocations. BCAM hosted visits to the centre (offered by Leire Garmendia, PhD student); researchers from the centre visited schools (Lore Zumeta and Jone Renteria) and collaborated in the dissemination of the activities.

DATE
17 February, 2024

Be Zientzia

Science fair in collaboration with Achucarro and BC3. More than 150 primary and secondary school pupils from Bilbao took part in it through different txokos organised by the 3 BERC centres.

DATE
11 October, 2024

Frances Allen Award of the Spanish Association for Artificial Intelligence

Verónica Álvarez Castro won the Frances Allen Award of the Spanish Association for Artificial Intelligence 2024 for her doctoral thesis entitled 'Supervised Learning in Time-dependent Environments with Performance Guarantees'. This prize recognizes the excellence and impact of his work in the field of AI. This recognition highlights not only the exceptional quality of his research, but also his significant contribution to the advancement of knowledge in the area of supervised learning in time-dependent environments with performance guarantees.

DATE
25 April, 2024

Luz Roncal, new president of the RSME's International Relations Commission

Luz Roncal, Ikerbasque Research Associate at BCAM, has been appointed president of the International Relations Commission of the RSME, Relations with international institutions, particularly with mathematical societies in other countries, and international action represent a fundamental part of the RSME's activities. Among the objectives to be achieved are to provide greater international visibility of the events organized by the Society and the Spanish mathematical community in general, and to serve as a meeting point for Spanish mathematicians abroad.

DATE
30 April, 2024

Matematikhariak

BCAM won, through its initiative MATEMATIKHARIAK, the Special Mention of Gender in the fourth edition of the STEAM Euskadi Sariak Awards, in the category of 'STEAM education initiatives promoted by socioeconomic entities'. These awards are organized by the Department of Education of the Basque Government in collaboration with the Basque Innovation Agency-Innobasque, within the STEAM Euskadi Strategy. The Gender Special Mention also has an economic endowment of 1,000 euros.

DATE
30 May, 2024

Women at BCAM

At BCAM, we are proud to have a diverse team of women researchers and scientists who contribute significantly to the advancement of knowledge in applied mathematics. We value the talent and dedication of all the women who are part of our community, and we are committed to supporting their professional and personal development.

This International Day of Women and Girls in Science, join us in celebrating the achievements of women in science and inspiring girls to pursue their scientific passions. Together, we can build a more inclusive and equitable future for all people interested in science."

VIDEO

11

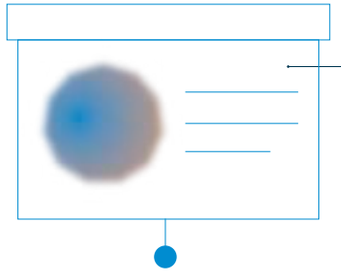
HRS4R Strategy at BCAM

BCAM signed the European Charter for Researchers and Code of Conduct in December 2008. In 2015, the HRS4R internal analysis process began to enhance people management. The Internal Analysis and Action Plan 2016 led to BCAM earning the “HR Excellence in Research” award. In 2018, BCAM conducted a self-assessment and updated its HR Action Plan through a GAP analysis. The centre remains committed to the Charter, Code, and HRS4R, developing a 2024-2027 Action Plan. During 2024, BCAM has worked on carrying out the Action Plan for 2024-2027.

HR Logo Committee

The HR Logo Committee, created in 2024, ensures that policy compliance and development actions align with the institution’s goals. This involves assessing the adequacy and impact of the developed actions to ensure they meet the desired outcomes. In the context of BCAM’s HR Logo policy, new actions can be proposed for integration to strengthen the policy further. Supervision and monitoring of the implementation of these actions are key to ensuring their proper execution, followed by comprehensive reporting and evaluation.

The collaboration with the HRS4R Working Group is essential for maintaining alignment, while promotion and dissemination efforts help increase awareness and adherence to the policy across the institution. The Commitee will always be composed by a minimum of 6 members, and they will be renewed coinciding with the ellaboration of any new action plan.



Training development at BCAM

Throughout the year, BCAM offers various training courses that enrich the professional and personal development of its team. These initiatives aim to provide key tools and knowledge for individual and collective growth. This year, particularly noteworthy is the training in equality, carried out in September 2024, aimed at fostering an inclusive and respectful work environment, eradicating biases and promoting equal opportunities. On the other hand, the leadership training, given throughout November 2024, aims to strengthen management and leadership skills, enabling participants to lead teams in an effective and inspiring way. Finally, the language courses (Basque and Spanish), given throughout the academic year, facilitate communication in an international and globalised environment, opening doors to collaboration and the exchange of knowledge with colleagues from all over the world.

Professional and personal development of BCAM’s members

Throughout the year, BCAM offers various training courses that enrich the professional and personal development of its team. These initiatives aim to provide key tools and knowledge for individual and collective growth. This year, particularly noteworthy is the training in equality, carried out in September 2024, aimed at fostering an inclusive and respectful work environment, eradicating biases and promoting equal opportunities. On the other hand, the leadership training, given throughout November 2024, aims to strengthen management and leadership skills, enabling participants to lead teams in an effective and inspiring way. Finally, the language courses (Basque and Spanish), given throughout the academic year, facilitate communication in an international and globalised environment, opening doors to collaboration and the exchange of knowledge with colleagues from all over the world.

Development of a Decalogue on Inclusive Communication

The process of developing BCAM's inclusive communication decalogue has been a collaborative effort, guided by a commitment to promote an environment where all voices are heard and respected. This document not only seeks to establish clear guidelines for communication that is accessible and respectful, but also reflects the core values of diversity and inclusion that are central to the BCAM. Each point of the Decalogue has been meticulously designed to foster inclusive and empathetic dialogue, ensuring that all people, regardless of their differences, feel recognized and valued in all forms of communication within the organization.

BCAM Talent Hub

In 2024, BCAM launched the BCAM Talent Hub, a specialized office for talent acquisition whose goal is to attract new talent and strengthen that of our research team through an integrated human-resources strategy. This approach is built on four key pillars:

- Internship programs, Visiting Fellows, and Visitors.
- Recruitment of doctoral students via international calls and support schemes for promising young researchers, such as Ikerbasque Fellow, JDC, RYC, or MSCA.
- Collaboration with Ikerbasque and other prestigious institutions to attract senior profiles.

At BCAM, talent lies at the heart of our scientific mission. The BCAM Talent Hub is one of our main reference points—alongside the Recruitment & People Care areas—for everything related to professional development and talent attraction at our centre.

MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES
AGENCIA ESTATAL DE INVESTIGACIÓN
BCAM TALENT HUB
Ayuda GPE2023-001295-I financiada por MICIU/AEI/10.13039/501100011033

STEAM Euskadi Saria

BCAM has been awarded the Steam Euskadi seal and the special mention for gender for its educational initiative, 'Matematikhariak'.

The STEAM Euskadi seal, awarded by the Basque Government, recognises initiatives with a marked STEAM education character, i.e. those that aim to foster scientific vocations and STEM professional aspirations, as well as to improve the STEAM skills of students. This recognition highlights BCAM's commitment to the integration of science and mathematics in education.

Emakumeak Zientzian

In 2024, BCAM once again became part of Emakumeak Zientzian, thus ratifying its commitment to the objectives of the initiative: to make the activity of women in science visible, to break with the typically male roles attributed to scientific-technical activities and to promote the choice of scientific careers among girls and adolescents.

WomenXAfrica

Diversity and inclusion are fundamental to innovation and progress in scientific research. BCAM participates with the WomenXAfrica Foundation, promoting a culture of equity and excellence. In 2024 we worked with Myriam Sonia Djoukwe Tapi, researcher at the University of Douala (Cameroon) and Visiting Fellow in Mathematical and Theoretical Biology.

FUNDACIÓN MUJERES POR ÁFRICA

BATERA Mentoring Programme

BCAM launched the fourth edition of Batera, its mentoring programme. For three months, four pairs of mentors and mentees have enjoyed this initiative that focuses on supporting young researchers in the different reflections that may arise regarding their career goals, competencies and options for their professional development.

BCAM participated in Bilbao's Business Race

BCAM's participation in the Business Race sought to promote a healthy lifestyle and team spirit: the research staff put on the center's T-shirt to run together through Bilbao. In addition to promoting BCAM's visibility in a sporting event, the experience became a perfect occasion to reinforce values such as motivation and collaboration, which also guide the day-to-day scientific work.

BBK Kuna Kideak

BCAM joins the BBK Kuna Kideak alliance to promote the 2030 Agenda and the Sustainable Development Goals in Bizkaia.

BCAM is 'Kidea' (member) of Sustainable Development Goal 9 (SDG 9), which focuses on building resilient infrastructures, promoting inclusive and sustainable industrialisation, and fostering innovation. BCAM's expertise and advanced knowledge in applied mathematics is very useful to address these challenges and contribute significantly to Bizkaia's progress in these areas.

BCAM Podcast – Let's write together the mathematics for the future

The recording and launch of the BCAM Podcast marked a milestone in our commitment to science communication. Thanks to the joint efforts of our communications team and the researchers themselves, we worked for bringing applied mathematics and strengthening our mission to promote knowledge and collaboration within our community.

12

Networks and Agreements

Being a multidisciplinary centre, collaboration between institutions and researchers is fundamental for the Basque Center for Applied Mathematics. Currently, BCAM belongs to some of the most important national and international networks in its field. We organized our participation in these networks and consortiums in the following way:

Strategic & Institutional Networks

ERCOM
European Research Centers on Mathematics

https://euro-math-soc.eu/committee/ercom

EWM
European Women in Mathematics

https://www.european-womeninmaths.org

SOMMA
The 'Severo Ochoa' Centers and 'Maria de Maeztu' Units of Excellence Alliance

https://www.somma.es

REM
Strategic Network in Mathematics

https://institucionales.us.es/remimus/

Joint Research Labs & Platforms

LTC-TRANSMATH
Joint Transborder Laboratory in Mathematics

https://euskampus.eus/en/programmes-en/euskampus-bordeaux/about-the-campus/joint-transborder-laboratories

JRL-ORE
Joint Research Lab on Offshore Renewable Energy

https://jrl-ore.com

JRL-AI
Joint Research Laboratory on Applied Artificial Intelligence (JRL-A2I)

https://jrlab.science

"Aulas" BCAM
UPV/EHU in Leioa and Donostia-San Sebastián

Thematic Networks

MATH-IN
Spanish Network of Mathematics and Industry
http://www.math-in.net

BIOSTATNET
National Network of Biostatistics
https://biostatnet.com

CLISYNE
Clinical Systems Neuroscience
https://clisyne.org

PET MSO-ED
Spanish Platform for Modelling, Simulation and Optimization Technologies in a Digital Environment
http://math-in.net/?q=es/content/pet-mso-ed

RGAS
Algebraic Geometry and Theory of Singularities
https://blogs.mat.ucm.es/rgas/objectives/

Associations & Consortiums

ECMI
European Consortium for Mathematics in Industry
https://ecmiindmath.org

EOSC
European Open Science Cloud
https://eosc-portal.eu

BAIC
Basque Artificial Intelligence Center
https://www.baic.eus/es/

BCSC
Basque CyberSecurity Centre
https://www.basquecybersecurity.eus/en/

EARMA
European Association of Research Managers and Administrators
https://www.earma.org/

BDIH
Basque Digital Innovation Hub
https://basqueindustry.spri.eus/es/basque-digital-innovation-hub/

BAT
B Accelerator Tower
https://bacceleratortower.com/

EU-MATHS-IN
European Service Network of Mathematics for Industry and Innovation
https://eu-maths-in.eu

INNOLAB Bilbao
https://www.ilb.eus/en/

Societies

We are institutional members of:

EMS
European Mathematical Society
https://euromathsoc.org

RSME
Real Sociedad Matemática Española
https://www.rsme.es

SEMA
Sociedad Española de Matemática Aplicada
https://www.sema.org.es/es/

Agreements

1 Basque Country

Achucarro
Aula AIMS
Aula BCAM Donosti & Leioa
Bilbao Ekintza EPEL
BioAraba
CIC bioGUNE
DIPC
EITB
Emergencias Osakidetza
GHI Hornos Industriales
GSGIHub
Ikerbasque (IBM)
Innovation Data Space Iberdrola
INSERTEC
JRU UPV-Tecnalia-BCAM
Kronikgune
Nautilus
Noray Bioinformatics
Novattia
Osakidetza
OSI Barrualde Galdakao + BIOEF

2 National

BGSMATH
Sedical
EJE&CON

3 International

Alfred Renyi
Berkeley Labs
BMW
Instituto de Ciências Matemáticas e de Computação
PGS Geophysical AS
SCCH

Activity Report
2024

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